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Observed at Creston, Wyo.,
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From a Study made in
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ASTRONOMICAL PHENOMENA.

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WERNER ENCYCLOPÆDIA.

GOUDA, or TER GOUWE, a town of the Netherlands, in the province of South Holland, at the confluence of the Gouw with the Yssel, 12 miles N. E. of Rotterdam, at the junction of the railway from that city with the line between the Hague and Utrecht. The town is for the most part laid out in an open and lightsome manner, and like the other towns of Holland is intersected by numerous canals. Portions of the old fortifications are changed into promenades, and the suburban quarters, Fluweelensingel, Bleekerssingel, Kattensingel, and Turfsingel, are adorned with fine trees. The Groote Markt is the largest market square in Holland. Among the churches—five of which are Protestant, two Roman Catholic, and one Old Catholic—the first place belongs to the church of St. John (Janskerk), a building of the 16th century, which replaced an earlier structure of the 15th, and which is not only remarkable for its dimensions, 345 feet in length and 150 feet broad, but possesses a celebrated organ, and a series of splendid painted windows, several of which are the workmanship of Dirk and Wouter Krabeth (1555–1603). (Compare *Explanation of the Famous and Renowned Glass Work*, etc., Gouda, 1876, reprinted from an older volume, 1718.) Of the other public buildings it is sufficient to mention the town-house, with a fine Gothic façade, founded in 1449, but rebuilt in 1690, the weigh-house, the house of correction for women, the gymnasium, St. Catherine's hospital, and the music hall. A public library containing many rare and valuable works is kept in St. John's church, and a municipal museum of antiquities was opened in 1874. In the time of the counts the wealth of Gouda was mainly derived from brewing and cloth weaving: about 1510, for example, the breweries numbered 156, and upwards of 1000 pieces of cloth were made in the course of the year; but at a later date the making of tobacco pipes became the staple trade, and in the middle of the 18th century gave employment to 3000 men. Though this industry has in turn declined, Gouda still possesses large pipe works and potteries; and among its other establishments are a celebrated manufactory of stearine candles, a yarn factory, an oil refinery, and cigar factories. It has also a good transit and shipping trade, and its market for cheese has made its name widely known throughout Europe. The population of the commune was, in 1796, 11,715; in 1830, 14,878; in 1850, 13,788; in 1860, 14,843; and in 1900, after a slight addition of area, 22,200. At the last date the town proper numbered 15,174 inhabitants. The greater proportion belong to the Dutch Reformed Church, but nearly 5000 are Roman Catholics. Gouda received its constitution as a town from Count Floris V. in 1272. In 1382 it had only 820 houses; but it rapidly increased, and in the 14th century it was the fifth in size of the towns of Holland. The rise of Amsterdam made it only the sixth; but it retained this position till the revolution of 1795. The principal facts in its history are the attack by the people of Utrecht in 1488; the repulse of the Spaniards in 1574; the destruction of the castle of the lords of Gouda in 1577; the voluntary flooding of the surrounding country as a defence against the French in 1672; the great inundation of November, 1775; and the riots of 1787.

GOUDIMEL, CLAUDE, composer of the 16th century, must be named amongst the founders of modern music. The French and the Belgians claim him as their countryman, and the place of his birth is not sufficiently established. In all probability, however, he was born at Vaison near Avignon, about the year 1510. As to his early education we know little or nothing, but the excellent Latin in which some of his letters were written proves that, in addition to his musical knowledge, he also acquired a good classical training. In 1540 we find him established in Rome at the head of a music school, and here, amongst many other celebrated musicians, Palestrina, the greatest master of the early Italian school, and one of the greatest masters of all schools, was amongst his pupils. About the middle of the century he seems to have left Rome for Paris, where, in conjunction with Jean Duchemin, he published, in 1555, a setting of Horace's *Odes*, entitled, *Horatii Flacci odæ omnes quotquot carminum generibus differunt ad rhythmos musicos redactæ*. Infinitely more important is another collection of vocal pieces, a setting of the celebrated French version of the Psalms by Marot and Beza (*Les Psaumes de David, mis en rime Française par Clement Marot et Théodore de Bèze, mis en musique par Claude Goudimel*), published in 1565. It is written in four parts, the melody being assigned to the tenor. Some of the tunes were probably of popular origin, and they are still used by the French Protestant Church. Others were adopted by the German Lutherans, a German imitation of the French versions of the Psalms in the same metres having been published at an early date. There is little doubt that, at the time of the last-named composition, Goudimel had embraced the new faith, although the French version of the Psalms was at first used by Catholics as well as Protestants. Seven years later he fell a victim to religious fanaticism during the St. Bartholomew massacres at Lyons (24th August, 1572), his death, it is stated, being due to " les ennemis de la gloire de Dieu et quelques méchants envieux de l'honneur qu'il avait acquis." In addition to the collections already named, many of his works are preserved. Masses and motets belonging to his Roman period are found in the Vatican library, and in the archives of various churches in Rome; others were published. Thus the work entitled *Missæ tres a Claudio Goudimel præstantissimo musico auctore, nunc primum in lucem editæ*, contains one mass by the learned editor himself, the other two being by Claudius Sermisy and Jean Maillard respectively. Another collection, *La fleur des chansons des deux plus excellens musiciens de nostre temps*, consists of part songs by Goudimel and Orlando di Lasso. Burney gives a motet of Goudimel's, *Domine quid multiplicati sunt*, in his history.

GOUGH, HUGH GOUGH, VISCOUNT (1779–1869), British field-marshal, was of Irish origin, and was a descendant of Francis Gough, who was made bishop of Limerick in 1626. He was born at Woodstown, Limerick, November 3, 1779. After holding for a short time a commission in his father's regiment of militia, he was transferred to the line as ensign in August, 1794, and was very soon after promoted lieutenant. In the following year he served with the 78th Highlanders at the Cape of Good Hope, taking part in the capture of Cape Town and of the Dutch fleet in Saldanha Bay. His next service was in the West Indies, where, with the 87th (Royal Irish Fusiliers), he shared in the attack on Porto Rico, the capture of Surinam, and

the brigand war in St. Lucia. In 1809 he was called to take part in the Peninsular War, and, joining the army under Wellington, commanded his regiment as major in the operations before Oporto, by which the town was taken from the French. At Talavera he was severely wounded, and had his horse shot under him. For his conduct on this occasion he was afterwards promoted lieutenant-colonel, his commission, on the recommendation of Wellington, being antedated from the day of the duke's despatch. He was thus, as pointed out in *Hart's Army List*, the first officer who ever received brevet rank for services performed in the field at the head of a regiment. He was next engaged at the battle of Barossa, at which his regiment captured a French eagle. At the defence of Tarifa the post of danger was assigned to him, and he compelled the enemy to raise the siege. At Vittoria, where Gough again distinguished himself, his regiment captured the baton of Marshal Jourdan. He was again severely wounded at Nivelle, and was soon after created a knight of St. Charles by the king of Spain. In recognition of his services the citizens of Dublin presented him with the freedom of the city and with a costly sword. At the close of the war he returned home and enjoyed a respite of some years from active service. He next took command of a regiment stationed in the south of Ireland, discharging at the same time the duties of a magistrate during a period of agitation. Gough did not attain the rank of field-officer till 1830, when he was promoted major-general. Seven years later a new epoch opened for him; he was sent to India to take command of the Mysore division of the army. But not long after his arrival in India, the difficulties which had arisen between the Chinese and British Governments, and which led to the first Chinese war, made the presence of an energetic general on the scene indispensable, and Gough was appointed commander-in-chief of the British forces in China. This post he held during all the operations of the war; and by his great achievements and numerous victories in the face of immense difficulties, he at length enabled the English plenipotentiary, Sir H. Pottinger, to dictate peace on his own terms, and on terms of perfect equality with the emperor. After the conclusion of the treaty of Nanking in August, 1842, the British forces were withdrawn; and before the close of the year Gough was created a baronet, and was invested with the grand cross of the Bath. He also received the thanks of both houses of Parliament. Returning to India, he was appointed (August, 1843) commander-in-chief of the British forces in India. In December, 1843, he took the command in person against the Mahrattas, and defeated them at Maharajpore, capturing more than fifty guns. He defeated them again at Punniar, and peace was then concluded at Gwalior. In 1845 occurred the rupture with the Sikhs, who crossed the Sutlej in large numbers, and Sir Hugh Gough conducted the operations against them. In this campaign he was well supported by Lord Hardinge, the governor-general, who had been his comrade in the Peninsula, and now volunteered to serve under him. The Sikhs were defeated in three great battles in rapid succession—at Moodkee, Ferozeshah, and Sobraon,—and submitted to make peace soon after at Lahore. The services of Sir Hugh Gough on these occasions were rewarded by a vote of thanks from both Houses of Parliament, and by his elevation to the peerage of the United Kingdom as Baron Gough (April, 1846). The war broke out again in 1848, and again Lord Gough took the field. With unabated energy he defeated the Sikhs at Ramnuggar, and at Chillianwallah, and finally broke their power by his decisive victory at Gujrat (February, 1849). He was now succeeded as commander-in-chief by Sir Charles Napier, and, returning to England, was raised to a viscountcy, and for the third time received the thanks of both Houses of Parliament. A pension of £2000 per annum was granted to him by parliament, and an equal pension by the East India Company. He did not again see active service. In 1854 he was appointed colonel of the Royal Horse Guards, and two years later he was sent to the Crimea to invest Marshal Pelissier and other officers with the insignia of the Bath. Honors were multiplied upon him during his latter years. He was made a knight of St. Patrick, being the first knight of the order who did not hold an Irish peerage, was sworn a privy councillor, was named a knight grand commander of the Star of India, and in November, 1862, was made field-marshal. He was twice married, and left children by both his wives. He died at his seat near Dublin, March 2, 1869.

GOUGH, Richard (1735–1809), an English antiquary, was the son of a wealthy East India director, and was born in London, October 1, 1735. He received his early education privately, and his literary talents developed with such precocity that, at the age of twelve and a half years, he had completed the translation of a history of the Bible from the French, which his mother printed for private circulation; at the age of fifteen he wrote a translation of Fleury's work on the customs of the Israelites; and at sixteen he had published an elaborate work entitled *Atlas Renovatus, or Geography modernized.* In 1752 he entered Benet College, Cambridge, where his taste for antiquarian research received additional impulse, and where he commenced his work on British topography, which was published in 1768. After leaving Cambridge in 1756 he began a series of antiquarian excursions in various parts of Great Britain, the fruit of which was seen in the volumes which he subsequently published. In 1773 he began to prepare an edition in English of Camden's *Britannia*, but the work did not appear till 1789. Meantime he published, in 1786, the first volume of his splendid work, the *Sepulchral Monuments of Great Britain, applied to illustrate the history of families, manners, habits, and arts at the different periods from the Norman Conquest to the Seventeenth Century.* This volume, which contained the first four centuries, was followed in 1796 by a second volume containing the 15th century, and an introduction to the second volume appeared in 1799. Gough was chosen a fellow of the Society of Antiquaries of London, in 1767, and from 1771 to 1791 he was its director. He was elected F.R.S. in 1775. He died at his residence at Enfield, 20th February, 1809. His books and manuscripts relating to Anglo-Saxon and northern literature, all his collections in the department of British topography, and a large number of his drawings and engravings of other archæological remains, were bequeathed to the university of Oxford.

Among the minor works of Gough are *An Account of the Bedford Missal* (in MS.); *A Catalogue of the Court of Canute, King of Denmark*, 1777; *History of Pleshy in Essex*, 1803; *An Account of the Coins of the Seleucidæ, Kings of Syria*, 1803; and *History of the Society of Antiquaries of London*, prefixed to their *Archæologia.* He also published several new editions of antiquarian works by other authors.

GOUJET, Claude Pierre (1697–1767), a French abbé and littérateur, was born at Paris, 19th October, 1697. He studied at the college of the Jesuits, and at the Collége Mazarin, but he nevertheless became a strong Jansenist. In 1705 he assumed the ecclesiastical habit, in 1719 entered the order of Oratorians, and soon afterwards was named canon of St. Jacques l'Hôpital. On account of his extreme Jansenist opinions he suffered considerable persecution from the Jesuits, and several of his works were suppressed at their instigation. In his latter years his health began to fail, and he lost his eyesight. As he received little remuneration for his writings, he came also to be in circumstances of great poverty, and was compelled to sell his library, a sacrifice which hastened his death, which took place at Paris, 1st February, 1767.

He is the author of a large number of works, of which the principal are:—*Supplément au Dictionnaire de Moréri*, Paris, 1735, and a *Nouveau Supplément* to a subsequent edition of the work; *Bibliothèque française ou Histoire littéraire de la France*, 18 vols., Paris, 1740–1759; *Vies des Saints*, 7 vols., 1730; *Mémoires historiques et littéraires sur le Collége royal de France*, 3 vols., Paris, 1758; *Histoire des Inquisitions*, Paris, 1752; and an edition of the *Dictionnaire*, of which he has also given an abridgment. See *Mémoires hist. et litt. de l'Abbé Goujet*, 1767.

GOUJON, Jean, was the most distinguished sculptor produced by France during the 16th century. Although some evidence has been offered in favor of the date 1520 (*Archives de l'Art français*, vol. iii. p. 350), the time and place of his birth are still uncertain. The first mention of his name occurs in the accounts of the church of St. Maclou at Rouen in the year 1540, and in the following year he was employed at the cathedral of the same town, where he added to the tomb of Cardinal d'Amboise a statue of his nephew Georges, afterwards removed. The tomb of Louis de Brezé, executed some time after 1545, has also been attributed to Goujon, but there is no evidence in point, nor even any tradition, of the fact. On leaving Rouen, Goujon was employed by Pierre Lescot, the celebrated architect of the Louvre, on the restorations of St. Germain l'Auxerrois; the building accounts—some of which for the years 1542-

44 were discovered by M. de Laborde on a piece of parchment binding—specify as his work, not only the carvings of the pulpit (Louvre), but also a Notre Dame de Piété, now lost. In 1547 appeared Martin's French translation of Vitruvius, the illustrations of which were due, the translator tells us in his "Dedication to the King," to Goujon, "naguères architecte de Monseigneur le Connétable, et maintenant un des vôtres." We learn from this statement, not only that Goujon had been taken into the royal service on the accession of Henry II., but also that he had been previously employed under Bullant on the chateau of Écouen. At the Louvre, Goujon, under the direction of Lescot, executed the carvings of the south-west angle of the court, the reliefs of the Escalier Henri II., and the Tribune des Cariatides. About a year before the execution of the Caryatides, for which Goujon received 737 livres on September 5, 1550, he produced, according to unbroken tradition, the reliefs of the Fontaine des Innocents (Louvre, and *in situ*); after which he is supposed to have been occupied in work destined for the decoration of the chateau of Anet, then building for Diana of Poitiers. Unfortunately the building accounts of Anet have disappeared, but tradition not only ascribes to Goujon the *chef d'œuvre* of French sculpture, the Diane Chasseresse now in the Louvre, but asserts that he also executed a vast number of other works of equal importance, destroyed or lost since 1792. In 1555 his name appears again in the Louvre accounts, and continues to do so every succeeding year up to 1561, when all trace of him is lost. In the course of this year an attempt was made to turn out of the royal employment all those who were suspected of Huguenot tendencies. Goujon has always been claimed as a Reformer; it is consequently possible that he was one of the victims of this attack. We should therefore probably ascribe the work attributed to him in the Hôtel Carnavalet (*in situ*), together with much else executed in various parts of Paris—but now dispersed or destroyed—to a period intervening between the date of his dismissal from the Louvre and his death (of which there is no evidence), which is said to have taken place during the St. Bartholomew massacre in 1572. Goujon's work is remarkable—as may be observed in the sculpture of the Louvre—for its perfect harmony with the architectural lines which it was intended to enrich or accompany, and is distinguished in a supreme degree by that elegance which was the leading characteristic of the school of which he was the chief representative. His treatment of the nude (Diane Chasseresse), both in style of line and choice of forms, attains a degree of accomplished perfection which, in its complete fulfilment of the proposed—though very different—ideal, comes nearer to the character of tranquil achievement, which marks all classic art, than any other work of modern times.

Engravings after Goujon will be found in Cicognara's *Storia della Scultura*, and in M. de Clarac's *Musée du Louvre*. M. Berty has given a brief notice of his life and works in *Grands architectes français de la Renaissance;* and a fuller account will be found in Mrs. Pattison's *Renaissance of Art in France*.

GOULD, Augustus Addison (1805–1866), American conchologist, was born at New Ipswich, New Hampshire, April 23, 1805, graduated at Harvard College in 1825, and took his degree of doctor of medicine in 1830. Thrown from boyhood on his own exertions, it was only by industry, perseverance, and self-denial that he obtained the means to pursue his earlier and later studies. Establishing himself in Boston, he devoted himself to the practice of medicine, and finally rose to high professional rank and social position. He became president of the Massachusetts Medical Society, and was employed as authority in editing the vital statistics of the state. As a conchologist his reputation is world-wide. With Say, Conrad, Adams, Anthony, Lea, Binney, and others, he was a pioneer of the science in America. His writings fill many pages of the publications of the Boston Society of Natural History (see vol. xi. p. 197 for a list) and other periodicals. He published with Agassiz the *Principles of Zoology;* he edited the *Terrestrial Air-breathing Mollusks* of Binney; he translated Lamarck's *Genera of Shells*. The two most important monuments to his scientific work, however, are *The Mollusks and Shells* of the United States exploring expedition under Commodore Wilkes, published by the Government, and the *Report on the Invertebrata*, published by order of the legislature of Massachusetts in 1841. A second edition of the latter work was authorized in 1865, and published in 1870 after the author's death, which took place at Boston, September 18, 1866. Gould was an active member of the Boston Society of Natural History, and a corresponding member of all the prominent American scientific societies, and many of those of Europe, including the English Royal Society.

GOUR. See Gaur.

GOURD, a name given to various plants of the order *Cucurbitaceæ*, but more strictly applied to those belonging to the genus *Cucurbita*, monœcious trailing herbs of annual duration, with long succulent stems furnished with tendrils, and large, rough, palmately-lobed leaves; the flowers, reticulated with veins, are generally large and of a bright yellow or orange color, the barren ones with the stamens united; the fertile are followed by the large, succulent fruit that gives the gourds their chief economic value. Many varieties of *Cucurbita* are under cultivation in tropical and temperate climates, especially in southern Asia; but it is extremely difficult to refer them to definite specific groups, on account of the facility with which they hybridize; while it is very doubtful whether any of the original forms now exist in the wild state. M. Naudin, who made a careful and interesting series of observations upon this genus, came to the conclusion that all varieties known in European gardens might be referred to six original species; probably three, or at most four, have furnished the edible kinds in ordinary cultivation; and, as all these appear occasionally to hybridize, their limits must be regarded as very uncertain. Adopting the specific names usually given to the more familiar forms, the most important of the gourds, from an economic point of view, is perhaps *C. maxima*, the *Potiron Jaune* of the French, the red and yellow gourd of British gardeners, the spheroidal fruit of which is remarkable for its enormous size: the color of the somewhat rough rind varies from white to bright yellow, while in some kinds it remains green; the fleshy interior is of a deep yellow or orange tint. This valuable gourd is grown extensively in southern Asia and Europe. In Turkey and Asia Minor it yields, at some periods of the year, an important article of diet to the people; immense quantities are sold in the markets of Constantinople, where in the winter the heaps of one variety with a white rind are described by Walsh as resembling mounds of snowballs. The yellow kind attains occasionally a weight of upwards of 240 lb. It grows well in Central Europe and the United States, while in the south of England it will produce its gigantic fruit in perfection in hot summers. The yellow flesh of this gourd and its numerous varieties yields a considerable amount of nutriment, and is the more valuable as the fruit can be kept, even in warm climates, for a long time. In France and in the East it is much used in soups and ragouts, while simply boiled it forms a substitute for other table vegetables; the taste has been compared to that of a young carrot. In some countries the larger kinds are employed as cattle food. The seeds yield by expression a large quantity of a bland oil, which is used for the same purposes as that of the poppy and olive. The "mammoth" gourds of English and American gardeners appear to belong to this species, or to hybrids between it and another valuable member of the group, the pumpkin, *C. Pepo*, well known in English cottage gardens, and largely cultivated in continental Europe and North America. The pumpkin varies much in form, being sometimes nearly globular, but more generally oblong or ovoid in shape; the rind is smooth, and very variable in color. This gourd is a useful plant to the American backwoods farmer, yielding, both in the ripe and unripe condition, a valuable fodder for his cattle and pigs, being frequently planted at intervals among the maize that constitutes his chief crop. The larger kinds acquire a weight of from 40 to 80 lb, but smaller varieties are in more esteem for garden culture. When ripe, the pumpkin is boiled or baked, or made into various kinds of pie, alone or mixed with other fruit; while small and green, it may be eaten like the vegetable marrow. Some of the varieties of *C. maxima* and *Pepo* contain a considerable quantity of sugar, amounting in the sweetest kinds to 4 or 5 per cent., and in the hot plains of Hungary efforts have been made to make use of them as a commercial source of sugar. The young shoots of both these large gourds may be given to cattle, and admit of being eaten as a green vegetable when boiled. The vegetable marrow, *C. ovifera*, regarded by Naudin as a variety of *C. Pepo*, is much esteemed in England for the delicate flavor of its fruit, which is eaten boiled, in the

immature state, as a pleasant summer vegetable. A large number of varieties are in cultivation,—the larger oblong or pear-shaped kinds growing a foot or more in length, while some are comparatively small. This useful esculent will succeed in any warm and open situation, if planted over a small trench filled with manure; it is often trained over the fences of cottage gardens, and may be sometimes seen flourishing on the sunny side of railway cuttings in the south of England. *C. Melopepo*, is the squash or bush gourd, a favorite vegetable in the United States and in parts of continental Europe, but less cultivated in Britain than the preceding. It has a somewhat different habit from most of the family, having more rigid shoots and a tendency towards a shrubby mode of growth; the fruit, yellowish when ripe, is smaller than the pumpkin, and of various shapes, usually with many angles or projections; some sorts resemble a turban, others many-cornered hats, whence fanciful names have been applied to them. The number of kinds is considerable, especially in the United States, where the squashes are much cultivated; the larger kinds are grown as food for pigs and cattle, besides being valued as table esculents; for cooking they should be used when wholly ripened. Many smaller gourds are cultivated in India and other hot climates, and some have been introduced into English gardens, rather for the beauty of their fruit and foliage than for their esculent qualities. Among these is *C. Aurantia*, the orange gourd, bearing a spheroidal fruit, like a large orange in form and color; in Britain it is generally too bitter to be palatable, though applied to culinary purposes in Turkey and the Levant. *C. pyriformis*, *C. verrucosa*, and *C. moschata* are likewise occasionally eaten, especially in the immature state; and several other gourds are used as esculents in India and the neighboring countries.

The bottle-gourds are now generally placed in a separate genus, *Lagenaria*, chiefly differing from *Cucurbita* in the anthers being free instead of adherent. The bottle-gourd properly so called, *L. vulgaris*, is a climbing plant with downy, heart-shaped leaves and beautiful white flowers: the remarkable fruit first begins to grow in the form of an elongated cylinder, but gradually widens towards the extremity, until, when ripe, it resembles a flask with a narrow neck and large rounded bulb; it sometimes attains a length of 7 feet. When ripe, the pulp is removed from the neck, and the interior cleared by leaving water standing in it; the woody rind that remains is used as a bottle; or the lower part is cut off and cleared out, forming a basin-like vessel applied to the same domestic purposes as the calabash (*Crescentia*) of the West Indies; the smaller varieties, divided lengthwise, form spoons. The ripe fruit is apt to be bitter and cathartic, but while immature it is eaten by the Arabs and Turks. When about the "size of a small cucumber," Lane says, it is stuffed with rice and minced meat, flavored with pepper, onions, etc., and then boiled, forming a favorite dish with Eastern epicures. The elongated snake-gourds of India and China (*Trichosanthes*) are said to be used in curries and stews.

All the gourds have a tendency to secrete the cathartic principle *colocynthin*, and in many varieties of *Cucurbita* and the allied genera it is often elaborated to such an extent as to render them unwholesome, or even poisonous. The seeds of some species possess rather strong anthelmintic properties; those of the common pumpkin are frequently administered in America as a vermifuge. The cultivation of gourds commenced far beyond the dawn of history, and the esculent species have become so modified by culture that the original plants from which they have descended can no longer be traced. The abundance of varieties in India would seem to indicate that part of Asia as the birthplace of the present edible forms; but some appear to have been cultivated in all the hotter regions of that continent, and in North Africa, from the earliest ages, while the Romans were familiar with at least certain kinds of *Cucurbita*, and with the bottle-gourd. It is even doubtful whether the culture of gourds had not spread to the American continent before its discovery by Europeans; for the Indian tribes of the interior were certainly in possession of some kinds at a date so early that it is difficult to believe they had received them from the settlers. Dr. Asa Gray has even suggested that some of these esculent forms may possibly have been indigenous to the American plains.

Most of the annual gourds may be grown successfully in Britain. They are usually raised in hotbeds or under frames, and planted out in rich soil in the early summer as soon as the nights become warm. The more ornamental kinds may be trained over trellis-work, a favorite mode of displaying them in the East; but the situation must be sheltered and sunny. Even the *Lagenariæ* will sometimes produce fine fruit when so treated in the southern counties.

(C. P. J.)

GOURGAUD, Gaspard, Baron (1783–1852), a French general of artillery, was born at Versailles, 14th September, 1783. After studying at the polytechnic school and at the artillery school of Châlons, he joined the artillery in 1802, and, having acquitted himself with distinction in several campaigns, he received in 1807 the cross of honor and the grade of captain. He served in the subsequent Spanish and Austrian campaigns, and in 1811 he was sent to report on the strength of the fortifications of Dantzic, a mission which he fulfilled so much to the satisfaction of Napoleon that he was named one of the emperor's ordnance officers. During the Russian campaign he was the first to enter the Kremlin at Moscow, where he removed the match from a large quantity of powder, the explosion of which would in all probability have destroyed the emperor's life. For this service he received the title of baron. He accompanied the emperor in his subsequent campaigns, and in 1814, at the battle of Brienne, was again successful in delivering him from imminent peril. After the accession of Louis XVIII. he was named chief of the staff of the first artillery division, but on the return of Napoleon from Elba he was nevertheless named by him adjutant and general, and took part in the battle of Waterloo. Being one of the three French officers chosen by Napoleon to accompany him to St. Helena, he was employed there in collecting materials for a history of Napoleon's campaigns, but on account of some misunderstanding with Montholon, he left the island, and went to England. He published in 1818 *La Campagne de 1815*, and he also endeavored to interest the emperors of Russia and Austria in Napoleon's behalf. Shortly afterwards he was expelled from England as a spy of Napoleon's. Returning to France in 1821, he published, along with Montholon, in 1823, *Mémoires de Napoléon à Sainte-Hélène*. His reply in 1825 to Ségur's *Histoire de la Grande Armée* was the occasion of a duel between the two authors; and he also, in 1827, became involved in a controversy with Sir Walter Scott regarding some statements made by the latter in his life of Napoleon. After the July revolution of 1830, Gourgaud was appointed to the command of the artillery of Paris and Vincennes; in 1832 he was named aide-de-camp of the king, and in 1835, lieutenant-general. In 1840 he was one of the commissioners sent to bring the remains of Napoleon to France. On the occurrence of the revolution of February, 1848, his name was struck off the list of generals, but after the events of the following June he was chosen colonel of the first legion of the national guard of Paris. In 1849 he was elected representative of the legislative assembly for the department of Deux-Sèvres. He died 25th July, 1852.

GOUT, a specific constitutional disorder connected with excess of uric acid in the blood, and manifesting itself by inflammation of joints, with deposition therein of urate of soda, and also by morbid changes in various important organs.

The term gout, which was first used about the end of the 13th century, is derived through the French *goutte* from the Latin *gutta*, a drop, in allusion to the old pathological doctrine (which in the present case seems to be essentially the correct one) of the dropping of a morbid material from the blood within the joints. The disease was known and described by the ancient Greek physicians under various terms, which, however, appear to have been applied by them alike to rheumatism and gout. The general term *arthritis* (*ἄρθρον*, a joint) was employed when many joints were the seat of inflammation; while in those instances where the disease was limited to one part the terms used bore reference to such locality; hence *podagra* (*ποδάγρα*, from *πούς*, the foot, and *ἄγρα*, a seizure), *chiragra* (*χείρ*, the hand), *gonagra* (*γόνυ*, the knee), etc.

Hippocrates in his *Aphorisms* speaks of gout as occurring most commonly in spring and autumn, and mentions the fact that women are less liable to it than men. He also gives directions as to treatment. Celsus gives a similar account of the disease. Galen regarded gout as an unnatural accumulation of humors in a part, and the chalkstones as the concretions of these, and he attributed the disease to over-indulgence and luxury. Gout is alluded to

in the works of Ovid and Pliny, and Seneca in his 95th epistle mentions the prevalence of gout among the Roman ladies of his day as one of the results of their high living and debauchery. Lucian in his *Tragopodagra* gives an amusing account of the remedies employed for the cure of gout.

In all times this disease has engaged a large share of the attention of physicians, from its wide prevalence, and from the amount of suffering which it entails. Sydenham, the famous English physician of the 17th century, wrote an important treatise on the subject, and his description of the gouty paroxysm, all the more vivid from his having himself been afflicted with the disease for thirty-four years, is still quoted by writers as the most graphic and exhaustive account of the symptomatology of gout. Subsequently Cullen, recognizing gout as capable of manifesting itself in various ways, divided the disease into *regular gout*, which affects the joints only, and *irregular gout*, where the gouty disposition exhibits itself in other forms; and the latter variety he subdivided into *atonic gout*, where the most prominent symptoms are throughout referable to the stomach and alimentary canal; *retrocedent gout*, where the inflammatory attack suddenly disappears from an affected joint and serious disturbance takes place in some internal organ, generally the stomach or heart; and *misplaced gout*, where from the first the disease does not appear externally, but reveals itself by an inflammatory attack of some internal part. Dr. Garrod, one of the most eminent living authorities on gout, adopts a division somewhat similar to though simpler than that of Cullen, namely, *regular gout*, which affects the joints alone, and is either acute or chronic, and *irregular gout*, affecting non-articular tissues, or disturbing the functions of various organs.

It is often stated that the attack of gout comes on without any previous warning; but, while this is true in many instances, the reverse is probably as frequently the case, and the premonitory symptoms, especially in those who have previously suffered from the disease, may be sufficiently precise to indicate the impending seizure. Among the more common of these may be mentioned marked disorders of the digestive organs, with a feeble and capricious appetite, flatulence and pain after eating, and uneasiness in the right side in the region of the liver. A remarkable tendency to gnashing of the teeth is sometimes observed. This symptom was first noticed by Dr. Graves, who connected it with irritation in the urinary organs, which also is present as one of the premonitory indications of the gouty attack. Various forms of nervous disturbance also present themselves in the form of general discomfort, extreme irritability of temper, and various perverted sensations, such as that of numbness and coldness in the limbs. These symptoms may persist for many days and then undergo amelioration immediately before the impending paroxysm. On the night of the attack the patient retires to rest apparently well, but about two or three o'clock in the morning is awakened with a painful feeling in the foot, most commonly in the ball of the great toe, but it may be in the instep or heel, or in the thumb. With the pain there often occurs a distinct shivering followed by feverishness. The pain soon becomes of the most agonizing character: in the words of Sydenham, "now it is a violent stretching and tearing of the ligaments, now it is a gnawing pain, and now a pressure and tightening; so exquisite and lively meanwhile is the part affected that it cannot bear the weight of the bedclothes, nor the jar of a person walking in the room."

When the affected part is examined it is found to be swollen and of a deep red hue. The superjacent skin is tense and glistening, and the surrounding veins are more or less distended. After a few hours there is a remission of the pain, slight perspiration takes place, and the patient may fall asleep. The pain may continue moderate during the day but returns as night advances, and the patient goes through a similar experience of suffering to that of the previous night, followed with a like abatement towards morning. These nocturnal exacerbations occur with greater or less severity during the continuance of the attack, which generally lasts for a week or ten days. As the symptoms decline the swelling and tenderness of the affected joint abate, but the skin over it pits on pressure for a time, and with this there is often associated slight desquamation of the cuticle. During the attacks there is much constitutional disturbance. The patient is restless and extremely irritable, and suffers from cramp in the limbs and from dyspepsia, thirst, and constipation. The urine is scanty and high-colored, with a copious deposit, consisting chiefly of urates. During the continuance of the symptoms the inflammation may leave the one foot and affect the other, or both may suffer at the same time. After the attack is over the patient feels quite well and fancies himself better than he had been for a long time before; hence the once popular notion that a fit of the gout was capable of removing all other ailments. Any such idea, however, is sadly belied in the experience of most sufferers from this disease. It is rare that the first is the only attack of gout, and another is apt to occur within a year, although by care and treatment it may be warded off. The disease, however, undoubtedly tends to take a firmer hold on the constitution and to return. In the earlier recurrences the same joints as were formerly the seat of the gouty inflammation suffer again, but in course of time others become implicated, until in advanced cases scarcely any articulation escapes, and the disease thus becomes chronic. It is to be noticed that when gout assumes this form the frequently recurring attacks are usually attended with less pain than the earlier ones, but their disastrous effects are evidenced alike by the disturbance of various important organs, especially the stomach, liver, kidneys, and heart, and by the remarkable changes which take place in the joints from the formation of the so-called chalk-stones or tophi. These deposits, which are highly characteristic of gout, appear at first to take place in the form of a semifluid material, consisting for the most part of urate of soda, which gradually becomes more dense, and ultimately quite hard. When any quantity of this is deposited in the structures of a joint the effect is to produce stiffening, and, as deposits appear to take place to a greater or less amount in connection with every attack, permanent thickening and deformity of the parts is apt to be the consequence. The extent of this depends of course on the amount of the deposits, which, however, would seem to be in no necessary relation to the severity of the attack, being in some cases even of chronic gout so slight as to be barely appreciable externally, but on the other hand occasionally causing great enlargement of the joints, and fixing them in a flexed or extended position which renders them entirely useless. Dr. Garrod describes the appearance of a hand in an extreme case of this kind, and likens its shape to a bundle of French carrots with their heads forward, the nails corresponding to the stalks. Any of the joints may be thus affected, but most commonly those of the hands and feet. The deposits take place in other structures besides those of joints, such as along the course of tendons, underneath the skin and periosteum, in the sclerotic coat of the eye, and especially on the cartilages of the external ear. When largely deposited in joints an abscess sometimes forms, the skin gives way, and the concretion is exposed. Sir Thomas Watson quotes a case of this kind where the patient when playing at cards was accustomed to chalk the score of the game upon the table with his gouty knuckles.

The recognition of what is termed irregular gout is less easy than that form above described, where the disease gives abundant external evidence of its presence; but that other parts than joints suffer from gouty attacks is beyond question. The diagnosis may often be made in cases where, in an attack of ordinary gout, the disease suddenly leaves the affected joints and some new series of symptoms arises. It has been often observed when cold has been applied to an inflamed joint that the pain and inflammation in the part ceased, but that some sudden and alarming seizure referable to the stomach, brain, heart, or lungs supervened. Such attacks, which correspond to what is termed by Cullen retrocedent gout, often terminate favorably, more especially if the disease again returns to the joints. Further, the gouty nature of some long-continued internal or cutaneous disorder may be rendered apparent by its disappearance on the outbreak of the paroxysm in the joints. Gout, when of long standing, is often found associated with degenerative changes in the heart and large arteries, the liver, and especially the kidneys, which are apt to assume the contracted granular condition already alluded to as one of the forms of Bright's disease (see BRIGHT'S DISEASE). A variety of urinary calculus—the uric acid—formed by concretions of this substance in the kidneys is a not unfrequent occurrence in connection with gout; hence the well-known association of this disease and gravel.

As regards the pathology of gout, all inquiry agrees in connecting it closely with an altered state of the blood,

more particularly with the presence in that fluid in excessive amount of uric acid, and its subsequent deposition in the joints in the form of urate of soda. Uric acid is formed in the system in the processes of nutrition, and is excreted by the kidneys, the amount passing off by the urine being estimated at about 8 grains daily. In the healthy human subject the blood contains the merest trace of this acid, but in gout it may be detected in abundance in the blood-serum both prior to and during the acute attack, while in chronic gout it becomes a constant constituent of the blood and of other fluids of the body, both natural and morbid. According to Dr. Garrod it is not merely the presence of the uric acid in the blood but its deposition in the inflamed part that gives rise to the attack of gout, the inflammation being the effect and not the cause of the deposit. The gouty paroxysm thus induced appears to rid the system to a certain extent of the accumulated uric acid, although such relief is generally of but temporary duration.

Whether the accumulation of urates in the blood be due, as some affirm, to their excessive formation in the system as the result of functional derangement of the liver, or, as others hold, depends simply on the defective excreting power of the kidneys of the daily amount, is disputed, although it has been often observed during an attack of gout that the amount of uric acid excreted was markedly deficient. The likelihood is that both these conditions concur, and that while the kidneys retain their functional integrity even an excessive amount of uric acid in the system may be got rid of, but that these organs, becoming themselves affected by the deposition of urates in their tubular structure, lose to a large extent their excreting power, and thus the blood is overcharged with the product which the kidneys can no longer entirely remove. Another view of the pathology of gout recently advanced regards the disease as resulting from special degenerative changes in the fibrous textures of the body, one of the effects of which is the deposition of urates in the affected parts whence they pass into the blood. This theory has not, however, as yet been extensively supported, and the weight of opinion remains on the whole in favor of the views of Dr. Garrod. It must nevertheless be admitted that many points in the pathology of this disease still remain unexplained, for, as remarked by Trousseau, "the production in excess of uric acid and urates is a pathological phenomenon inherent like all others in the disease; and like all the others it is dominated by a specific cause, which we know only by its effects, and which we term the gouty diathesis." This subject of diathesis (habit, or organic predisposition of individuals), which is universally admitted as an essential element in the pathology of gout, naturally suggests the question as to whether, besides being inherited, such a peculiarity may also be acquired, and this leads to a consideration of the causes which are recognized as influential in favoring the occurrence of this disease.

It is beyond dispute that gout is in a marked degree hereditary, fully more than half the number of cases being, according to Sir C. Scudamore and Dr. Garrod, of this character. But it is no less certain that there are habits and modes of life the observance of which may induce the disease even where no hereditary tendencies can be traced, and the avoidance of which may on the other hand go far towards weakening or neutralizing the influence of inherited liability. Gout is said to affect the sedentary more readily than the active, but this cannot be taken as a very constant rule. If, however, inadequate exercise be combined with a luxurious manner of living, with habitual over-indulgence in animal food and rich dishes, and especially in alcoholic beverages, then undoubtedly the chief factors in the production of the disease are present.

Much has been written upon the relative influence of various forms of alcoholic drinks in promoting the development of gout. It is generally stated that fermented are more injurious than distilled liquors, and that, in particular, the stronger wines, such as port, sherry, and madeira, are much more potent in their gout-producing action than the lighter class of wines, such as hock, moselle, etc., while malt liquors are fully as hurtful as strong wines. If this alleged difference in their tendency to induce gout be correct, it cannot be said that any satisfactory explanation of it has been furnished; but indeed the point has not been clearly proved, and it may be fairly questioned whether, other things being equal, an individual in abandoning the use of wines and substituting that of spirits would improve his position in relation to this disease. It seems quite as probable that over-indulgence in any form of alcohol, when associated with the other conditions already adverted to, will have very much the same effect in developing gout. Even those who affirm the mischievous effects of fermented liquors in this way are obliged to admit that they are injurious in proportion to the amount of alcohol they contain. The comparative absence of gout in countries where spirituous liquors are chiefly used, such as Scotland, is cited as showing their relatively slight effect in encouraging that disease; but it is to be noticed that in such countries there is on the whole a less marked tendency to excess in the other pleasures of the table, which in no degree less than alcohol are chargeable with inducing the gouty habit Gout is not a common disease among the poor and laboring classes, and when it does occur may often be connected even in them with errors in living. It is not very rare to meet gout in butlers, coachmen, etc., who are apt to live luxuriously while leading comparatively easy lives.

Gout, it must ever be borne in mind, may also affect persons who observe the strictest temperance in living, and whose only excesses are in the direction of over-work, either physical or intellectual. Many of the great names in history in all times have had their existence embittered by this malady, and have died from its effects. The influence of hereditary tendency may often be traced in such instances, and is doubtless called into activity by the depressing consequences of over-work. It may, notwithstanding, be affirmed as generally true that those who lead regular lives and are moderate in the use of animal food and alcoholic drinks, or still better abstain from the latter altogether, are little likely to be the victims of gout even where an undoubted inherited tendency exists.

Gout is more common in mature age than in the earlier years of life, the greatest number of cases in one decennial period being between the ages of thirty and forty, next between twenty and thirty, and thirdly between forty and fifty. It may occasionally affect very young persons, but such cases are generally in a marked degree hereditary. After middle life gout rarely appears for the first time. Women are much less the subjects of gout than men, apparently from their less exposure to the influences (excepting of course that of heredity) which tend to develop the disease, and doubtless also from the differing circumstances of their physical constitution. It most frequently appears in females after the cessation of the menses. Persons exposed to the influence of lead poisoning, such as plumbers, painters, etc., are apt to suffer from gout; and it would seem that impregnation of the system with this metal markedly interferes with the uric-acid-excreting function of the kidneys.

Attacks of gout are readily excited in those predisposed to the disease. Exposure to cold, disorders of digestion, fatigue, and irritation or injuries of particular joints will often precipitate the gouty paroxysm.

With respect to the treatment of gout the greatest variety of opinion has prevailed and practice been pursued, from the numerous quaint nostrums detailed by Lucian to the "expectant" or do-nothing system recommended by Sydenham and gravely advocated by a few among eminent modern physicians, who regard the disease as beyond the reach of remedies. But that gout, although, as has been shown, a malady of a most severe and intractable character, may nevertheless be successfully dealt with by appropriate medicinal and hygienic measures is a belief largely entertained, and one which happily guides the practice of the physician. The general plan of treatment can be here only briefly indicated. During the acute attack the affected part should be kept at perfect rest, and have applied to it warm opiate fomentations or poultices, or, what answers fully better, be enveloped in cotton wool covered in with oil silk. The diet of the patient should be light, without animal food or stimulants. The administration of some simple laxative will be of service, as well as the free use of alkaline diuretics, such as the bicarbonate or acetate of potash. The medicinal agent most to be relied on in the treatment of gout is colchicum, which manifestly exercises a powerful action on the disease. This drug (*Colchicum autumnale*), which is believed to correspond to the hermodactyl of the ancients, was introduced as a remedy for gout about a century ago, and has proved of such efficacy in modifying the attacks that, as observed by Dr. Garrod, "we may safely assert that colchicum possesses as specific a control over the gouty inflammation as cinchona barks or their alkaloids over intermittent fever." The mode of action of colchicum

in gout is by no means determined, since it would appear to have no certain effect upon the uric acid excreted from the system; and the general opinion seems to be that this drug has a special sedative effect on the gouty inflammation. It is usually administered in the form of the wine in doses of 10–30 drops every four or six hours, or in pill as the acetous extract (gr. ½–gr. i.). The effect of colchicum in subduing the pain of gout is generally so prompt and marked that it is unnecessary to have recourse to opiates; but its action requires to be carefully watched by the physician from its well-known nauseating and depressing consequences, which, should they appear, render the suspension of the drug necessary. Otherwise the remedy may be continued in gradually diminishing doses for some days after the disappearance of the gouty inflammation. The statements often made that colchicum tends to encourage the speedy return of the disease do not seem to be well founded. Should gout give evidence of its presence in an irregular form by attacking internal organs, besides the medicinal treatment above mentioned, the use of frictions and mustard applications to the joints is indicated with the view of exciting its appearance there.

When gout has become chronic, colchicum, although of less service than in acute gout, is yet valuable, particularly when the inflammatory attacks recur. More benefit, however, appears to be derived from iodide of potassium, guaiacum, and more especially from the alkalis potash and lithia. This latter drug is strongly recommended by Dr. Garrod from its solvent action upon the urates. It is usually administered in the form of the carbonate (gr. v., freely diluted).

The treatment and regimen to be employed in the intervals of the gouty attacks are of the highest importance. These bear reference for the most part to the habits and mode of life of the patient. Restriction must be laid upon the amount and quality of the food, and equally, or still more, upon the alcoholic stimulants. "The instances," says Sir Thomas Watson, "are not few of men of good sense, and masters of themselves, who, being warned by one visitation of the gout, have thenceforward resolutely abstained from rich living and from wine and strong drinks of all kinds, and who have been rewarded for their prudence and self-denial by complete immunity from any return of the disease, or upon whom, at any rate, its future assaults have been few and feeble." The same eminent authority adds—"I am sure it is worth any *young* man's while, who has had the gout, to become a teetotaller." By those more advanced in life who, from long-continued habit, are unable entirely to relinquish the use of stimulants, the strictest possible temperance must be observed. Regular but moderate exercise in the form of walking or riding, in the case of those who lead sedentary lives, is of great advantage, and all over-work, either physical or mental, should be avoided. Unfortunately the complete carrying out of such directions, even by those who feel their importance, is too often rendered difficult or impossible by circumstances of occupation and otherwise, and at most only an approximation can be made. The effect upon the gouty constitution of certain mineral waters and baths is well known. The particular place must in each case be determined by the physician, and special caution must be observed in recommending this plan of treatment in persons whose gout is complicated by organic disease of any kind. (J. O. A.)

GOUVION SAINT CYR, Laurent, Marquis de (1764–1830), a French marshal, was born at Toul, 13th April, 1764. At the age of eighteen he went to Rome with the view of prosecuting the study of painting, but, although he continued his artistic studies after his return to Paris in 1784, he never definitely adopted the profession of a painter. In 1792 he was chosen a captain in the *chasseurs républicains*, and served on the staff of General Custine. His promotion rapidly followed, and in the course of two years he had become a general of division. In 1796 he commanded the centre division of Moreau's army in the campaign of the Rhine, and by coolness and sagacity greatly aided him in his brilliant defence against superior numbers, and in his subsequent celebrated retreat. In 1798 he was appointed to the command of the army of Italy, the officers of which had revolted against their general Massena, and he was speedily successful in obtaining the complete re-establishment of discipline. In the following year he commanded the left wing of Jourdan's army in Germany; but when Jourdan was succeeded by Massena, he joined the army of Moreau in Italy, where, in face of great difficulties, he was not only completely successful in his defensive tactics, but gained, on the 13th December, an important victory at Albano. When Moreau, in 1800, was appointed to the command of the army of the Rhine, Gouvion St. Cyr was named his first lieutenant, and on the 9th May gained a victory over General Kray at Biberach. In 1801 he was sent to Spain to command the army intended for the invasion of Portugal, and was named grand officer of the legion of honor. When a treaty of peace was shortly afterwards concluded with Portugal, he succeeded Lucien Bonaparte as ambassador at Madrid. In 1803 he was appointed to the command of an army corps in Italy, and he gained in 1805 a victory over the Austrians at Castel Franco. He took part in the Prussian and Polish campaigns of 1807, and in 1808 he commanded an army corps with some success in Catalonia; but, not wishing to comply with certain orders he received from Paris, he resigned his command, and remained in disgrace till 1811. On the opening of the Russian campaign he received command of the 6th army corps, and on the 7th August, 1812, obtained a victory over the Russians at Polosk, in recognition of which he was created a marshal of France. He distinguished himself at the battle of Dresden, 26th and 27th August, 1813, but, after a stubborn resistance, capitulated there to the allies on the 11th November following, and remained for some time a prisoner in Hungary. On the restoration of the Bourbons he was created a peer of France, and in July, 1815, was appointed war minister, but resigned his office in the November following. In June, 1817, he was appointed minister of marine, and in September following again resumed the duties of war minister, which he continued to discharge till November, 1819. He died 17th March, 1830. Gouvion St. Cyr was a prudent and cautious rather than a brilliant general, but he would doubtless have obtained better opportunities of acquiring distinction had he shown himself more blindly devoted to the interests of Napoleon.

He is the author of the following works:—*Journal des opérations de l'armée de Catalogne en 1808 et 1809*, Paris, 1821; *Mémoires sur les Campagnes des armées de Rhin et de Rhin-et-Moselle de 1794 à 1797*, Paris, 1829; and *Mémoires pour servir à l'histoire militaire sous le Directoire, le Consulat, et l'Empire*, 1831. See Gay de Vernon's *Vie de Gouvion Saint-Cyr*, 1857.

GOVERNMENT. Without attempting to discriminate by verbal definitions the various shades of meaning which this word assumes, we shall use it in this article in its widest sense—that of the ruling power in a political society. The conception of society which this use of the word implies may be illustrated by two well-known theories.

In John Austin's celebrated analysis of law, the first step is the proposition that a law is a command issued by a superior to a subject and enforced by a sanction or penalty. The laws of God with reference to the conduct of men, the laws of a private club or association of men with reference to the conduct of its members, and the laws of a political society, are all, according to Austin's definition, laws properly so called. The laws of nature are laws not properly so called. They are generalizations as to the uniform course of nature, and have no analogy to laws properly so called except in point of uniformity. Positive law, again, is distinguished from other laws, properly so called, as the command of the sovereign of an independent political community. A sovereign is a person, or a determinate body of persons, to whom the bulk of the community is habitually obedient. Every word in this definition has its precise meaning, which is developed by Austin with admirable clearness. The faculty "of untying knots" on which he prided himself is nowhere more conspicuously manifested than in the analysis which lays bare the real meaning of the common phrases used to describe the fundamental parts of society. It is not our purpose to examine the value of this analysis here, but simply to call attention to the assumption that in every society of men there is a determinate body (whether consisting of one individual, or a few or many individuals) whose commands the rest of the community obey. This sovereign body is what in more popular phrase is termed the Government of the country, and the varieties which may exist in its constitution are known as forms of government.

Mr. Herbert Spencer, approaching the study of society under the influence of conceptions derived from the study of physical organisms, brings us to very much the same result. The union of men in society is itself an organic structure, having parts and functions corresponding to the

parts and functions of an animal or a plant. Mr. Spencer pursues this analogy so fully and minutely as to leave the impression that he believes it to be something more than an analogy,—that it is a general law from which true deductions regarding society may be drawn. The veins and arteries correspond to our railroads and highways; the nerves, communicating intelligence to the brain, are paralleled by the telegraph wires; the centralized action of society at the seat of government is the same thing as the regulative activity of the brain. Government is here represented by the regulative functions of a living organism, and forms of government are so many varieties in the structure. Austin, for the purposes of jurisprudence, finds it convenient to regard society as moulded by the will of a dominant body. Spencer exhibits the regulative parts of society as bound up with the rest in one organism. With both the existence of a government is necessary to the conception of society. In the one theory the element of command, in the other that of regulation, is conspicuous. If to these we add a third, that of simple agency, we shall have a tolerably complete view of the relations between Government and society. Besides commanding the conduct of individuals, besides regulating the relations of the various members of society, Government may be conceived of as merely the instrument of society. Where men are united in groups there arises from their union the necessity of action on behalf of the group. That part of society which attends to the business of the whole is the Government.

Two main lines of inquiry divide the subject. The first relates to varieties in the structure of the governing body—forms of government. The second relates to the functions of the governing body, the sphere of government, the things which fall within the province of state action. In both lines we have to deal with the ascertained facts of the past history and present condition of human societies. In both we have also to notice the speculative opinions of political thinkers. Notwithstanding the apparent confusion it will probably be found more convenient not to separate the historical from the speculative treatment of the subject. What is the best form of government?—is not quite the same question as What was the constitution of Athens or Rome? What are the proper limits of state interference?—is not the same question as What are the functions of the state in France or England? And yet the same answer may often serve for both sets of questions. Ideal constitutions have a suspicious resemblance to the constitutions with which their authors are most familiar. The political speculations of Plato and of Cicero are based on the state systems of Greece and Italy. Cicero's ideal code in the treatise *De Legibus* is simply an adaptation of the Twelve Tables. On the other hand, the form of political speculation is often determined by, and in turn determines, the practical politics of the time. The intimate connection between speculation and practice in politics is strikingly illustrated in the period of controversy which culminated in the Revolution of 1688. The irreconcilable claims of crown and parliament threw the mind back on first principles. Never had theorists a better chance. Popular government and absolute government each sought to establish itself on a basis of reason and nature. Filmer founds kingly authority on the natural subjection of mankind and the lineal succession of the king to Adam, the first and divinely appointed head of mankind. Locke's general theories of civil government were, in his own opinion, sufficient "to establish the throne of our great restorer or present king, William, to make good his title in the consent of the people, which, *being the only one of all lawful governments*, he has more fully and clearly than any prince in Christendom" We all know how the political issue was decided. The practical was not more complete than the speculative victory. For two centuries the speculations invented to support the popular cause against absolutism have been the accepted commonplaces of Englishmen on the constitution of civil society. A more recent example may be given from modern politics. During the discussions which preceded the passing of the Reform Act of 1867, no question was more hotly disputed than that of the real nature of the franchise. Was it a right or was it a privilege? In form this is a scientific or, if we like, a metaphysical question. But the answer to it depended on another question altogether—whether you wished the franchise to be extended to a larger class or not.

Origin of Government.—A preliminary question, formerly of vast theoretical importance, would be, What is the origin of government? How did government come into existence? As a question of historical fact, it demands for its solution a knowledge of the whole past of the human race. It has been answered over and over again in times when historical knowledge could hardly be said to exist, and it has therefore been answered without any reference to history. The answers which have satisfied the minds of men may be distinguished broadly into three classes. The first class would comprehend the legendary accounts which nations have given in primitive times of their own forms of government. These are always attributed to the mind of a single lawgiver. The government of Sparta was the invention of Lycurgus. Solon, Moses, Numa, and Alfred in like manner shaped the government of their respective nations. There was no curiosity about the institutions of other nations,—about the origin of governments in general; and each nation was perfectly ready to accept the traditional *νομοθέται* of any other.

The second may be called the logical or metaphysical account of the origin of government. It contained no overt reference to any particular form of government, whatever its covert references may have been. It answered the question, How government in general came into existence; and it answered it by a logical analysis of the elements of society. The phenomenon to be accounted for being government and laws, it abstracted government and laws, and contemplated mankind as existing without them. The characteristic feature of this kind of speculation is that it reflects how contemporary men would behave if all government were removed, and infers that men must have behaved so before government came into existence. Society without government resolves itself into a number of individuals each following his own aims, and therefore, in the days before government, each man followed his own aims. It is easy to see how this kind of reasoning should lead to very different views of the nature of the supposed original state. With Hobbes, it is a state of war, and government is the result of an agreement among men to keep the peace. With Locke it is a state of liberty and equality,—it is not a state of war; it is governed by its own law,—the law of nature, which is the same thing as the law of reason. The state of nature is brought to an end by the voluntary agreement of individuals to surrender their natural liberty, and submit themselves to one supreme Government. In the words of Locke, "Men being by nature all free, equal, and independent, no one can be put out of this estate and subjected to the political power of another without his own consent. The only way whereby any one divests himself of his natural liberty, and puts on the *bonds of civil society*, is by agreeing with other men to join and unite into a community" (*On Civil Government*, c. viii.). Locke boldly defends his theory as founded on historical fact, and it is amusing to compare his demonstration of the baselessness of Filmer's speculations with the scanty and doubtful examples which he accepts as the foundation of his own. But in general the various forms of the hypothesis eliminate the question of time altogether. The original contract from which government sprung is likewise the subsisting contract on which civil society continues to be based. The historical weakness of the theory was probably always recognized. Its logical inadequacy was conclusively demonstrated by Austin. But it still clings to speculations on the principles of government.

The "social compact" is the most famous of the metaphysical explanations of government. It has had the largest history, the widest influence, and the most complete development. To the same class belong the various forms of the theory that governments exist by divine appointment. Of all that has been written about the divine right of kings, a great deal must be set down to the mere flatteries of courtiers and ecclesiastics. But there remains a genuine belief that men are bound to obey their rulers because their rulers have been appointed by God. Like the social compact, the theory of divine appointment avoided the question of historical fact.

The application of the historical method to the phenomena of society has changed the aspect of the question and robbed it of its political interest. The student of the history of society has no formula to express the law by which government is born. All that he can do is to trace governmental forms through various stages of social development. The more complex and the larger the society, the more distinct is the separation between the governing part and the

rest, and the more elaborate is the subdivision of functions in the government. The primitive type of ruler is king, judge, priest, and general. At the same time, his way of life differs little from that of his followers and subjects. The metaphysical theories were so far right in imputing greater equality of social conditions to more primitive times. Increase of bulk brings with it a more complex social organization. War tends to develop the strength of the governmental organization; peace relaxes it. All societies of men exhibit the germs of government; but there would appear to be races of men so low that they cannot be said to live together in society at all. Recent investigations have illustrated very fully the importance of the family in primitive societies, and the belief in a common descent has much to do with the social cohesion of a tribe. The government of a tribe resembles the government of a household; the head of the family is the ruler. But we cannot affirm that political government has its origin in family government, or that there may not have been states of society in which government of some sort existed while the family did not.

I. Forms of Government.

Three Standard Forms.—Political writers from the time of Aristotle have been singularly unanimous in their classification of the forms of government. There are three ways in which states may be governed. They may be governed by one man, or by a number of men, small in proportion to the whole number of men in the state, or by a number large in proportion to the whole number of men in the state. The government may be a monarchy, an aristocracy, or a democracy. The same terms are used by Austin as were used by Aristotle, and in very nearly the same sense. The determining quality in governments in both writers, and it may safely be said in all intermediate writers, is the numerical relation between the constituent members of the government and the population of the state. There were, of course, enormous differences between the state-systems present to the mind of the Greek philosopher and the English jurist. Aristotle was thinking of the small independent states of Greece, Austin of the great peoples of modern Europe. The unit of government in the one case was a city, in the other a nation. This difference is of itself enough to invalidate all generalization founded on the common terminology. But on one point there is a complete parallel between the politics of Aristotle and the politics of Austin. The Greek cities were to the rest of the world very much what European nations and European colonies are to the rest of the world now. They were the only communities in which the governed visibly took some share in the work of government. Outside the European system, as outside the Greek system, we have only the stereotyped uniformity of despotism, whether savage or civilized. The question of forms of government, therefore, belongs entirely to the European races. The virtues and defects of monarchy, aristocracy, and democracy are the virtues and defects manifested by the historical Governments of Europe. The generality of the language used by political writers must not blind us to the fact that they are thinking only of a comparatively small portion of mankind.

Greek Politics.—Aristotle divides governments according to two principles. In all states the governing power seeks either its own advantage or the advantage of the whole state, and the government is bad or good accordingly. In all states the governing power is one man, or a few men, or many men. Hence six varieties of government, three of which are bad and three good. Each excellent form has a corresponding depraved form, thus:—

The good government of one (Monarchy) corresponds to the depraved form (Tyranny).
The good government of few (Aristocracy) corresponds to the depraved form (Oligarchy).
The good government of many (Commonwealth) corresponds to the depraved form (Democracy).

The fault of the depraved forms is that the governors act unjustly where their own interests are concerned. The worst of the depraved forms is tyranny, the next oligarchy, and the least bad democracy.[1] Each of the three leading types exhibits a number of varieties. Thus in monarchy we have the heroic, the barbaric, the elective dictatorship, the Lacedemonian (hereditary generalship, στρατηγία), and absolute monarchy. So democracy and oligarchy exhibit four corresponding varieties. The best type of democracy is that of a community mainly agricultural, whose citizens, therefore, have not leisure for political affairs, and allow the law to rule. The best oligarchy is that in which a considerable number of small proprietors have the power; here, too, the laws prevail. The worst democracy consists of a larger citizen class having leisure for politics; and the worst oligarchy is that of a small number of very rich and influential men. In both the sphere of law is reduced to a minimum. A good government is one in which as much as possible is left to the laws, and as little as possible to the will of the governor.

The *Politics* of Aristotle, from which these principles are taken, presents a striking picture of the variety and activity of political life in the free communities of Greece. The king and council of heroic times had disappeared, and self-government in some form or other was the general rule. It is to be noticed, however, that the Governments of Greece were essentially unstable. The political philosophers could lay down the law of development by which one form of government gives birth to another. Aristotle devotes a large portion of his work to the consideration of the causes of revolutions. The dread of tyranny was kept alive by the facility with which an over-powerful and unscrupulous citizen could seize the whole machinery of government. Communities oscillated between some form of oligarchy and some form of democracy. The security of each was constantly imperilled by the conspiracies of the opposing factions. Hence, although political life exhibits that exuberant variety of form and expression which characterizes all the intellectual products of Greece, it lacks the quality of persistent progress. Then there was no approximation to a national government, even of the federal type. The varying confederacies and hegemonies are the nearest approach to anything of the kind. What kind of national government would ultimately have arisen if Greece had not been crushed it is needless to conjecture; the true interest of Greek politics lies in the fact that the free citizens were, in the strictest sense of the word, self-governed. Each citizen took his turn at the common business of the state. He spoke his own views in the agora, and from time to time in his own person acted as magistrate or judge. Citizenship in Athens was a liberal education, such as it never can be made under any representative system.

The Government of Rome.—During the whole period of freedom the government of Rome was, in theory at least, municipal self-government. Each citizen had a right to vote laws in his own person in the comitia of the centuries or the tribes. The administrative powers of government were, however, in the hands of a bureaucratic assembly, recruited from the holders of high public office. The senate represented capacity and experience rather than rank and wealth. Without some such instrument the city government of Rome could never have made the conquest of the world. The gradual extension of the citizenship to other Italians changed the character of Roman government. The distant citizens could not come to the voting-booths; the device of representation was not discovered; and the comitia fell into the power of the town voters. In the last stage of the Roman republic the inhabitants of one town wielded the resources of a world-wide empire. We can imagine what would be the effect of leaving to the people of London or Paris the supreme control of the British empire or of France,—irresistible temptation, inevitable corruption. The rabble of the capital learn to live on the rest of the empire.[2] The favor of the effeminate masters of the world is purchased by *panem et circenses*. That capable officers and victorious armies should long be content to serve such masters was impossible. A conspiracy of generals placed itself at the head of affairs, and the most capable of them made himself sole master. Under Cæsar, Augustus, and Tiberius the Roman people became habituated to a new form of government, which is best described by the name of Cæsarism. The outward forms of republican government remained, but one man united in his own person all the leading offices, and used them to give a seemingly legal title to what was essentially military despotism. There is no

[1] Aristotle elsewhere speaks of the error of those who think that any one of the depraved forms is better than any other.

[2] None of the free states of Greece ever made extensive or permanent conquests; but the tribute sometimes paid by one state to another (as by the Æginetans to the Athenians) was a manifest source of corruption. Compare the remarks of Hume (*Essays*, part i. 3, *That Politics may be reduced to a Science*), "free governments are the most ruinous and oppressive for their provinces."

more interesting constitutional study than the chapters in which Tacitus traces the growth of the new system under the subtle and dissimulating intellect of Tiberius. The new Roman empire was as full of fictions as the English constitution of the present day. The master of the world posed as the humble servant of a menial senate. Deprecating the outward symbols of sovereignty, he was satisfied with the modest powers of a consul or a tribunus plebis. The reign of Tiberius, little capable as he was by personal character of captivating the favor of the multitude, did more for imperialism than was done by his more famous predecessors. Henceforward free government all over the world lay crushed beneath the military despotism of Rome. Cæsarism remained true to the character imposed upon it by its origin. The Cæsar was an elective not an hereditary king. The real foundation of his power was the army, and the army in course of time openly assumed the right of nominating the sovereign. The characteristic weakness of the Roman empire was the uncertainty of the succession. The nomination of a Cæsar in the lifetime of the emperor was an ineffective remedy. Rival emperors were elected by different armies; and nothing less than the force of arms could decide the question between them.

Modern Governments.—Feudalism.—The Roman empire bequeathed to modern Europe the theory of universal dominion. The nationalities which grew up after its fall arranged themselves on the basis of territorial sovereignty. Leaving out of account the free municipalities of the Middle Ages, the problem of government had now to be solved, not for small urban communities, but for large territorial nations. The mediæval form of government was feudal. One common type pervaded all the relations of life. The relation of king and lord was like the relation between lord and vassal (see FEUDALISM). The bond between them was the tenure of land. In England there had been, before the Norman Conquest, an approximation to a feudal system. In the earlier English constitution, the most striking features were the power of the witan, and the common property of the nation in a large portion of the soil. The steady development of the power of the king kept pace with the aggregation of the English tribes under one king. The conception that the land belonged primarily to the people gave way to the conception that everything belonged primarily to the king.[1] The Norman Conquest imposed on England the already highly developed feudalism of France, and out of this feudalism the free governments of modern Europe have grown. One or two of the leading steps in this process may be indicated here. The first, and perhaps the most important, was the device of representation. For an account of its origin, and for instances of its use in England before its application to politics, we must be content to refer to Canon Stubbs's *Constitutional History*, vol. ii. The problem of combining a large area of sovereignty with some degree of self-government, which had proved fatal to ancient commonwealths, was henceforward solved. From that time some form of representation has been deemed essential to every constitution professing, however remotely, to be free.

The connection between representation and the feudal system of estates must be shortly noticed. The feudal theory gave the king a limited right to military service and to certain aids, both of which were utterly inadequate to meet the expenses of the government, especially in time of war. The king therefore had to get contributions from his people, and he consulted them in their respective orders. The three estates were simply the three natural divisions of the people, and Canon Stubbs has pointed out that, in the occasional treaties between a necessitous king and the order of merchants or lawyers, we have examples of inchoate estates or sub-estates of the realm. The right of representation was thus in its origin a right to consent to taxation. The pure theory of feudalism had from the beginning been broken by William the Conqueror causing all free-holders to take an oath of direct allegiance to himself. The institution of parliaments, and the association of the king's smaller tenants *in capite* with other commoners, still further removed the government from the purely feudal type, in which the mesne lord stands between the inferior vassal and the king.

Parliamentary Government.—The English System.—The right of the commons to share the power of the king and lords in legislation, the exclusive right of the commons to impose taxes, the disappearance of the clergy as a separate order, were all important steps in the movement towards popular government. The extinction of the old feudal nobility in the dynastic wars of the 15th century simplified the question by leaving the crown face to face with parliament. The immediate result was no doubt an increase in the power of the crown, which probably never stood higher than it did in the reigns of Henry VIII. and Elizabeth; but even these powerful monarchs were studious in their regard for parliamentary conventionalities. After a long period of speculative controversy and civil war, the settlement of 1688 established limited monarchy as the government of England. Since that time the external form of government has remained unchanged, and, so far as legal description goes, the constitution of William III. might be taken for the same system as that which still exists. The silent changes have, however, been enormous. The most striking of these, and that which has produced the most salient features of the English system, is the growth of cabinet government. Intimately connected with this is the rise of the two great historical parties of English politics. The normal state of government in England is that the cabinet of the day shall represent that which is, for the time, the stronger of the two. Before the Revolution the king's ministers had begun to act as a united body; but even after the Revolution the union was still feeble and fluctuating, and each individual minister was bound to the others only by the tie of common service to the king. Under the Hanoverian sovereigns the ministry became consolidated, the position of the cabinet became definite, and its dependence on parliament, and more particularly on the House of Commons, was established. Ministers were chosen exclusively from one house or the other, and they assumed complete responsibility for every act done in the name of the crown. The simplicity of English politics has divided parliament into two nearly equal parties, and the party in opposition has been steadied by the consciousness that it, too, has constitutional functions of high importance. Criticism is sobered by being made responsible. Along with this movement went the withdrawal of the personal action of the monarch in politics. No king has attempted to veto a bill since the Scotch Militia Bill was vetoed by Queen Anne. No ministry has been dismissed by the sovereign since 1834. Whatever the power of the monarch may be, it is unquestionably limited to his personal influence over his ministers. And it must be remembered that ministers are responsible ultimately, not to parliament, but to the House of Commons.

Apart, therefore, from the democratic changes of 1832 and 1867, we find that the House of Commons, as a body, had gradually made itself the centre of the government. Since the area of the constitution has been enlarged, it may be doubted whether the orthodox descriptions of the government any longer apply. The earlier constitutional writers, such as Blackstone and Delolme, regard it as a wonderful compound of the three standard forms—monarchy, aristocracy, and democracy. Each has its place, and each acts as a check upon the others. Hume, discussing the question "Whether the British government inclines more to absolute monarchy or to a republic," decides in favor of the former alternative. "The tide has run long and with some rapidity to the side of popular government, and is just beginning to turn toward monarchy." And he gives it as his own opinion that absolute monarchy would be the easiest death, the true euthanasia, of the English constitution. These views of the English Government in the 18th century may be contrasted with Mr. Bagehot's sketch of the modern government as a working instrument.[2]

Leading Features of Parliamentary Government.—The parliamentary government developed by England out of feudal materials has been deliberately accepted as the type of constitutional government all over the world. Nearly all the European states and nearly all the European colonies, dependent or independent, have adopted, more or less fully, the leading features of the English system—that is to say, popular representation more or less extensive, a bicameral

[1] Ultimately, in the theory of English law, the king may be said to have become the universal successor of the people. Some of the peculiarities of the prerogative rights seem to be explainable only on this view, *e. g.*, the curious distinction between wrecks come to land and wrecks still on water. The common right to wreckage was no doubt the origin of the prerogative right to the former. Every ancient common right has come to be a right of the crown or a right held of the crown by a vassal.

[2] See Bagehot's *English Constitution*.

legislature, and a cabinet or consolidated ministry. In connection with all of these, numberless questions of the highest practical importance have arisen, the bare enumeration of which would surpass the limits of our space. We shall confine ourselves to a few very general considerations.

The Two Chambers.—First, as to the double chamber. This, which is perhaps more accidental than any other portion of the English system, has been the most widely imitated. In most European countries, in the English colonies, in the United States congress, and in the separate States of the Union,[1] there are two houses of legislature. This result has been brought about partly by natural imitation of the accepted type of free government, partly from a conviction that the second chamber will moderate the democratic tendencies of the first. The theoretical question would take too long to argue, but it is easy to show that the elements of the English original cannot be reproduced to order under different conditions.[2] There have, indeed, been a few attempts to imitate the special character of hereditary nobility attaching to the English House of Lords, and these few have failed. The complete solidarity existing between the English nobility and at least the politically privileged, if not the whole mass, of their countrymen, is a result not to be attempted by the framers of constitutions. The English system, too, after its own way, obviates any danger of collision between the Houses,—the standing and obvious danger of the bicameral system. In England there is no doubt where the real sovereignty lies. The actual ministers of the day must possess the confidence of the House of Commons; they need not—in fact they often do not—possess the confidence of the House of Lords. It is only in legislation that the Lower House really shares its powers with the Upper; and the constitution possesses, in the unlimited power of nominating peers, a well-understood last resource should the House of Lords persist in refusing important measures demanded by the representatives of the people. In all but measures of first-class importance, however, the House of Lords is a real second chamber, and in these there is little danger of a collision between the Houses. There is the widest possible difference between the English and any other second chamber. In the United States the senate (constituted on the system of equal representation of States) is the more important of the two Houses, and the only one whose control of the executive can be compared to that exercised by the British House of Commons. In the English colonies a dead-lock between the two Houses is a matter of frequent occurrence. In France, it is an anticipated if not an intended source of danger to the new republican constitution.

The real strength of popular government in England lies in the ultimate supremacy of the House of Commons. That supremacy had been acquired, perhaps to its full extent, before the extension of the suffrage made the constituencies democratic. Foreign imitators, it may be observed, have been more ready to accept a wide basis of representation than to confer real power on the representative body. In all the monarchical countries of Europe, however unrestricted the right of suffrage may be, the real victory of constitutional government has yet to be won. Where the suffrage means little or nothing, there is little or no reason for guarding it against abuse. The independence of the executive in the United States brings that country, from one point of view, more near to the Continental than to the English state system. The people make a more complete surrender of power to the Government than is done in England.

Cabinet Government.—The peculiar functions of the English cabinet are not easily matched in any foreign system. They are a mystery even to most educated Englishmen. The cabinet in England is much more than a body consisting of chiefs of departments. It is the inner council of the empire, the arbiter of national policy, foreign or domestic, the sovereign in commission. The whole power of the House of Commons is concentrated in its hands. At the same time, it has no place whatever in the legal constitution. Its numbers and its constitution are not fixed even by any rule of practice. It keeps no record of its proceedings. The relations of an individual minister to the cabinet, and of the cabinet to its head and creator, the premier, are things known only to the initiated.[3] With the doubtful exception of France, no other system of government presents us with anything like its equivalent. In the United States, as in the European monarchies, we have a council of ministers surrounding the chief of the state.

Change of Power in the English System.—One of the most difficult problems of government is how to provide for the devolution of political power, and perhaps no other question is so generally and justly applied as the test of a working constitution. If the transmission works smoothly, the constitution, whatever may be its other defects, may at least be pronounced stable. It would be tedious to enumerate all the contrivances which this problem has suggested to political societies. Here, as usual, Oriental despotism stands at the bottom of the scale. When sovereign power is imputed to one family, and the law of succession fails to designate exclusively the individual entitled to succeed, assassination becomes almost a necessary measure of precaution. The prince whom chance or intrigue has promoted to the throne of a father or an uncle, must make himself safe from his relatives and competitors. Hence the scenes which shock the European conscience when "Amurath an Amurath succeeds." Constantinople, Afghanistan, and Burmah have all recently illustrated the standing difficulty of the succession in Oriental despotisms. The strong monarchical governments of Europe have been saved from this evil by an indisputable law of succession, which marks out from his infancy the next successor to the throne. The king names his ministers, and the law names the king. In popular or constitutional governments far more elaborate precautions are required. It is one of the real merits of the English constitution that it has solved this problem—in a roundabout way perhaps, after its fashion—but with perfect success. The ostensible seat of power is the throne, and down to a time not long distant the demise of the crown suspended all the other powers of the state. In point of fact, however, the real change of power occurs on a change of ministry. The constitutional practice of this century has settled, beyond the reach of controversy, the occasions on which a ministry is bound to retire. It must resign or dissolve when it is defeated in the House of Commons, and if after a dissolution it is beaten again, it must resign without alternative. It may resign if it thinks its majority in the House of Commons not sufficiently large. The dormant functions of the crown now come into existence. It receives back political power from the old ministry in order to transmit it to the new. When the new ministry is to be formed, and how it is to be formed, are also clearly settled by established practice. The out-going premier names his successor by recommending the king to consult him; and that successor must be the recognized leader of his successful rivals. All this is a matter of custom, not of law; and it is doubtful if any two authorities could agree in describing the custom in language of precision. It is certain that the intervention of the crown facilitates the transfer of power from one party to another, by giving it the appearance of a mere change of servants. The real disturbance is that caused by the appeal to the electors. A general election is always a struggle between the two great political parties for the possession of the powers of government. It may be noted that recent practice goes far to establish the rule that a ministry beaten at the hustings should resign at once without waiting for a formal defeat in the House of Commons.

The English custom makes the ministry dependent on the will of the House of Commons; and, on the other hand, the House of Commons itself is dependent on the will of the ministry. In the last result both depend on the will of the constituencies, as expressed at the general election. There is no fixity in either direction in the tenure of a ministry. It may be challenged at any moment, and it lasts until it is challenged and beaten. And that there should be a ministry and a House of Commons in harmony with each other but out of harmony with the people is rendered all but impossible by the law and the practice as to the duration of parliaments.

Change of Power in the United States.—The United States offers a very different solution of the problem. The American president is at once king and prime minister; and

[1] The double government in the last case was founded, says Sir G. C. Lewis, on the English municipal system, and corresponded to the difference between aldermen and common-council men.

[2] Sweden, a few years since, reduced her four mediæval estates to two houses, and is more like Great Britain in the composition of the new parliament than any other state in Europe.

[3] See Bagehot's *English Constitution*, which exhibits a working view of this and other parts of the constitution as they appear to an outsider. Mr. Gladstone's political essays, in the collection entitled *Gleanings of Past Years*, contain much valuable information at first hand.

there is no titular superior to act as a conduit-pipe between him and his successor. His crown is rigidly fixed; unshakable for four years, after four years he ceases to reign. No hostile vote can affect his power as the head of the administration, and it is difficult to resist his will even in legislation. But the day of his demise is known from the first day of his government; and almost before he begins to reign the political forces of the country are shaping out a new struggle for the succession. Further, a change of government in America means a change of the entire administrative staff. The commotion caused by a presidential election in the United States is thus infinitely greater than that caused by a general election in England. A change of power in England affects comparatively few personal interests, and absorbs the attention of the country for a comparatively short space of time. In the United States it is long foresecn and elaborately prepared for, and when it comes it involves the personal fortunes of large numbers of citizens. And yet the English constitution is more democratic than the American, in the sense that the popular will can more speedily be brought to bear upon the government.

Change of Power in France.—The established practice of England and America may be compared with the nascent constitutionalism of France. Here the problem presents different conditions. The head of the state is neither a premier of the English, nor a president of the American type. He is served by a prime minister and a cabinet, who, like an English ministry, hold office on the condition of parliamentary confidence; but he holds office himself on the same terms, and is, in fact, a minister like the others. So far as the transmission of power from cabinet to cabinet is concerned, he discharges the functions of an English king. But the transmission of power between himself and his successor is protected by no constitutional devices whatever, and recent experience would seem to show that no such devices are really necessary. Of course it is too soon to talk about the constitutional practice in France, but this much seems clear, that some rearrangement of the relations of the president and the cabinet must soon take place. It seems difficult to distinguish between a parliamentary president and a parliamentary ministry, or to see why they should not stand or fall together. As yet the new French constitution has not had time to exhibit that which is a constant feature of the English constitution, viz., a government headed by the chief of the dominant political party. When that time comes the office of premier ought, one would suppose, to merge in the office of president. Possibly the existence of numerous political parties, and the open disloyalty to the existing constitution professed by some of them, may retard the simplification of the French governmental system. Other European countries professing constitutional government appear to follow the English practice. The Swiss republic is so peculiarly situated that it is hardly fair to compare it with any other. But it is interesting to note that, while the rulers of the states are elected annually, the same persons are generally re-elected.

Representation.—The questions connected with representation are too numerous to be discussed with advantage here. Two recent changes of great importance may be noticed in the English system,—the vote by ballot, and the partial introduction of what is called the minority vote. By the latter, in a constituency returning three members, each elector has only two votes, and a minority exceeding one-third can thus elect at least one of the three. The representation of minorities is a device of political theorists, and the chief result of its partial application has been to weaken the influence of the large constituencies. The chief anomalies of the English system are the inequality of electoral districts and the multiplicity of votes. A town of 200 electors returns as many candidates as a constituency of ten times that number. On the other hand, while one man has a single vote only, his neighbor, by various qualifications, may be an elector in several constituencies. In each case there is a revolution of the only theory on which the representative system as a whole can be founded—the equality of the voters. The first of these anomalies is admittedly waiting the convenience of political parties. The second has been recently aggravated by the creation of new university constituencies, consisting almost entirely of persons who had already the right of voting under the ordinary qualification. The anomaly becomes a gross abuse in the practice of creating what are known as faggot votes. The simple remedy would be to require that each elector should be registered in one constituency only.

The Relation between Government and Laws.—It might be supposed that, if any general proposition could be established about government, it would be one establishing some constant relation between the form of a government and the character of the laws which it enforces. The technical language of the English school of jurists is certainly of a kind to encourage such a supposition. The entire body of law in force in a country at any moment is regarded as existing solely by the fiat of the governing power. There is no maxim more entirely in the spirit of this jurisprudence than the following:—"The real legislator is not he by whom the law was first ordained, but he by whose will it continues to be law." The whole of the vast repertory of rules which make up the law of England—the rules of practice in the courts, the local customs of a county or a manor, the principles formulated by the sagacity of generations of judges, equally with the statutes for the year, are conceived of by the school of Austin as created by the will of the sovereign and the two Houses of Parliament, or so much of them as would now satisfy the definition of sovereignty. It would be out of place to examine here the difficulties which embarrass this definition, but the statement we have made carries on its face a demonstration of its own falsity in fact. There is probably no government in the world of which it could be said that it might change at will the substantive laws of the country and still remain a government. However well it may suit the purposes of analytical jurisprudence to define a law as a command set by sovereign to subject, we must not forget that this is only a definition, and that the assumption it rests upon is, to the student of society, anything but a universal fact. From his point of view the cause of a particular law is not one but many, and of the many the deliberate will of a legislator may not be one. Sir Henry Maine has illustrated this point by the case of the great tax-gathering empires of the East, in which the absolute master of millions of men never dreams of making anything in the nature of a law at all. This view is no doubt as strange to the English statesman as to the English jurist. The most conspicuous work of government in his view is that of parliamentary legislation. For a large portion of the year the attention of the whole people is bent on the operations of a body of men who are constantly engaged in making new laws. It is natural for us, therefore, to think of law as a factitious thing, made and unmade by the people who happen for the time being to constitute parliament. We forget how small a proportion the laws actually devised by parliament are of the law actually prevailing in the land. No European country has undergone so many changes in the form of government as France. Republic, constitutional monarchy, and empire have there succeeded each other again and again in the course of a century It is surprising how little effect these political revolutions have had on the body of French law. The change from empire to republic is not marked by greater legislative effects than the change from a Conservative to a Liberal ministry in England would be.

These reflections should make us cautious in accepting any general proposition about forms of government and the spirit of their laws. We must remember, also, that the classification of governments according to the numerical proportion between governors and governed supplies but a small basis for generalization. What parallel can be drawn between a small town, in which half the population are slaves, and every freeman has a direct voice in the government, and a great modern state, in which there is not a single slave, while freemen exercise their sovereign powers at long intervals, and through the action of delegates and representatives? Propositions as vague as those of Montesquieu may indeed be asserted with more or less plausibility But to take any leading head of positive law, and to say that monarchies treat it in one way, aristocracies and democracies in another, is a different matter Laws affecting trade might be expected to depend on the more or less popular character of the government. Yet would it be safe to say that monarchy discourages, that democracy encourages, free trade? France under the empire was more free-trading than France under the republic. If there is any difference at all between Great Britain and her colonies it is that the latter are generally supposed to be more democratic than the mother country. Yet protection rules the

young democracies, while free trade reigns at home. The principle has indeed been broadly laid down that oligarchical governments interfere more actively and more extensively in the affairs of their subjects than popular governments. We shall have occasion to show directly that the popularization of government in England has up to this time been attended by a striking increase in the sphere of state action.

II. Sphere of Government.

We may now ask, What is the appropriate sphere of government? What kind of business does it undertake, and what kind of business ought it to undertake? By what limits is its action to be restricted? Here too the field is occupied by disputed theories and diversified practice. And the sphere assigned to state action in different ages and countries varies as widely as the form of government.

The action of the state, or sovereign power, or government in a civilized community shapes itself into the threefold functions of legislation, judicature, and administration. The two first are perfectly well defined, and the last includes all the kinds of state action not included in the other two. It is with reference to legislation and administration that the line of permissible state action requires to be drawn. There is no doubt about the province of the judicature, and that function of government may therefore be dismissed with a very few observations.

The complete separation of the three functions marks a high point of social organization. In simple societies the same officers discharge all the duties which we divide between the legislator, the administrator, and the judge. The acts themselves are not consciously recognized as being of different kinds. The evolution of all the parts of a highly complex government from one original is illustrated in a striking way by the history of English institutions. All the conspicuous parts of the modern government, however little they may resemble each other now, can be followed back without a break to their common origin. Parliament, the cabinet, the privy council, the courts of law, all carry us back to the same *nidus* in the council of the feudal king.

Judicature.—The business of judicature, requiring as it does the possession of a high degree of technical skill and knowledge, is generally entrusted by the sovereign body or people to a separate and independent class of functionaries. In England, the appellate jurisdiction of the House of Lords still maintains in theory the connection between the supreme legislative and the supreme judicial functions. It is only recently that the important subject of divorce passed from the legislative chambers to the courts of law. In some of the States of the American Union the judicial functions of the upper house are still maintained after the example of the English constitution as it existed when these States were founded. In England there is also still a considerable amount of judicial work in which the people takes its share. The inferior magistracies, except in populous places, are in the hands of private persons. And by the jury system the ascertainment of fact has been committed in very large measure to persons selected indiscriminately from the mass of the people, subject to a small property qualification. But the higher functions of the judicature are exercised by persons whom the law has jealously fenced off from external interference and control. The independence of the bench distinguishes the English system from every other. It was established in principle as a barrier against monarchical power, and hence has become one of the traditional ensigns of popular government. In many of the American States the spirit of democracy has demanded the subjection of the judiciary to popular control. The judges are elected directly by the people, and hold office for a short term, instead of being appointed, as in England, by the responsible executive, and removable only by a vote of the two Houses. There is not the smallest sign that democratic opinion in England is tending in this direction.[1] At the same time the constitution of the United States has assigned to the supreme court of the Union a perfectly unique position, standing in singular contrast to the depraved condition of many of the State judicatories. The supreme court is the guardian of the constitution. It has to judge whether a measure passed by the legislative powers is not void by reason of being unconstitutional, and it may therefore have to veto the deliberate resolutions of both Houses of Congress and the president. It is admitted that this singular experiment in government has been completely justified by its success.

Limits of State Interference in Legislation and Administration.—The question of the limits of state action does not arise with reference to the judiciary. The enforcement of the laws is a duty which the sovereign power must of absolute necessity take upon itself. But to what conduct of the citizens the laws shall extend is the most perplexing of all political questions. The correlative question with regard to the executive would be what works of public convenience should the state undertake through its own servants. The whole question of the sphere of government may be stated in these two questions:—What should the state do for its citizens? and How far should the state interfere with the action of its citizens? These questions are the direct outcome of modern popular government; they are equally unknown to the small democracies of ancient times and to despotic governments at all times. Accordingly ancient political philosophy, rich as it is in all kinds of suggestions, has very little to say that has any bearing on the sphere of government. The conception that the power of the state can be and ought to be limited belongs to the times of "government by discussion," to use Mr. Bagehot's expression,—to the time when the sovereign number is divided by class interests, and when the action of the majority has to be carried out in the face of strong minorities, capable of making themselves heard. Aristotle does indeed dwell on one aspect of the question. He would limit the action of the government in the sense of leaving as little as possible to the personal will of the governors, whether one or many. His maxim is that the law should reign. But that the sphere of law itself should be restricted, otherwise than by general principles of morality, is a consideration wholly foreign to ancient philosophy. The state is conceived as acting like a just man, and justice in the state is the same thing as justice in the individual. The Greek institutions which the philosophers are unanimous in commending are precisely those which the most state-ridden nations of modern times would agree in repudiating.

Importance of this Question in English Politics.—Limitation, then, being a principle known only to free governments, we naturally look to English political history for its elucidation; and the speculative and practical treatment of this question is perhaps the most valuable contribution made by England to political science. From the time of the Revolution, the principle that there is a limit to the permissible action of government has been tacitly admitted. The theories which restricted the powers of the constitutional king by founding them on popular consent tended also to the restriction of the sphere of government in general. The connection between the two may be seen very clearly in Locke. Government was created by the voluntary union of men in political society, and the object for which they agreed to unite was the preservation of their property. The scope of government is therefore limited by this its original object. "Though men, when they enter into society, give up the liberty, equality, and executive power they had in the state of nature into the hands of society, to be so far disposed of by the legislature as the good of society shall require, yet, it being only with an intention in every one the better to *preserve himself, his liberty, and property*, . . . the power of the society or legislature constituted by them can never be supposed to extend further than the common good." The practical application of these principles is to be found in his essay on *Toleration*. The business of the state being the protection of body and goods, it has no right to interfere with the religious worship or opinions of its citizens. The existence of religious dissent on a large scale kept up the practical importance of this theory. Even in the extreme absolutism of the partisans of monarchy, the curious doctrine of passive obedience recognizes the same principle. Although the will of the sovereign ought never to be resisted, there is a line of action beyond which he ought never to pass.

Another historical fact of some importance is the long-continued alienation of the aristocratic classes from the

[1] It is worth noting that direct election to offices—supposed to be characteristic of the democratic spirit—has no place in English political ideas. The few instances in which it occurs are regarded with indifference. The election of the coroner by the freeholders is universally condemned. In the few parishes where the clergyman may be appointed by the parishioners, the right is often left to be exercised by the bishop.

reigning family during the post-Revolution period. In the 18th century the natural champions of monarchical power were in opposition. Their vast local influence, which might otherwise have gone to aggrandize the influence of the crown, was really employed to thwart it. There thus sprang up in the most conservative classes of society a strong feeling of jealousy for local independence, and a standing dislike of Government interference. Squire Western, in *Tom Jones*, may be taken as the type of the country party of the period. His idea of intellectual conversation is abusing the Government over a bottle. Nothing in the new-fangled notions of his sister disgusts him more than her affected sympathy with the politicians then in power. The sullen disaffection of the most powerful section of society was a most effectual bulwark against any extension of the central power. It has been remarked by an acute observer[1] that the weakness of government in the 18th century suffered even public institutions to assert their local independence. Corporations of every kind enjoyed the most complete liberty of action, and, freed from state control, became the private patrimony of their members. The same sort of resistance to state action has been repeated in the 19th century. The natural adherents of the crown, and the leaders of provincial society, the aristocracy, the county gentry, and the clergy, have generally been in opposition to ministers. It is a fact not without significance that the first constitutional question of this reign was raised by Sir Robert Peel, the leader of the Conservative party.

Again, the exhaustive discussion of all political measures, which for two centuries has been a fixed habit of English public life, has of itself established the principle that there are assignable limits to the action of the state. Not that the limits ever have been assigned in terms, but popular sentiment has more or less vaguely fenced off departments of conduct as sacred from the interference of the law. Phrases like "the liberty of the subject," the "sanctity of private property," "an Englishman's house is his castle," "the rights of conscience," are the commonplaces of political discussion, and tell the state, "Thus far shalt thou go and no further."

State and Church.—The side on which the legitimate province of government has been most debated is that on which it comes in contact with religion. High ecclesiastical theories draw the lines of restriction as clearly as voluntaryism, but what they exclude is state control and not state support. The Roman Catholics, the High Church party in England, and the Free Church in Scotland, all unite in protesting against the intrusion of the secular government into spiritual affairs. This assertion of a spiritual domain lying beyond the sphere of government, and sacred from its interference, unfortunately implies that there is another authority from which, on religious matters, the Government ought to take its instructions. The duty of a national recognition of religion—implying compulsion of the most personal character—is strongly asserted by the very persons who denounce state control as illegitimate and tyrannical. The exclusion of the state from the spiritual domain is, in fact, not founded on any reasoned theory of the functions of government at all, but on the belief in a divinely appointed order for spiritual things, which it is the duty of the state to enforce. An attempt to base this position on general principles has, indeed, been made by Mr. Gladstone in his work on *Church and State*. Holding that the state is a moral person, he argues that its action must be regulated by conscience, and that its religious obligations are the same as those of the individual man. It must therefore recognize and practise a religion, and the true religion is that of the Christian Church, of which the English Establishment is a branch. That religion, with its divinely organized system of Episcopacy, the state should enforce in every way short of physical persecution. It should exclude heretics from office and privilege, but it should not put them in prison. Mr. Gladstone's book was the occasion of a controversy which doubtless had some effect on subsequent political events. Macaulay[2] stated the Whig view of the subject—holding that while the state may justifiably endow an established church, it may not persecute for dissent in any way whatever. Government has principally to deal with the material wants of society, and with the protection of life and property. While this is the main end of government, it may pursue such secondary ends as the promotion of education and religion, the encouragement of arts, etc., but the primary end must not be sacrificed to the secondary end. The state is therefore not a moral person at all, any more than a railway company or a hospital; and government is certainly not an institution for the promotion of religion; but, if it finds it expedient, it may justly support Presbyterianism in Scotland, Protestant Episcopacy in England, and Roman Catholicism in Ireland. It is needless to say that Macaulay makes no attempt to define the limits within which the government may thus provide for the good of society. These may be said to have been the views of Liberal politicians and latitudinarian churchmen. On the other hand, the religious theory of government, as expounded in Dr. Arnold's Oxford *Lectures on History*, is based on the conception that the ideal church and state are one. Here there can be no bounds to the legitimate action of the state except its conformity with religious truth. And Dr. Arnold does not hesitate to forecast an ideal state of society in which disbelief in the Christian religion shall so outrage the moral sense of the community that it may fittingly be put down by the strong arm of the law. The weakness of all theological speculations about government is that they are fitted only for local use. The theory of government cannot well be discussed to much purpose with a disputant who requires a series of theological propositions to be taken for granted.

The Laissez-faire Theory.—Mill.—A more profitable line of inquiry has been followed by writers of the economical school. The most important of these is John Stuart Mill, whose essay on *Liberty*, together with the concluding chapters of his treatise on *Political Economy*, gives a tolerably complete view of the principles of government. The leaning of political economists is towards what is called the *laissez-faire* or non-interference doctrine. There is a general presumption against the interference of Government, which is only to be overcome by very strong evidence of necessity. Governmental action is generally less effective than voluntary action. The necessary duties of Government are so burdensome, that to increase them destroys its efficiency Its powers are already so great that individual freedom is constantly in danger. As a general rule, nothing which can be done by the voluntary agency of individuals should be left to the state. Each man is the best judge of his own interests. But, on the other hand, when the thing itself is admitted to be useful or necessary, and it cannot be effected by voluntary agency, or when it is of such a nature that the consumer cannot be considered capable of judging of the quality supplied, then Mr. Mill would allow the state to interpose. Thus the education of children, and even of adults, would fairly come within the province of the state. Mr. Mill even goes so far as to admit that, where a restriction of the hours of labor, or the establishment of a periodical holiday, is proved to be beneficial to laborers as a class, but cannot be carried out voluntarily on account of the refusal of individuals to co-operate, Government may justifiably compel them to co-operate. Still further, Mr. Mill would desire to see some control exercised by the Government over the operations of those voluntary associations which, consisting of large numbers of shareholders, necessarily leave their affairs in the hands of one or a few persons. In short, Mr. Mill's general rule against state action admits of many important exceptions, founded on no principle less vague than that of public expediency. The essay on *Liberty* is mainly concerned with freedom of individual character, and its arguments apply to control exercised, not only by the state, but by society in the form of public opinion. The leading principle is that of Humboldt, "the absolute and essential importance of human development in its richest diversity." Humboldt broadly excluded education, religion, and morals from the action, direct and indirect, of the state. Mill, as we have seen, conceives education to be within the province of the state, but he would confine its action to compelling parents to educate their children.

Herbert Spencer.—The most thoroughgoing opponent of state action, however, is Mr. Herbert Spencer. In his *Social Statics*, published in 1850, he holds it to be the essential duty of Government to *protect*—to maintain men's rights to life, to personal liberty, and to property; and the theory that the Government ought to undertake other offices besides that of protector he regards as an untenable theory. Each man has a right to the fullest exercise of all his faculties, compatible with the same right in others. This is the funda-

[1] Mr. Mark Pattison in *Essays and Reviews*.
[2] *Critical and Historical Essays*, vol. i.

mental law of equal freedom, which it is the duty and the only duty of the state to enforce. If the state goes beyond this duty, it becomes, not a protector, but an aggressor. Thus all state regulations of commerce, all religious establishments, all Government relief of the poor, all state systems of education and of sanitary superintendence, even the state currency and the post-office, stand condemned, not only as ineffective for their respective purposes, but as involving violations of man's natural liberty. Many of the principles enunciated in this book are not reconcilable with the later views of the author, but he would still appear to maintain his theory of government to the fullest extent. Thus, in the *Principles of Sociology*, published in 1877, he distinguishes between the militant type of society and the industrial type. The former is framed on the principle of compulsory co-operation, while the latter is framed on the principle of voluntary co-operation. He vaguely indicates "a possible future social type, differing as much from the industrial as this does from the militant,—a type which, having a sustaining system more fully developed than any one known at present, will use the products of industry neither for maintaining a militant organization nor exclusively for material aggrandizement, but will devote them to the carrying on of higher activities." Of the two actually existing types, the militant is distinguished by a strong and the industrial by a feeble Governmental system. Reversing the analogy suggested by individual organisms, he holds the latter to be a higher and better type than the former.[1] And he maintains that military activity in the state distinguished by a high degree of industrial development produces a recurrence to the militant type of institutions generally. Thus, in Germany, the dealings of Bismarck with the ecclesiastical powers, and the measures taken for centralizing the state control of railways, are instances of a more coercive *régime* established by war. In England, the peaceful period from 1815 to 1850 is contrasted with the militant period since 1850. The latter has been marked by the usurpations of military officialism, by sanitary dictation, by coercive philanthropy, by compulsory education, by an unhesitating faith in state-judgment, and by a general disregard of the principles of free government, even on the side of the party which in the previous period effected changes in the direction of freedom.

Tendency of recent Legislation.—Turning from political theory to political practice, let us see how the legislation of the last fifty years in England has drawn the line between legitimate and illegitimate state action. The period that has elapsed since the passing of the Reform Act of 1832 has been one of great legislative activity. In no former period has legislation been so completely under the control of public opinion, or so directly affected by open discussion of the principles of projected measures. It will be of some interest, therefore, to inquire how the most enlightened political community in the world has, during the period of its fullest freedom, defined the business of government.

Reduction of State Action.—Religion.—The cases in which Government interference has been abolished or greatly limited during this period are mainly two—in matters of opinion (especially religious opinion), and in matters of contract. The principle that the state ought to maintain some form of religion has been surrendered by the disestablishment of the Irish Church. The disqualifications, political and civil, of dissenters, have, with a very few and not very important exceptions, been removed. The last remnant of the old rule, making witnesses incompetent on religious grounds, was removed by the Act enabling persons to give evidence without an oath. A few statutes making various forms of irreligion punishable still remain, but they are never enforced, and any attempt to enforce them would almost certainly end in their formal repeal. State prosecutions for expression of opinion have almost entirely ceased, and practically the only instrument of control now left is the law of libel. Under the influence of the judges, that law has, during the period in question, been uniformly interpreted in a sense favorable to the freedom of discussion. One of the few remaining restrictions on religious freedom is the principle, acted on in several recent cases, that a contract may be broken if its object is to facilitate the expression of irreligious opinions.[2]

At the same time there appears to be a tendency to distinguish between merely irreligious opinions and opinions pronounced to be immoral. Convictions have lately been obtained for publishing and selling books advocating opinions on certain moral and social questions which appeared to a jury to be calculated to deprave the morals of the people. But here again the distinction has been authoritatively drawn between such views when presented in a scientific form and adapted to a scientific audience, and the same views offered openly to the unscientific public. Untenable as such distinctions are, they manifest a tendency on the part of the courts to confine the prosecution of opinion within the principle of the law against indecent publications. It may further be added that, with one notable exception,—the Public Worship Regulation Act,—the dealings of the state with the church have been confined within a very narrow compass. The endowment of new sees, for instance, although sanctioned by the state, is left to the voluntary contributions of the public.

Contract.—Freedom of contract, in general, has been greatly advanced by the success of the free-trade agitation in 1843, which was not so much a protest against state regulation as a demand for a cheap supply of food. Since that time, the principle that the state should leave men to make what bargains they please, without attempting to encourage any particular industry or to favor any special class, has taken rank as a maxim of universal application. One class of contracts—those between master and servant—long remained an exception to the general rule. Breach of such contracts by the servant was treated as a criminal offence, and the combination of servants to obtain a rise of wages as a conspiracy. A series of statutes, the last of which was passed a few years ago, has abolished the criminal character of the breach of the contract of service, except in a few cases. The abolition of the laws against usury in 1857 is another instance; the authorization of trading companies with limited liability is another. The last great legislative measure before parliament (the Criminal Code Bill of 1879) proposes to do away with the old offences of maintenance and champerty. Besides the classes regarded by law as under disability to contract (infants, lunatics, and married women), a few doubtful instances of protected persons might still be named. Thus expectant heirs are treated in the spirit of the old laws against usury. Seamen are not allowed to make a charge upon their wages. In certain employments specified in the Truck Act wages are not allowed to be paid otherwise than in coin. The principle of free trade is outraged in its own name by the legal rule which vitiates contracts made "in restraint of trade."

Increase of State Action.—The enumeration of new restrictive measures, and instances of increased state interference within the same period, would occupy a much more formidable list. A rough classification only will be here attempted. We shall take first, interference for the protection of definite classes of persons.

Education of Children.—This is perhaps the most conspicuous, as it is certainly the most beneficial and the least disputed, of the recent encroachments of the state. The progress of opinion and legislation on this subject has been singularly rapid. Beginning with Government grants in aid of education, strenuously resisted on grounds going to the very root of the question of legitimate state interference, the system has now culminated in a network of state-supported and state-administered schools spread over the whole country. That the state should compel parents to educate their children would only be a slight departure, if any, from the general principle imposing duties on parents and disabilities on children. Under the present system the state not only compels the parent to educate, but itself provides, and in great measure pays for, the education. A generation of discussion has, however, drawn very distinctly the line beyond which this advance of state authority must not proceed. Compulsory state education is for children only, and may be justified by the general argument which justifies state protection to the helpless; it is elementary only; and it is secular only.

Regulation of the Labor of Children and Women.—The long series of Factory Acts is the best example of the

[1] *Principles of Sociology*, vol. i., London, 1877. In a postscript to part ii. Mr. Spencer explains the "origin of this seeming incongruity." Individual organisms, high or low, have to maintain their lives by offensive or defensive activities or both; social organisms, except during the militant stage of their evolution, have not.

[2] *E.g.*, a contract to let a hall for a lecture advocating atheistic principles.

steady and persistent advance of Government control in this direction. Here the line of protection is considerably advanced, but is again carefully drawn under male adults, although these of necessity share in the benefits of the protection in all employments where their work requires the co-operation of women and children. See FACTORY ACTS.

Regulation of Dangerous Employments.—Of these the Mines Regulation Acts are perhaps the best example. Here the Government actually lays down the rules under which alone these employments are suffered to be carried on. Here the principle that adults are capable of looking after themselves is overruled by the dangerous character of the employment.

In all these cases the action of the state is defended on the ground that the persons protected are unable sufficiently to protect themselves; and the principle adopted is that of prevention instead of mere punishment for breach of duty. Hence an enormous army of inspectors is required for the work of control.

Another class of interferences is justified on the ground of *public health*, and these, in respect of the amount of state supervision required, stand next to the protective measures already enumerated. The common law of nuisance recognizes the principle that any source of contagion or discomfort set up by an individual is an injury to those who may be affected by it, which they may call upon the state to suppress. The Sanitary Acts interpose the remedy at an earlier stage, and by the usual apparatus of Government inspectors and detectives. The largest measure on this subject is the Public Health Act, and the most extreme development of the principle is the lending of money by the Government to municipalities for the erection of healthy dwelling-houses for laborers. Personal freedom is more directly affected by measures like the Vaccination Act, for which, however, the double ground of the helplessness of the subjects and the prevention of danger amounting to nuisance may be taken. The least defensible of all the measures of this class are those relating to the adulteration of various kinds of food. The fraudulent or negligent supply of food injurious to health is an injury which may be appropriately punished by awarding compensation to the person injured, and inflicting punishment on the delinquent. But under the last Act (Sale of Food and Drugs Act, 1875) it is a criminal offence to sell goods of a quality not asked for, and the usual staff of analysts and inspectors is established to facilitate detection. The mighty engine of Government determines the exact percentage of water which the dairyman may put in his milk and the publican in his gin.

Next come the cases in which the Government either aids or itself undertakes works of *public convenience*. The state monopoly of the post-office is the most conspicuous example, and we have recently seen it extended by the acquisition of the telegraphs. Less directly the state has acquired control of the locomotive system, by granting compulsory powers of various sorts and a partial monopoly to railway companies, and by imposing certain regulations on them. This department of state activity has been greatly increased by the operations of the Public Works Loans Commission, which lends money to local bodies for such purposes as the erection of baths and wash-houses, improving rivers, harbors, and towns, building lighthouses and public libraries, and the like.

The assertion of state control over *endowments* is another marked feature of the period. Except in this way, Government has not, in England at least, interfered with the higher sort of education to any great extent. But most of the endowed schools and the universities have been subjected to inquiry, and remodelled according to what are understood to be the demands of the age. Almost every kind of corporation has been revised in the same way, the most notable and scandalous exception being the numerous and wealthy corporations of the city of London. The history of these reforms reveals a perfectly clear *rationale* of the relations existing between an endowed institution and the state. All endowments are privileges created by the state in the way of exception to the universal rule of law against perpetuities —the rule which limits the operation of dead men's wills, and makes each generation master of its existing resources. When the purposes of an institution cease to be useful, or its organization is seen to be defective, it is the right and duty of the state to withdraw the privilege altogether, or continue it under new conditions. All endowments become, in virtue of this rule, the property of the state; and how it shall deal with them becomes a question of statesmanship, not of interference with private interests. Under the name of "vested interests," all existing rights of individuals are stringently preserved. These two correlative principles—the right of the state to revise all endowments, and the obligation to respect vested interests in any such revision—have ceased to be disputable in English politics.

A similar extension of state control is to be seen in the organization of the *professions*—*i. e.*, persons licensed to practise particular arts. The church, like the army, is not, properly speaking, a profession, and its regulations belong to the same class as those of the army or the civil service. The true professions are the various grades of lawyers and medical men. They have an exclusive monopoly of the arts which they profess. The protection of this monopoly was long the only connection between them and the Government. They were left to the management of self-governing societies or corporations. Within our own generation there has been, not only a marked increase of state control over the professions, but a marked tendency to extend it to occupations hitherto uncontrolled. The system of medical licentiation is year by year becoming more stringent and more centralized. A recent Act provides for the more efficient testing of the qualifications of solicitors. The bar, which has hitherto with immense practical wisdom governed itself by means of voluntary societies, is threatened with a parliamentary constitution, settling the conditions of admission, examination, discipline, and dismissal. The free professions are demanding the like recognition and supervision by the state. A bill is now (1879) before parliament for organizing the professions of schoolmasters in the higher class of schools; and elementary schoolmasters are claiming to be included in its scope. The business of buying and selling stocks and shares has narrowly escaped, if it has escaped, the rules and regulations of an act of parliament. A commission was actually appointed a few years ago to investigate the practices of brokers and jobbers, and one of its recommendations was that the Stock Exchange should forthwith become a corporation. The last interference of this sort was the appointment of a committee of the House of Commons, at the instance of the London retail traders, to inquire into the working of what are called co-operative stores. Inquiry does not of course imply interference, and a committee or a commission is often a convenient way of stopping the mouths of agitators whom it might not be convenient to ignore altogether. Futile as the remedy may be, the first thought of every aggrieved class is to lay its wrongs before parliament.

Protection of things from Excessive Consumption.—Another class of interferences may be described, in the most general terms, as measures taken for the protection of things which would otherwise perish, or greatly diminish, by reason of excessive use. Statutes of this sort have greatly multiplied during the last fifty years. There is hardly any kind of animal, which men think worth catching or eating, without its statutory close-time. The ostensible reason for this kind of legislation is that salmon, let us say, or oysters, are a very important article of food, and unless men are restrained from pursuing them to excess, the whole breed would ultimately be extinguished, or so reduced in number as to be of little use. Another and less avowed reason is that animals of the protected order are necessary for the recreation of a certain class of gentlemen, who, in the interest of their own pleasures, must be restrained from carrying them to excess. Thus no gun must be lifted against grouse before the 12th of August, or against partridges before the 1st of September, so that next year there may still be grouse and partridges in the land. The great majority of these enactments belong in spirit to the game-laws, but many of them are genuinely intended for the perpetuation of perishable supplies of food. Some of them, like the Seabirds Protection Act, or the Small Birds Protection Act, are dictated by some sentimental fear of the extinction of such animals. As a whole, they are among the least defensible of the modern extensions of state power.

Coercion for Moral Purposes.—The measures hitherto noticed may in general be justified either on the ground of the inability of the persons protected to help themselves, or on the ground that some good to society as a whole, or to

large portions of it, is secured thereby. Another class of measures openly aims at the moral improvement of the individuals affected by them, and in this class there has been an amazing and alarming increase. The laws against gaming are one of the best examples. At common law a wager was a contract, enforceable by the tribunals like any other. Not content with declining to enforce wagers, the state went further, and tried to put them down altogether. It made lotteries illegal. It visited with heavy penalties the keeping of betting-houses, all betting in public places, the publication of betting lists, etc. Games which lead to betting are put under the restraint of a licensing system, and in some parts of the provinces the state orders its citizens not to play billiards after eleven o'clock at night. To this class belongs the severe code regulating what is called the liquor traffic. Through the agency of licensing magistrates the state first of all limits the number of public-houses; then it dictates directly the hours during which liquor may be bought and sold; and in Scotland and Ireland it goes further, and prohibits altogether the sale of liquor on Sunday. A committee of the House of Lords has touched the highest point of government control in proposing to empower local authorities to buy up all the public-houses in their districts, and carry on the business for themselves. There is a simultaneously increasing tendency to interfere with people's amusements; fairs are being put down as immoral, music and dancing require licenses very charily granted, the grip of the lord chamberlain over the London theatres is tightened, and so on. The course of moral legislation, in fact, threatens to sweep away every barrier to the encroachments of the state. The extended range of government interference in other things has been accompanied, as we have seen, by a very distinct recognition of limits, either in the rights of the individual conscience, or in the capacity of adult manhood to manage its own affairs. But Acts of Parliament for improving the moral characters of men seem to recognize no limit at all. And it is a singular fact that, while this kind of legislation, under existing social arrangements, fails to affect the well-to-do classes, and presses chiefly on the comparatively poor, it is becoming more and more identified with the popular party in politics, and gathers strength with every addition to the popular element in government.

We have hitherto confined our attention to simple as opposed to compound forms of government, and to the supreme as opposed to the subordinate functions of government. The complete treatment of the subject would require us to take some notice of the (1) association of several communities, with separate governments under one sovereignty, and (2) of the subordinate organizations for carrying on the government of localities, under the supreme government.

1. *Federal Government.*—As this is the subject of a separate article (vol. ix. p. 55), we need only notice here the case in which one of the associated Governments is the ultimate seat of sovereign power—the others being its colonies or dependencies. England is, of course, by far the most illustrious example of a country so situated, and her relations with the subordinate communities exhibit much variety of form. One leading distinction may be drawn,—namely, between the communities which are allowed to govern themselves and those which, either as being unfit for self-government, like India and Fiji, or on account of the military necessities of the situation, as Malta and Gibraltar, are governed by the officers of the English Government. In the subject dependencies, as the latter may be called, the government is usually carried on by a governor and council, nominated by the crown, and holding office for various terms of years. The council, as a general rule, consists of the higher officers of the dependency, such as the chief-justice or the attorney-general. The governor and council are strictly the delegates of the home Government and have no legal or constitutional status of their own. The recently acquired island of Cyprus occupies an anomalous position in the British state system. The English Government holds it, not as sovereign, but as lieutenant-general of the sovereign, the sultan of Turkey. The government of the island is vested in a commissioner who takes his orders, not from the colonial, but from the foreign office. As a general rule the relations between the mother country and her dependencies are under the charge of a special department of state —the colonial office.

In free dependencies the alternative is between some kind of confederation with the mother country, whereby the dependency shall have a representative voice in the supreme government, and the practical independence of the dependency in all but international affairs. In the French system the deputies of Algiers and other colonies sit in the supreme legislature along with the other representatives of France. In the English system distance alone would render such a scheme impracticable; and, even where distance would be little or no hindrance, there has been no desire on either side for any such connection. Dependencies like the Isle of Man and the Channel Islands are as completely separated from England as New Zealand and Canada. The free dependencies have local constitutions framed on the model of the home Government—two chambers of legislature, a governor nominated by the crown, and a ministry dependent on parliament. The governor is supposed to stand to the ministry and parliament as the crown to the ministry and parliament at home; but it is to be remembered that the governor is, properly speaking, the representative not of the English crown but of the English Government. It is from the colonial secretary that the governor takes his instructions, and the colonial secretary and his colleagues take their instructions from the House of Commons. And, just as the practice of the constitution has made it impossible for the monarch to resist the wishes of parliament, so it is established that the governor, as representing England, shall not veto enactments of the colonial legislature. Just as in England the House of Commons invariably determines the fate of a ministry, so does the lower or popular house in a colonial legislature. It is needless to say that this is a very great advance on the old theory of colonial relations. Beginning in special grants or charters granted to individuals or corporations, the English colonies in North America held their liberties by the grace of the crown. The successful revolt of the colonies taught the mother country the folly of supposing that Englishmen in America would consent to be governed by Englishmen at home.

Although colonial institutions are modelled as nearly as may be after the original type, they are not entirely free from questions of fundamental difficulty. The central question of government—Whose will is to prevail?—has at the present time (1879) been agitating two of the greatest of the colonies, a deadlock between the council and the assembly in Victoria being referred to England, and the governor-general of Canada refusing to dismiss a lieutenant-governor on the advice of his responsible ministry.

The subjection of colonies to the home Government is still retained in two important cases. The colonies have no voice whatever in determining the nature of their relations with other communities; the question of peace or war is decided for them by the home Government. Again, all the colonies, whatever may be their powers of local self-government, seek justice in the last resort from the sovereign in council.

2. *Local Government.*—As the business of society at large must be undertaken by the supreme government, so the local business of the subdivisions of society must be undertaken by local sub-governments. Local government repeats on a small scale the features of the supreme government, but its business is chiefly judicial and administrative. The most marked distinction here is between rural and urban communities—between the county and the borough. Self-government or representative government is the rule in the latter, the exception in the former. In England, since the Municipal Corporations Act, the affairs of all urban communities, except the city of London and a few unimportant boroughs, are managed by the direct representatives of the inhabitants. In the counties the control of affairs rests with the justices of the peace, who are nominated by the crown exclusively from the class of gentry.

The degree of control exercised by the supreme government over local governments is a point of first-rate importance in the constitution of a country. Among free countries England and France stand at opposite ends of the scale,—England being characterized by great local independence, France by strict central control. Thus it is said that, even under the republic, the minister of education can say that at a given hour all the children in all the schools of France are learning the same lesson. The habitual dependence of the French people upon the action of the state has been described as a survival from the times of imperial despotism which may be expected to disappear gradually under the influence of freedom. A step in this direction has certainly

been taken in the proposal to allow communes to elect their own *maire;* and the abuse of the prefectoral system by a recent ministry ought to lead to some diminution of its enormous powers. On the other hand the increased activity of the state, which, as we have already seen, has accompanied the establishment of popular government on a wide basis in England, has shown itself also in increased centralization. The new functions—educational, sanitary, and other—imposed on local bodies are controlled by the supreme government through central boards. In 1871 the local government board was constituted to take over the powers of control over local boards hitherto exercised by various high officers of state, the poor law board, and the privy council. More recently the Prisons Act of 1877 has transferred to the secretary of state the powers hitherto exercised by the local prison authorities, and has made the cost of maintaining local prisons a burden on the public funds.

As we have already said, the work of local governments generally embraces very little that can properly be called legislation. They have a power of making bye-laws for carrying out within their district the purposes of a general law, and over that power the courts of justice exercise a vigilant control. Parliament in England has hitherto looked with great distrust on subordinate legislatures, and it is a common saying that the jealousy of the House of Commons is one of the reasons why the metropolis remains without municipal government. But it would now be generally admitted that the legislation demanded of parliament every year is greatly beyond its effective powers. There are indications of an approach to something that may be described as home rule—a name which inspires more distrust than the reality. Parliament makes no pretence of consistency in legislating separately for England, Scotland, and Ireland. To take only notorious examples,—the Irish Land Act, the Disestablishment Act, and the Sunday Liquor Act of Ireland, and the Forbes Mackenzie Act of Scotland are instances of legislation according to the supposed wishes of the people specially affected. Irish and Scotch business tends in the House of Commons more and more to fall into the hands of Irish and Scotch members, and the interference of others is not unfrequently resented as an intrusion. Again, private bill legislation, regulated as it is by ascertained general principles, has come to be in fact, as in form, a purely judicial proceeding, which might well be relegated, as it no doubt one day will be relegated, to local tribunals. Another indication of the same tendency is to be found in what is called permissive legislation, which leaves to local authorities the responsibility of deciding how far a given principle shall be applied. (E. R.)

GOWER, John (1325?–1408), one of the best of the English minor poets, was born in or about the year 1325; but the date is not exactly known. It has been conclusively shown by Sir Harris Nicolas that he belonged to the county of Kent. His family was wealthy; and he seems to have had various country houses. So far as we know he did not marry till 1397, when he was united to Agnes Groundolf. He was an intimate friend of Chaucer; but there is no evidence to prove that they were fellow-students. A few years after his marriage, Gower became blind, and had to give up writing. He spent his declining years in the priory of St. Mary Overies, or, as it is now called, St. Saviour's, in Southwark, where his monument is still to be seen.

Near the close of the *Confessio Amantis*, Gower puts the following compliment to Chaucer into the mouth of Venus:—

> "And greet weel Chaucer when ye meet,
> As my disciple and my poet;
> For in the floures of his youth,
> In sundry wise, as he well couth
> Of ditties and of songes glade,
> The which he for my sake made,
> The land fulfilled is over all;" etc.

In these lines he was merely requiting a compliment that had been paid him some years before by his brother-poet, who, in dedicating to him his *Troilus and Cressida*, addressed him as "O moral Gower," an epithet which, though not remarkably happy, has stuck to him. Gower died in 1408. In his will he leaves a number of religious legacies to various ecclesiastical persons and institutions, and £100, along with the rents of his manors, to his wife Agnes. The beautiful church in which Gower lies was rebuilt in great part at his expense, and proves, among other things, that he must have been exempt from one of the usual misfortunes of poets—poverty.

Gower's poetical works are four in number—*Balades and other Poems*, in French, printed in 1818 for the Roxburghe Club; the *Speculum Meditantis*, a treatise on the duties of married life, written in French verse, and divided into ten books; *Vox Clamantis*, a narrative in Latin elegiacs, of the insurrection of the commons in the reign of Richard II; and the *Confessio Amantis*. The second of these works is believed to have perished; of the third there is a good edition by the Rev. H. O. Coxe, printed for the Roxburghe Club in 1850; and the fourth was first printed by Caxton in 1483. The *Confessio Amantis*, or Lover's Confession, is a huge miscellaneous collection of physical, metaphysical, and moral reflections, and of stories culled from the common repertories of the Middle Ages. A kind of unity is given to these apparently incongruous materials by the form of the poem, which is a dialogue between a lover and his confessor, who is a priest of Venus, and is called Genius. In the moral part of his theme, Gower is confessedly wise, impressive, and sometimes almost sublime. But, as Ellis, in his *Specimens of the Early English Poets*, observes, "His narrative is often quite petrifying; and when we read in his works the tales with which we have been familiarized in the poems of Ovid, we feel a mixture of surprise and despair at the perverse industry employed in removing every detail on which the imagination had been accustomed to fasten. The author of the *Metamorphoses* was a poet, and at least sufficiently fond of ornament. Gower considers him as a mere annalist, scrupulously preserves his facts, relates them with great perspicuity, and is fully satisfied when he has extracted from them as much morality as they can reasonably be expected to furnish." As Professor Lowell has well remarked, Gower "has positively raised tediousness to the precision of a science." Though his descriptions are often extremely agreeable, and his diction easy and smooth, his prolixity, and the prosaic feebleness of the conceptions, will prevent the *Lover's Confession* from ever rivalling the writings of Chaucer, or even approximating them in popularity.

See Todd's *Illustrations of the Lives and Writings of Gower and Chaucer*, Ellis's *Specimens of the Early English Poets;* Craik's *Hist. Lit.;* Warton's *Hist. Eng. Poetry;* Godwin's *Life of Chaucer;* Morley's *English Writers;* Sir Harris Nicolas's *Life of Chaucer*, Mrs. Masson's *Three Centuries of English Poetry; Retrospective Review for 1828*, where Sir Harris Nicolas throws fresh light on the subject; *Observations on the Language of Chaucer's Canterbury Tales, and Gower's Confessio Amantis*, by F. J. Childs, Minto's *Characteristics of English Poets;* and, above all, Dr Reinhold Pauli's scholarly edition of the *Confessio Amantis* (London, 1857), which contains a notice of Gower, and an account of the MSS. and editions of the poem.

GOYA, a town of the Argentine Republic, in the province of Corrientes, near the junction of a small stream with the Paraná, about 100 miles S. of Corrientes. The streets are about 60 feet wide, and the houses, built of brick, are often two stories high. One side of the handsome plaza is occupied by a large church erected by local subscription, and in the centre there is a pyramid 50 feet high. Hides, wool, cheese, and oranges are the principal articles of trade, the cheese especially finding a good market at Buenos Ayres and elsewhere. The town was founded in 1807 by the national Government, and is said to have derived its name from Goya or Gregoria, the wife of the Portuguese cattle-farmer who was formerly settled on the spot. The population, which includes a large foreign element,—Italians, Basques, and French,—amounted to 5,900 in 1900. See Mulhall's *Handbook of the River Plate*.

GOYANNA, a city of Brazil, in the province of Pernambuco, on a river of its own name, about 10 miles from the sea. It is a well-built place, and carries on a trade in cotton, sugar, rum, hides, timber, dye-stuffs, oils, and other products of the fertile region in which it lies. Most of its exports are sent to Recife for shipment, its own port being only deep enough for the larger class of coasting vessels. The population is about 15,000.

GOYA Y LUCIENTES, Francisco (1746–1820), Spanish painter, was born in 1746 at Fuendetodos, a small Aragonese village near Saragossa. At an early age he commenced his artistic career under the direction of José Luzan Martinez, who had studied painting at Naples under Mas-

troleo. It is clear that the accuracy in drawing Luzan is said to have acquired by diligent study of the best Italian masters did not much influence his erratic pupil. Goya, a true son of his province, was bold, capricious, headstrong, and obstinate. He took a prominent part on more than one occasion in those rival religious processions at Saragossa which often ended in unseemly frays; and his friends were led in consequence to despatch him in his nineteenth year to Madrid, where, prior to his departure for Rome, his mode of life appears to have been anything but that of a quiet, orderly citizen. Being a good musician, and gifted with a voice, he sallied forth nightly, serenading the caged beauties of the capital, with whom he seems to have been a very general favorite.

Lacking the necessary royal patronage, and probably scandalizing by his mode of life the sedate court officials, he did not receive—perhaps did not seek—the usual honorarium accorded to those students who visited Rome for the purpose of study. Finding it convenient to retire for a time from Madrid, he decided to visit Rome at his own cost; and being without resources he joined a "quadrilla" of bull-fighters, passing from town to town until he reached the shores of the Mediterranean. We next hear of him reaching Rome, broken in health and financially bankrupt. In 1772 he was awarded the second prize in a competition initiated by the academy of Parma, styling himself "pupil to Bayeu, painter to the king of Spain." Compelled to quit Rome somewhat suddenly, he appears again in Madrid in 1775, the husband of Bayeu's daughter, and father of a son. About this time he appears to have visited his parents at Fuendetodos, no doubt noting much which later on he utilized in his genre works. On returning to Madrid he commenced painting canvases for the tapestry factory of Santa Barbara, in which the king took much interest. Between 1776 and 1780 he appears to have supplied thirty examples, receiving about £1200 for them. Soon after the revolution of 1868, an official was appointed to take an inventory of all works of art belonging to the nation, and in one of the cellars of the Madrid palace were discovered forty-three of these works of Goya on rolls forgotten and neglected (see *Los Tapices de Goya; por Cruzado Villaamil*, Madrid, 1870).

His originality and talent were soon recognized by Mengs, the king's painter, and royal favor naturally followed. His career now becomes intimately connected with the court life of his time. He was commissioned by the king to design a series of frescos for the church of St. Anthony of Florida, Madrid, and he also produced works for Saragossa, Valencia, and Toledo. Ecclesiastical art was not his forte, and although he cannot be said to have failed in any of his work, his fame was not enhanced by his religious subjects.

In portraiture, without doubt, Goya excelled; his portraits are evidently life-like and unexaggerated, and he disdained flattery. He worked rapidly, and during his long stay at Madrid painted, amongst many others, the portraits of four sovereigns of Spain—Charles III. and IV., Ferdinand VII., and "King Joseph." The duke of Wellington also sat to him; but on his making some remark which raised the artist's choler, Goya seized a plaster cast and hurled it at the head of the duke. There are extant two pencil sketches of Wellington, one in the British Museum, the other in a private collection. One of his best portraits is that of the lovely Andalusian duchess of Alva. He now became the spoiled child of fortune, and acquired, at any rate externally, much of the polish of court manners. He still worked industriously upon his own lines, and, while there is a stiffness almost ungainly in the pose of some of his portraits, the stern individuality is always preserved.

Including the designs for tapestry, Goya's genre works are numerous and varied, both in style and feeling, from his Watteau-like Al Fresco Breakfast, Romeria de San Isidro, to the Curate feeding the Devil's Lamp, the Meson del Gallo, and the painfully realistic massacre of the Dos de Mayo (1808). Goya's versatility is proverbial; in his hands the pencil, brush, and graver are equally powerful. Some of his crayon sketches of scenes in the bull ring are full of force and character, slight but full of meaning. He was in his thirty-second year when he commenced his etchings from Velasquez, whose influence may, however, be traced in his work at an earlier date. A careful examination of some of the drawings made for these etchings indicates a steadiness of purpose not usually discovered in Goya's craft as draughtsman. He is much more widely known by his etchings than his oils; the latter necessarily must be sought in public and private collections principally in Spain, while the former are known and prized in every capital of Europe. The etched collections by which Goya is best known include Los Caprichos, which have a satirical meaning known only to the few; they are bold, weird, and full of force. Los Proverbios are also supposed to have some hidden intention. Los Desastres de la Guerra may fairly claim to depict Spain during the French invasion. In the bull fight series, Goya is evidently at home; he was a skilled master of the barbarous art, and no doubt every sketch is true to nature, and from life.

Goya retired from Madrid, desiring probably during his latter years to escape the trying climate of that capital. He died at Bordeaux in his eighty-third year, and a monument has been erected there over his remains. Whether his influence produced the art of Fortuny and the modern Spanish school may be matter for discussion; but, from the deaths of Velasquez and Murillo to the advent of Fortuny, Goya's name is the only important one found in the history of Spanish art. Paul Lefort and Yriarte may be consulted for fuller details of his life and works.

GOYAZ, or, as it was formerly called, Villa Bõa de Goyaz, the chief town of the province of Goyaz in Brazil, in the valley of the auriferous Velmelho, a right-hand tributary of the Araguaia. It lies about 650 miles N. W. of Rio de Janeiro, and 700 miles S. W. of San Salvador. As a bishop's see, the seat of the provincial assembly, and the residence of a civil president and a military governor, it is a place of considerable importance; and with its broad streets, wide squares, and well-built houses it ranks as one of the most attractive towns of Brazil. The public buildings comprise the legislative chambers, a court-house, a hospital, a prison, an institution for the assaying of gold, and a municipal slaughter-house. Goyaz was founded in 1736 under the name of Santa Anna, and it received its present designation about three years later when it was raised to the rank of a city. The population is about 7,000.

GOYEN, Jan Josephszoon van (1596–1656), was born at Leyden on the 13th of January, 1596, learned painting under several masters at Leyden and Haarlem, married in 1618, and settled at the Hague about 1631. One of the few Dutch painters who failed to captivate English taste, his influence was great on Dutch art; and he was one of the first to emancipate himself from the traditions of minute imitation embodied in the works of Breughel and Savery. Though he preserved the dun scale of tone peculiar to those painters, he studied atmospheric effects in black and white with considerable skill. He formed Solomon Ruysdael and Pieter Potter, forced attention from Rembrandt, and bequeathed some of his precepts to Pieter de Molyn, Coelenbier, Saftleven, Van der Kabel, and even Berghem. His life at the Hague for twenty-five years was very prosperous, and he rose in 1640 to be president of his guild. A friend of Van Dyck and Bartholomew van der Helst, he sat to both these artists for his likeness. His daughter Margaret married Jan Steen, and he had steady patrons in the stadtholder Frederick Henry, and the chiefs of the municipality of the Hague. He died at the Hague in 1656, possessed of land and houses to the amount of 15,000 florins.

Between 1610 and 1616 Van Goyen wandered from one school to the other. He was first apprenticed to Isaak Swanenburgh; he then passed through the workshops of De Man, Klok, and De Hoorn. In 1616 he took a decisive step and joined Esaias van der Velde at Haarlem; amongst his earlier pictures, some of 1621 (Berlin Museum) and 1623 (Brunswick Gallery) show the influence of Esaias very perceptibly. The landscape is minute. Details of branching and foliage are given, and the figures are important in relation to the distances. After 1625 these peculiarities gradually disappear. Atmospheric effect in landscapes of cool tints varying from gray green to pearl or brown and yellow dun is the principal object which Van Goyen holds in view, and he succeeds admirably in light skies with drifting misty cloud, and downs with cottages and scanty shrubbery or stunted trees. Neglecting all detail of foliage, he now works in a thin diluted medium, laying on rubbings as of sepia or Indian ink, and finishing without loss of transparence or lucidity. Throwing his foreground into darkness, he casts alternate light and shade upon the more

distant planes, and realizes most pleasing views of large expanse. In buildings and water, with shipping near the banks, he sometimes has the strength if not the color of Albert Cuyp. The defect of his work is chiefly want of solidity. But even this had its charm for Van Goyen's contemporaries, and some time elapsed before Cuyp, who imitated him, restricted his method of transparent tinting to the foliage of foreground trees.

Van Goyen's pictures are comparatively rare in English collections. Unrepresented in the national galleries, he is seen to advantage abroad, and chiefly at the Louvre, and in Berlin, Gotha, Vienna, Munich, and Augsburg. Twenty-eight of his works were exhibited together at Vienna in 1873. His panels fell in value during the 17th century, when they fetched prices as low as 10 and seldom as high as 100 florins. Now they are worth ten times more than in 1700. Though he visited France once or twice, Van Goyen chiefly confined himself to the scenery of Holland and the Rhine. Nine times from 1633 to 1655 he painted views of Dordrecht. Nimeguen was one of his favorite resorts. But he was also fond of Haarlem and Amsterdam, and he did not neglect Arnheim or Utrecht. One of his largest pieces is a view of the Hague, executed in 1651 for the municipality, and now in the town collection of that city. Most of his panels represent reaches of the Rhine, the Waal, and the Maese. But he sometimes sketched the downs of Scheveningen, or the sea at the mouth of the Rhine and Scheldt; and he liked to depict the calm inshore, and rarely ventured upon seas stirred by more than a curling breeze or the swell of a coming squall. He often painted winter scenes, with ice and skaters and sledges, in the style familiar to Isaac van Ostade. There are numerous varieties of these subjects in the master's works from 1621 to 1653. One historical picture has been assigned to Van Goyen—the embarkation of Charles II. in the Bute collection. But this canvas was executed after Van Goyen's death. When he tried this form of art he properly mistrusted his own powers. But he produced little in partnership with his contemporaries, and we can only except the Watering-place in the gallery of Vienna, where the landscape is enlivened with horses and cattle by Philip Wouvermans. Even Jan Steen, who was his son-in-law, only painted figures for one of his pictures, and it is probable that this piece was completed after Van Goyen's death. More than 250 of Van Goyen's pictures are known and accessible. Of this number little more than 70 are undated. None exist without the full name or monogram, and yet there is no painter whose hand it is easier to trace without the help of these adjuncts. An etcher, but a poor one, Van Goyen has only bequeathed to us two very rare plates.

GOZLAN, Léon, a French novelist and play writer, was born at Marseilles in 1803, and died in 1866. When he was still a boy, his father, who had made a large fortune as a ship-broker, met with adverse circumstances, and Léon, before completing his education, had to go to sea in order to earn a living. He went several trading voyages to Algiers and to Senegal, without, it would seem, much profit. In the mean time his literary tastes gradually developed, and he abandoned mercantile pursuits for the modest employment of a teacher in Marseilles. He, however, did not remain long there, and in 1828 we find him in Paris, determined to run the risks of literary life. His townsman, Joseph Méry, who was then making himself famous by his political satires, smoothed his way, and introduced him to several newspapers. But Gozlan did not sacrifice literature to politics. Though he contributed many essays to the reviews, it is as a fertile and ingenious author of novels and plays that he is best known. His first novel was *Les Mémoires d'un Apothicaire* (1828), and this was followed by numberless others, among which may be mentioned *Le Notaire de Chantilly*, *Aristide Froissart* (one of the most curious and celebrated of his productions), *Les Nuits du Père-Lachaise*, *Le Tapis Vert*, *Georges III.*, *La Folle du logis*, *La famille Lambert*, *Les Émotions de Polydore Marasquin*, etc. His principal works for the theatre are—*La Goutte de Lait*, *La Pluie et le beau temps*, *Le Lion empaillé*, *Pied-de-Fer*, *Louise de Nanteuil*, *Le Gâteau des Reines*, *Les Paniers de la Comtesse*, *Le Diamant et le Verre*, and adaptations of several of his own novels to the stage. Gozlan also wrote a romantic and picturesque description of the old manors and mansions of his country, entitled *Les Châteaux de France*, 4 vols. (1844), and a biographical essay on the great novelist Balzac (1861). He was made a member of the legion of honor in 1846, and in 1859 an officer of that order. Louis Huart has published a sketch of his life.

Of the many novels which uninterruptedly dropped, as it were, from Gozlan's pen during a period of thirty-eight years, very few have the qualities which commend a work of fiction to posterity; but nearly all are pleasant to read, and some will no doubt survive as an interesting and lively picture of French manners during the first half of this century. He holds an honorable place in the second rank of French novelists.

GOZO. See Malta.

GOZZI, Carlo, Count (1722–1806), an Italian dramatist, was descended from an old Venetian family, and was born in March, 1722. Compelled by the embarrassed condition of his father's affairs to procure the means of self-support, he, at the age of sixteen, joined the army in Dalmatia; but three years afterwards he returned to Venice, where he soon made a reputation for himself as the wittiest member of the Granelleschi society, to which the publication of several satirical pieces had gained him admission. This society, nominally devoted to conviviality and wit, had also serious literary aims, and was especially zealous to preserve the Tuscan literature pure and untainted by foreign influences. The displacement of the old Italian comedy by the dramas of Chiari and Goldoni founded on French models threatened defeat to all their efforts; and in 1757 Gozzi came to the rescue by publishing a satirical poem, *Tartana degli influssi per l'anno bisestile*, and in 1761 by his comedy, *Fiaba dell' amore delle tre melarancie*, a parody of the manner of the two obnoxious poets, founded on a fairy tale. For its representation he obtained the services of the Sacchi company of players, who, on account of the popularity of the comedies of Chiari and Goldoni—which afforded no scope for the display of their peculiar talents—had been left without employment; and as their satirical powers were thus sharpened by personal enmity, the play met with extraordinary success. Struck by the effect produced on the audience by the introduction of the supernatural or mythical element, which he had merely used as a convenient medium for his satirical purposes, Gozzi now produced a series of dramatic pieces based on fairy tales, which for a period obtained great popularity, but after the breaking up of the Sacchi company were completely disregarded. They have, however, obtained high praise from Goethe, Schlegel, Madame de Staël, and Sismondi; and one of them, *Re Turandote*, was translated by Schiller. In his later years Gozzi set himself to the production of tragedies in which the comic element was largely introduced; but as this innovation proved unacceptable to the critics, he had recourse to the Spanish drama, from which he obtained models for various pieces which, however, met with only equivocal success. He died 4th April, 1806.

His collected works were published under his own superintendence, at Venice, in 1792, in 10 volumes; and his dramatic works, translated into German by Werthes, were published at Bern in 1795. See Gozzi's work, *Memorie inutili della vita di Carlo Gozzi*, 3 vols., Venice, 1797, translated into French by Paul de Musset, Paris, 1848; F. Horn, *Ueber Gozzis dramatische Poesie*, Venice, 1803; Gherardini, *Vita di Gasp. Gozzi*, 1821; "Charles Gozzi," by Paul de Musset, in the *Revue des Deux Mondes* for 15th November, 1844; and Magrini, *Carlo Gozzi e la fiabe: saggi storici, biografici, e critici*, Cremona, 1876.

GOZZI, Gasparo, Count (1713–1786), eldest brother of Carlo Gozzi, was born 4th December, 1713. In 1739 he married the poetess Luise Bergalli, and she undertook the management of the theatre of San Angelo, Venice, he supplying the performers with dramas chiefly translated from the French. The speculation proved unfortunate, but meantime he had attained a high reputation for his contributions to the *Gazzetta Veneta*, and he soon came to be known as one of the ablest critics and purest and most elegant stylists in Italy. For a considerable period he was censor of the press in Venice, and in 1774 he was appointed to reorganize the university system at Padua. He died at Padua, 26th December, 1786.

His principal writings are *Osservatore Veneta Periodico*, on the model of the English *Spectator*, and distinguished by its high moral tone and its light and pleasant satire; *Lettere famigliari*, a collection of short racy pieces in prose and verse, on subjects of general interest; *Sermoni*, poems in blank verse after the manner of Horace; *Il mondo morale*, a personification of human passions with inwoven dialogues in the style of Lucian; and *Giudizio degli antichi poeti sopra la moderna cen-*

sura di Dante, a defence of the great poet against the attacks of Bettinelli. He also translated various works from the French and English, including Marmontel's *Tales* and Pope's *Essay on Criticism*. His collected works were published at Venice, 1794–98, in 12 volumes, and several editions have appeared since.

GOZZOLI, Benozzo, an eminent painter, was born in Florence in 1424, or perhaps 1420, and in the early part of his career assisted Fra Angelico, whom he followed to Rome, and worked with at Orvieto. While in Rome, he executed, in the Cappella at Araceli, a fresco of St. Anthony and Two Angels. In 1449 he left Angelico, and went to Montefalco, near Foligno in Umbria. In S. Fortunato, near Montefalco, he painted a Madonna and Child with Saints and Angels, and three other works. One of these, the altar-piece representing St. Thomas receiving the Girdle of the Virgin, is now in the Lateran Museum, and shows the affinity of Gozzoli's early style to Angelico's. He next painted in the monastery of St. Francis, Montefalco, filling the choir with a triple course of subjects from the life of the saint, with various accessories, including heads of Dante, Petrarch, and Giotto. This work was completed in 1452, and is still marked by the style of Angelico, crossed here and there with a more distinctly Giottesque influence. In the same church, in the chapel of St. Jerome, is a fresco by Gozzoli of the Virgin and Saints, the Crucifixion, and other subjects. He remained at Montefalco probably till 1456, employing Mesastris as assistant. Thence he went to Perugia, and painted in a church a Virgin and Saints, now in the local academy, and soon afterwards to his native Florence, the headquarters of art. By the end of 1459 he had nearly finished his important labor in the chapel of the Palazzo Riccardi, the Journey of the Magi to Bethlehem, and, in the tribune of this chapel, a composition of Angels in a Paradise. His picture in the London National Gallery, a Virgin and Child with Saints, 1461, belongs also to the period of his Florentine sojourn. Another small picture in the same gallery, the Rape of Helen, is of dubious authenticity. In 1464 Gozzoli left Florence for S. Gemignano, where he executed some extensive works; in the church of St. Augustine, a composition of St. Sebastian protecting the City from the Plague of this same year, 1464; over the entire choir of the church, a triple course of scenes from the legends of St. Augustine, from the time of his entering the school of Tegaste on to his burial, seventeen chief subjects, with some accessories; in the Pieve di S. Gemignano, the Martyrdom of Sebastian, and other subjects, and some further works in the city and its vicinity. Here his style combined something of Lippo Lippi with its original elements, and he received co-operation from Giusto d'Andrea. He stayed in this city till 1467, and then began, in the Campo Santo of Pisa, from 1469, the vast series of mural paintings with which his name is specially identified. These are twenty-four subjects from the Old Testament, from the Invention of Wine by Noah to the Visit of the Queen of Sheba to Solomon. He contracted to paint three subjects per year, for about ten ducats each—a sum which may be regarded as equivalent to £100 at the present day. It appears, however, that this contract was not strictly adhered to, for the actual rate of painting was only three pictures in two years. Perhaps the great multitude of figures and accessories was accepted as a set-off against the slower rate of production. By January, 1470, he had executed the fresco of Noah and his Family,—followed by the Curse of Ham, the Building of the Tower of Babel (which contains portraits of Cosmo de' Medici, the young Lorenzo, Poliziano, and others), the Destruction of Sodom, the Victory of Abraham, the Marriages of Rebecca and of Rachel, the Life of Moses, etc. In the Cappella Ammannati, facing a gate of the Campo Santo, he painted also an Adoration of the Magi, wherein appears a portrait of himself. All this enormous mass of work, in which Gozzoli was probably assisted by Zanobi Macchiavelli, was performed, in addition to several other pictures during his stay in Pisa (we need only specify the Glory of St. Thomas Aquinas, now in the Louvre), in sixteen years, lasting up to 1485. This is the latest date which can with certainty be assigned to any work from his hand, although he is known to have been alive up to 1496, if not afterwards. In 1478 the Pisan authorities had given him, as a token of their regard, a tomb in the Campo Santo. He had likewise a house of his own in Pisa, and houses and land in Florence. In rectitude of life he is said to have been worthy of his first master, Fra Angelico.

The art of Gozzoli does not rival that of his greatest contemporaries either in elevation or in strength, but is preeminently attractive by its sense of what is rich, winning, lively, and abundant, in the aspects of men and things. His landscapes, thronged with birds and quadrupeds, especially dogs, are more varied, circumstantial, and alluring than those of any predecessor; his compositions are crowded with figures, more characteristically true when happily and gracefully occupied than when the demands of the subject require tragic or dramatic intensity, or turmoil of action; his color is bright, vivacious, and festive. Gozzoli's genius was, on the whole, more versatile and assimilative than vigorously original; his drawing not free from considerable imperfections, especially in the extremities and articulations, and in the perspective of his gorgeously-schemed buildings. In fresco-painting he used the methods of tempera, and the decay of his works has been severe in proportion. Of his untiring industry the recital of his labors, and the number of works produced, are the most forcible attestation.

GRAAL. See Grail.

GRABE, Johann Ernst (1666–1711), a learned divine of the Anglican Church, was born July 10, 1666, at Königsberg, where his father, the author of some treatises now forgotten, was professor of theology and history. In the course of his theological studies Grabe succeeded in persuading himself of the schismatical character of the Reformation of the 16th century, and accordingly presented to the consistory at Samland a memorial in which he compared the position of the evangelical Protestant churches with that of the Simonians, Novatians, and other ancient schismatics. Hardly, however, had he resolved to join the Church of Rome, when his peace was again disturbed by Spener and others, who had pointed out some flaws in his written argument, and called his attention to the English Church as apparently possessing that apostolic succession, and manifesting that fidelity to ancient institutions, which he desired. In 1697, accordingly, he removed to London, and received priest's orders, attaching himself to the nonjuring party. The learned labors to which the remainder of his life was devoted were rewarded with an Oxford degree and a royal pension. He died on the 3d of November, 1711, and in 1726 a monument was erected to him by Lord Oxford in Westminster Abbey.

Some account of Grabe's life is given by Dr. Hickes in a discourse prefixed to the pamphlet against Whiston's *Collection of Testimonies against the True Deity of the Son and of the Holy Ghost*. His works, which show him to have been learned and laborious but somewhat deficient in critical acumen, include a *Spicilegium SS. Patrum et Hæreticorum* (1698–99), which was designed to cover the first three centuries of the Christian church, but never was continued beyond the close of the second; editions of Justin's *Apologia Prima* (1700), of Irenæus, *Adversus omnes Hæreses* (1702), and of the Septuagint (*Vet. Test. juxta LXX. interpretes*, 4 vols. fol., 1707–1720); also some polemical pieces now of little importance.

GRABOW, a town of Pomerania, Prussia, government district of Stettin and circle of Randow, is situated on the Oder below Stettin, and closely adjoining its suburbs. Shipbuilding and the manufacture of machinery are the principal industries, and there is also a considerable shipping trade. Grabow did not acquire the rank of a town till 1855. The population in 1905 was 5,524.

GRACCHUS is the name of a family of the Gens Sempronia. To this family there attaches a remarkably sweet and lovable nature, which, combined with their high character and ability, makes their history the most charming page in the Roman annals. Tiberius Sempronius Gracchus was appointed magister equitum after the battle of Cannæ, and held the consulship in 215 and 213 B.C. During the great weakness that followed the defeat at Cannæ the resolute and judicious generalship by which he ably seconded Fabius did much to maintain a courageous attitude at Rome. He raised some legions of slaves; and his generous conduct kept them together and made them important in the war. After several successes he was betrayed by a Lucanian into the hands of Mago, and having fallen in the battle that ensued, he was honored with a magnificent burial by Hannibal. Another Tiberius, born about 210, married Cornelia, the daughter of Scipio Africanus, who is famous as the highest type of Roman matron. As prætor and proprætor, Gracchus governed Hither Spain from 181 to 178. He conquered the Celtiberi, and by his magnan-

imous and kindly treatment of the Spaniards made a lasting impression on them. He was consul in 177 and 163. In 169, as censor, his review of the senate and equites was very strict; but though his colleague became unpopular, Gracchus remained as much esteemed as ever. He enjoyed a high reputation for his power of calming down internal seditions and conciliating foreign enemies of the state. One of his daughters became the wife of Scipio Africanus the younger; while his two sons, Tiberius and Gaius, famous besides for having determined the history of Rome at a critical point, are as remarkable for the charm of their personal character and for the careful education given them by their widowed mother. Tiberius served as quæstor in Spain in 137; and the respect still entertained by the Spaniards for his father's name enabled him to save the Roman army from utter ruin after its defeat by the Numantines. See ROMAN HISTORY.

GRACES is the name generally given to the Greek goddesses Charites. The chief seat of their worship was the ancient Bœotian city Orchomenus. They were three in number, but their names were not known; and stones fallen from heaven stood in their temple as symbols of the goddesses (Paus., ix. 35). Their worship was instituted by a king Eteocles, whose three daughters fell into a well while dancing in honor of the Charites (Westermann, *Myth. Gr.*, p. 387). In no Greek legend is the pre-Greek Indo-Germanic character more strongly marked. Eteocles, he whose glory is real, is the Vedic Satyaçravas, the sun; and his genealogy consists of a string of epithets for sun and dawn. Charis (Skt. *hari*, bright) is an old adjective, originally an epithet of the light-illumined clouds which seem to escort the dawn, often applied in the Rig-Veda to the horses of the dawn or of the sun, and at last growing into a distinct deity who preserves the character of the ancient dawn-goddess (see Müller, *Lect. Lang.*, ii., Sonne in Kuhn, *Zft.*, x.). The burning bright *vasas* (Ushas, ἠώς, Aurora, with a different suffix Ostara, Easter)—who restores the blessings lost during the night, who lights up what was dark and reveals the hidden wrong, who gives active labor and wealth to men, growth and fertility to plants—had been from the earliest time the centre of a great worship. To appearance these religious ceremonies have been lost in Greece; and in a people so retentive of all that relates to religion, this implies merely that the worship of the dawn has been changed in outward form. Eos is of slight importance; but Charis, Hebe, Aphrodite (in so far as the genuine Greek goddess has not given way to the Oriental deity) preserve and develop the original idea. Charis then was the goddess of the freshness and vigor of life, of fertility and growth; like Aphrodite, she closely resembles Persephone (see Gerhard, *Venus Proserpina*), and in later art the Graces often hold corn ears in their hands; like Hebe, she is often associated with Hera (see Welcker, *Gr. Gött.*, iii. 174). The single goddess grew into a triad, as occurs often in Greek mythology; in Sparta, however, and in Athens only two Charites were known. Rites of peculiar antique character belong to the worship of the Charites; in Orchomenus nightly dances took place in their honor (compare the legend of Eteocles's daughters, who obviously are bye-forms of the goddesses); in Paros their worship was celebrated without music or garlands; in Messene they were worshipped along with the Eumenides; in Athens their rites secret from the vulgar were held at the entrance of the Acropolis; one swore by the Charites as one did by the deities of the lower world (Pollux, viii. 106). Far as these characteristics seem removed from the nature of a dawn-goddess we find a similar double character in many other cases, such as Artemis-Hecate. They are thus brought into the cycle of older more purely nature worship, which we find in Greece alongside of the more moral religion of the Olympian deities, and which has in mythology its counterpart in the older generation of Titans destroyed by the younger gods. The Charites were received into the Olympian Pantheon only in a subordinate character. In Homer we have a transitional stage; they appear sometimes as distinct independent beings, one being wife of Hephæstus, another of Sleep (*Il.*, xviii. 382, xiv. 231); often they are a set of nymphs attending on Aphrodite, herself then wife of Hephæstus (*Od.*, viii. 364, etc.). The dawn is naturally the wife of Hephæstus, the fire of the sun in heaven and of the morning sacrifice on earth. In later literature this second form prevails. Obviously the noun *charis* and the connected verbs and substantives, which existed alongside of the mythological name, exercised a continually growing influence on it. The Charites become then the impersonation of the bloom of all sensuous appearance, of grace and cheerfulness, both in nature and in moral action. They form part of the train attendant on the greater gods, especially Aphrodite and Apollo. Their names, Aglaia, Euphrosyne, and Thalia, occur first in Hesiod (*Theog.*, 907). Pindar, however, following the Bœotian belief, celebrates them (*Ol.*, xiv.) as the queens of glittering Orchomenus and as the guardian-goddesses of the ancient Minyæ. In art they were represented in earlier time as draped goddesses with varying attributes; gradually the one well-known conception predominated of the three beautiful nude figures gracefully intertwined. Jacobi (*Wörterb. d. Myth.*) gives a very complete list of ancient authorities.

GRACKLE (Latin, *Gracculus* or *Graculus*), a word which has been much used in ornithology, but generally in a vague sense, though restricted to members of the families *Sturnidæ*, belonging to the Old World, and *Icteridæ*, belonging to the New. Of the former those to which it has been most commonly applied are the species variously known as Mynas, Mainas, and Minors of India and the adjacent countries, and especially the *Gracula religiosa* of Linnæus, who, according to Jerdon and others, was very probably led to confer this epithet upon it by confounding it with the *Sturnus* or *Acridotheres tristis*[1] which is regarded by the Hindus as sacred to Ram Deo, one of their deities, while

Gracula religiosa.

the true *Gracula religiosa* does not seem to be anywhere held in veneration. This last is about 10 inches in length, clothed in a plumage of glossy black, with purple and green reflections, and a conspicuous patch of white on the quill-feathers of the wings. The bill is orange and the legs yellow, but the bird's most characteristic feature is afforded by the curious wattles of bright yellow, which, beginning behind the eyes, run backwards in form of a lappet on each side, and then return in a narrow stripe to the top of the head. Beneath each eye also is a bare patch of the same color. This species is common in southern India, and is represented further to the north, in Ceylon, Burmah, and some of the Malay Islands by cognate forms. They are all frugivorous, and, being easily tamed and learning to pronounce words very distinctly, are favorite cage-birds.[2]

In the New World the name Grackle has been applied to several species of the genera *Scolecophagus* and *Quiscalus*, though these are more commonly called in the United States and Canada "Blackbirds," and some of them "Boat-tails." They all belong to the family *Icteridæ*. The best known of these are the Rusty Grackle, *S. ferrugineus*, which per-

[1] By some writers the birds of the genera *Acridotheres* and *Temenuchus* are considered to be the true Mynas, and the species of *Gracula* are called "Hill Mynas" by way of distinction.

[2] For a valuable monograph on the various species of *Gracula* and its allies see Prof. Schlegel's *Bijdrage tot de Kennis van het Geschlacht* Beo (*Nederlandsch Tijdschrift voor de Dierkunde*, i. pp. 1–9).

vades almost the whole of North America, and *Q. purpureus*, the Purple Grackle or Crow-Blackbird, of more limited range, for though abundant enough in most parts to the east of the Rocky Mountains, it seems not to appear on the Pacific side. There is also Brewer's or the Blue-headed Grackle, *S. cyanocephalus*, which has a more western range, not occurring to the eastward of Kansas and Minnesota. A fourth species, *Q. major*, is also found to inhabit the Atlantic States as far as North Carolina. All these birds are of exceedingly omnivorous habit, and though undoubtedly destroying large numbers of pernicious insects are in many places held in bad repute from the mischief they do to the corn-crops. (A. N.)

GRACIAN, Baltazar (1584–1658), one of the principal "cultistas" or Spanish prose writers of the school of Gongora, was born at Calatayud, Aragon, in 1584. Little is known of his personal history except that on attaining to manhood he entered the Society of Jesus, and that ultimately he became rector of the Jesuit College at Tarragona, where he died in 1658. His principal works are *El Héroe* (1630), written in short compact sentences, which has been described as a sort of recipe for making a hero; *La Agudeza, y Arte de Ingenio* (1648), a sort of art of poetry or system of rhetoric in which the principles of "Gongorism" are inculcated; *Criticon* (1650–53), an allegory in which, under the imagery of the seasons of the year, the course of human life is described; *El Discreto*, a delineation of the typical character of a courtier; *Oraculo Manual*, a system of rules for the conduct of life. His works, which have been often reprinted in Spanish under the name of his brother Lorenzo, have also for the most part been translated into French and Italian. The *Oraculo Manual* has been translated into German by A. Schopenhauer (1862), and into English anonymously (*Courtier's Manual Oracle*, 1684). The *Hero* also occurs in English (from the French, 1726). Gracian's merits as a writer have been very differently estimated by his critics, and it is probable that from none of them has he received strict justice. If his style is hardly so bombastic, involved, and obscure as his enemies represent it, neither can he in fairness receive all that credit for depth and originality of thought which is claimed for him by his friends. As examples of the widely differing appreciations which have been passed upon him, see Ticknor's *Spanish Literature*, vol. iii., and Mr. Grant Duff's *Miscellanies* (1878).

GRADISCA, a town of Austria, in the principality of Görz and Gradisca, situated about 10 miles S.W. of Görz, on the right bank of the Isonzo. It was formerly a strongly fortified place, but its citadel is now occupied as a prison. The inhabitants of the commune, who numbered in 1900 rather more than 3800, are engaged in silk-spinning. Between 1471 and 1481 Gradisca was fortified by the Venetians, but in 1511 they surrendered it to the imperial forces. In 1647 Gradisca and its territory, including Aquileia and forty-three smaller places, was erected into a prince-countship in favor of the prince of Eggenberg. It lapsed in 1717 to the imperial crown, and in 1754 was completely incorporated with Görz. The name was revived by the constitution of 1861, which established the crown-land of the countship of Görz and Gradisca. See Görz.

GRADUATION is the name given to the art of dividing straight scales, circular arcs, or whole circumferences into any required number of equal parts. It is the most important and difficult part of the work of the mathematical instrument maker, and is required in the construction of most physical, astronomical, nautical, and surveying instruments, such as thermometer scales, linear measuring instruments, quadrants, sextants, mural circles, theodolites, etc.

The art was, undoubtedly, first practised by clockmakers for cutting the teeth of their wheels at regular intervals; but so long as it was confined to them, no particular delicacy or accurate nicety in its performance was required. This only arose when astronomy began to be seriously studied, and the exact position of the heavenly bodies to be determined, which created the necessity for strictly accurate means of measuring linear and angular magnitude. Then graduation began to be looked upon as an art which required special talents and training, and hence we find that all the best artists have spent their best efforts on the perfecting of astronomical instruments. Of these may be named Abraham Sharp, Bird, Smeaton, Ramsden, the Duc de Chaulnes, John and Edward Troughton, Simms, and Ross.

It is obvious that the first graduated instrument must have been done by the hand and eye alone, whether it was in the form of a straight-edge with equal divisions, or a screw, or a divided plate; but, once in the possession of one such divided instrument, it was a comparatively easy matter to employ it as a standard, and copy its divisions on any other article that might be desired. Hence graduation naturally divides itself into two distinct branches, *original graduation* and *copying*, which latter may be done either by the hand or by a machine called a dividing engine. We may thus speak of graduation under the three heads of *original graduation*, *copying*, and *machine graduation*.

Original Graduation.—This is by far the most difficult part of the art—so difficult, indeed, and requiring such accuracy of hand and eye, that but few in any generation have been completely competent for the task. The earlier astronomers graduated their own instruments, and, from the examples that have come down to us, it must have been very roughly done as compared with modern work.

In regard to the graduation of straight scales, we have, by elementary geometry, the means, theoretically, of dividing a straight line into any number of equal parts; but the practical carrying out of the geometrical construction is so beset with difficulties as to render the method untrustworthy. This method, which employs the common diagonal scale, was used in dividing a quadrant of 3 feet radius, which belonged to Napier of Merchiston, and which only read to minutes—a result, say Thomson and Tait (*Nat. Phil.*), "giving no greater accuracy than is now attainable by the pocket sextants of Troughton and Simms, the radius of whose arc is little more than an inch."

The original graduation of a straight line is, in practice, done either by the method of continual bisection or by stepping. In continual bisection the entire length of the line is first laid down. Then, as nearly as possible, half that distance is taken in the beam-compass and marked off by faint arcs from each end of the line. Should these marks coincide the exact middle point of the line is obtained. If not, as will almost always be the case, the distance between the marks is carefully bisected by hand with the aid of a magnifying glass. The same process is again applied to the halves thus obtained, and so on in succession, dividing the line into parts represented by 2, 4, 8, 16, etc., till the desired divisions are reached. In the method of stepping the smallest division required is first taken, as accurately as possible, by spring dividers, and that distance is then laid off, by successive steps, from one end of the line. It is evident that, in this method, any error at starting will be multiplied at each division by the number of that division. Errors so made are usually adjusted by the dots being put either back or forward a little by means of the dividing punch guided by a magnifying glass. This is an extremely tedious process, as the dots, when so altered several times, are apt to get insufferably large and shapeless.

The division of circular arcs is essentially the same in principle as the graduation of straight lines, and of this we shall now give some examples.

The first example of note is the 8-feet mural circle which was graduated by Graham for the National Observatory in 1725. In this two concentric arcs of radii 96·85 and 95·8 inches respectively were first described by the beam-compass. On the inner of these the arc of 90° was to be divided into degrees and 12th parts of a degree, while the same on the outer was to be divided into 96 equal parts, and these again into 16th parts. The reason for adopting the latter was that, 96 and 16 being both powers of 2, the divisions could be got at by continual bisection alone, which, in Graham's opinion, who first employed it, is the only accurate method, and would thus serve as a check upon the accuracy of the divisions of the outer arc. With the same distance on the beam-compass as was used to describe the inner arc, laid off from 0°, the point 60° was at once determined. With the points 0° and 60° as centres successively, and a distance on the beam-compass very nearly bisecting the arc of 60°, two slight marks were made on the arc; the distance between these marks was carefully divided by the hand aided by a lens, and this gave the point 30°. The chord of 60° laid off from the point 30° gave the point 90°, and the quadrant was now divided into three equal parts. Each of these parts was similarly bisected, and the resulting divisions again trisected, giving 18 parts of 5° each. Each of these quinquesected gave degrees, the 12th parts of which were arrived at by bisecting and trisecting as before. The outer arc was divided by continual bisection alone, and a table was constructed by which the readings of the one arc could be converted into those of the other. After the dots

indicating the required divisions were obtained, either straight strokes all directed towards the centre were drawn through them by the dividing knife, or sometimes small arcs were drawn through them by the beam-compass having its fixed point somewhere on the line which was a tangent to the quadrantal arc at the point where a division was to be marked.

The next important example of graduation was done by Bird in 1767. His quadrant, which was also 8 feet radius, was divided into degrees and 12th parts of a degree. He employed the method of continual bisection aided by chords taken from an exact scale of equal parts, which could read to ·001 of an inch, and which he had previously graduated by continual bisections. With the beam-compass an arc of radius 95·938 inches was first drawn. From this radius the chords of 30°, 15°, 10° 20′, 4° 40′, and 42° 40′ were computed, and each of them by means of the scale of equal parts laid off on a separate beam-compass to be ready. The radius laid off from 0° gave the point 60°; by the chord of 30° the arc of 60° was bisected; from the point 30° the radius laid off gave the point 90°; the chord of 15° laid off backwards from 90° gave the point 75°; from 75° was laid off forwards the chord of 10° 20′; and from 90° was laid off backwards the chord of 4° 40′; and these were found to coincide in the point 85° 20′. Now 85° 20′ being $= 5' \times 1024 = 5' \times 2^{10}$, the final divisions of 85° 20′ were found by continual bisections. For the remainder of the quadrant beyond 85° 20′, containing 56 divisions of 5′ each, the chord of 64 such divisions was laid off from the point 85° 40′, and the corresponding arc divided by continual bisections as before. There was thus a severe check upon the accuracy of the points already found, viz., 15°, 30°, 60°, 75°, 90°, which, however, were found to coincide with the corresponding points obtained by continual bisections. The short lines through the dots were drawn in the way already mentioned.

The next eminent artists in original graduation are the brothers John and Edward Troughton. The former was the first to devise a means of graduating the quadrant by continual bisection without the aid of such a scale of equal parts as was used by Bird. His method was as follows:—The radius of the quadrant laid off from 0° gave the point 60°. This arc bisected and the half laid off from 60° gave the point 90°. The arc between 60° and 90° bisected gave 75°; the arc between 75° and 90° bisected gave the point 82° 30′, and the arc between 82° 30′ and 90° bisected gave the point 86° 15′. Further, the arc between 82° 30′ and 86° 15′ trisected, and two-thirds of it taken beyond 82° 30′, gave the point 85°, while the arc between 85° and 86° 15′ also trisected, and one-third part laid off beyond 85°, gave the point 85° 25′. Lastly, the arc between 85° and 85° 25′ being quinquesected, and four-fifths taken beyond 85°, gave 85° 20′, which as before is $= 5' \times 2^{10}$, and so can be finally divided by continual bisection.

Edward Troughton's Method.—The method of original graduation discovered by Edward Troughton is fully described in the *Philosophical Transactions* for 1809, as employed by himself to divide a meridian circle of 4 feet radius. The circle was first accurately turned both on its face and its inner and outer edges. A roller was next provided, of such diameter that it revolved 16 times on its own axis while made to roll once round the outer edge of the circle. This roller, made movable on pivots, was attached to a frame-work, which could be slid freely, yet tightly, along the circle, the roller meanwhile revolving, by means of frictional contact, on the outer edge. The roller was also, after having been properly adjusted as to size, divided as accurately as possible into 16 equal parts by lines parallel to its axis. While the frame carrying the roller was moved once round along the circle, the points of contact of the roller-divisions with the circle were accurately observed by two microscopes attached to the frame, one of which (which we shall call H) commanded the ring on the circle near its edge, which was to receive the divisions, and the other viewed the roller-divisions. The exact points of contact thus ascertained were marked with faint dots, and the meridian circle thereby divided into 256 very nearly equal parts.

The next part of the operation was to find out and tabulate the errors of these dots, which are called *apparent* errors, in consequence of the error of each dot being ascertained on the supposition of its neighbors being all correct. For this purpose two microscopes (which we shall call A and B) were taken, with cross-wires and micrometer adjustments, consisting of a screw and head divided into 100 divisions, 50 of which read in the one and 50 in the opposite direction. These microscopes, A and B, were fixed so that their cross-wires respectively bisected the dots 0 and 128, which were supposed to be diametrically opposite. The circle was now turned half-way round on its axis, so that dot 128 coincided with the wire of A, and, should dot 0 be found to coincide with B, then the two dots were sure to be 180° apart. If not, the cross-wire of B was moved till it coincided with dot 0, and the number of divisions of the micrometer head noted. Half this number gave clearly the error of dot 128, and it was tabulated + or − according as the arcual distance between 0 and 128 was found to exceed or fall short of the remaining part of the circumference. The microscope B was now shifted, A remaining opposite dot 0 as before, till its wire bisected dot 64, and, by giving the circle one-quarter of a turn on its axis, the difference of the arcs between dots 0 and 64 and between 64 and 128 was obtained. The half of this difference gave the apparent error of dot 64, which was tabulated with its proper sign. With the microscope A still in the same position the error of dot 192 was obtained, and in the same way by shifting B to dot 32 the errors of dots 32, 96, 160, and 224 were successively ascertained. By proceeding in this way the apparent errors of all the 256 dots were tabulated.

From this table of apparent errors a table of real errors was drawn up by employing the following formula:—

$$\tfrac{1}{2}(x_a + x_c) + z = \text{the real error of dot } b,$$

where x_a is the real error of dot a, x_c the real error of dot c, and z the apparent error of dot b midway between a and c. Thus having got the real errors of any two dots, the table of apparent errors gives the means of finding the real errors of all the other dots.

The above formula is easily derived as follows:—

Let a and c be the number of micrometer divisions from 0 to dots a and c respectively; and let b be the number of similar divisions from 0 to the point b, supposed to be midway between a and c. Also let x_a and x_c be the real errors of dots a and c, and z the apparent error of b. Then we have

$$z = b - a - \tfrac{1}{2}(c - a) = b - \tfrac{1}{2}(a + c).$$

Now the real positions of a and c are $a - x_a$ and $c - x_c$ respectively.

Therefore the real position of b, the point midway between a and c, is

$$= a - x_a + \tfrac{1}{2}\{c - x_c - (a - x_a)\}$$
$$= \tfrac{1}{2}(a + c) - \tfrac{1}{2}(x_a + x_c).$$

Therefore the real error of b

$$= b - \text{real position of } b$$
$$= b - \tfrac{1}{2}(a + c) + \tfrac{1}{2}(x_a + x_c) = z + \tfrac{1}{2}(x_a + x_c).$$

Having obtained the 256 dots and their real errors, the third and last part of Troughton's process was to employ them to cut the final divisions of the circle, which were to be spaces of 5′ each. Now the mean interval between any two dots is $\frac{360°}{256}$ $= 5' \times 16\frac{7}{8}$, and hence, in the final division, this interval must be divided into $16\frac{7}{8}$ equal parts. In order to accomplish this a small instrument, called a subdividing sector, was provided. It was formed of thin brass and had a radius about four times that of the roller, but made adjustable as to length. The sector was placed concentrically on the axis, and rested on the upper end of the roller. It turned by frictional adhesion along with the roller, but at the same time was sufficiently loose to allow of its being moved back by hand to any position without affecting the roller. Now it is evident that, while the roller passes over an angular space equal to the mean interval between two dots, any point of the sector must pass over 16 times that interval, that is to say, over an angle represented by $\frac{360°}{256} \times 16$ $= 22° 30'$. This interval was therefore divided by $16\frac{7}{8}$, and a space equal to 16 of the parts taken. This was laid off on the arc of the sector and carefully divided into 16 equal parts, each equal to 1° 20′; and, in order to provide for the necessary $\frac{7}{8}$ths of a division, there was laid off at each end of the sector, and beyond the 16 equal parts, two of these parts each subdivided into 8 equal parts. A microscope with cross-wires, which we shall call I, was placed on the main frame, so as to command a view of the sector divisions, just as the microscope H viewed the final divisions of the circle. Before the first or zero mark was cut, the zero of the sector was brought under I and then the division cut at the point on the circle indicated by H, which also coincided with the dot 0. The frame was then slipped along the circle by the slow screw motion provided for the purpose, till the first sector-division, by the action of the roller, was brought under I. The second mark was then cut on the circle at the point indicated by H. That the marks thus obtained are 5′ apart, as they should be, is evident when we reflect that the distance between them must be $\frac{1}{16}$th of a division on the section which by construction is 1° 20′. By proceeding in this way the first 16 divisions were cut; but before cutting the 17th it was necessary to adjust the micrometer wires of H to the real error of dot 1, as indicated by the table, and bring back the sector, not to zero, but to $\frac{1}{8}$th short of zero. Starting from this position the divisions between dots 1 and 2 were next filled in, and then H was adjusted to the real error of dot 2, and the sector brought back to its proper division before commencing the third course. By proceeding in this manner through the whole circle, the microscope H was finally found with its wire at zero, and the sector with its 16th division under its microscope indicating that the circle had been accurately divided.

Copying.—In graduation by copying the first requisite is a pattern, which must be either an accurately divided straight scale, or an accurately divided circle, commonly called a *dividing plate.*

In copying a straight scale the pattern and scale to be divided, usually called the work, are first fixed side by side, with their upper faces in the same plane. The dividing square, which closely resembles an ordinary joiner's square, is then laid across both, and the point of the dividing knife dropped into the zero division of the pattern. The square is now moved up close to the point of the knife; and, while it is held firmly in this position by the left hand, the first division on the work is made by drawing the knife along the edge of the square with the right hand. Great care must be taken that the knife is held exactly in the same position in cutting the division and in setting the square.

It frequently happens that the divisions required on a scale are either greater or less than those on the pattern. To meet this case and still use the same pattern, the work must be fixed at a certain angle of inclination with the pattern. This angle is easily found in the following way. Take the exact ratio of a division on the pattern to the required division on the scale. Call this ratio α. Then, if the required divisions are longer than those of the pattern, the angle is $\cos^{-1}\alpha$, but, if shorter, the angle is $\sec^{-1}\alpha$. In the former case two operations are required before the divisions are cut: first, the square is laid on the pattern, and the corresponding divisions merely notched very faintly on the edge of the work; and, secondly, the square is applied to the work and the final divisions drawn opposite each faint notch. In the second case, that is, when the angle is $\sec^{-1}\alpha$, the dividing square is applied to the work, and the divisions cut when the edge of the square coincides with the end of each division on the pattern.

In copying circles use is made of the dividing plate. This is a circular plate of brass, of 36 inches or more in diameter, carefully graduated near its outer edge. It is turned quite flat, and has a steel pin fixed exactly in its centre, and at right angles to its plane. For guiding the dividing knife an instrument called an index is employed. This consists of a straight bar of thin steel of length equal to the radius of the plate. A piece of metal, having a V notch with its angle a right angle, is riveted to one end of the bar in such a position that the vertex of the notch is exactly in a line with the edge of the steel bar. In this way, when the index is laid on the plate, with the notch grasping the central pin, the straight edge of the steel bar lies exactly along a radius. The work to be graduated is laid flat on the dividing plate, and fixed by two clamps in a position exactly concentric with it. The index is now laid on, with its edge coinciding with any required division on the dividing plate, and the corresponding division on the work is cut by drawing the dividing knife along the straight edge of the index.

Machine Graduation.—The first dividing engine was probably that of Henry Hindley of York, constructed in 1740, and used for the most part by him for cutting the teeth of clock wheels. This was followed shortly after by an engine devised by the Duc de Chaulnes; but the first engine which obtained distinct notoriety was that made by Ramsden, of which an account was published by the Board of Longitude in 1777. He was rewarded by that board with a sum of £300, and a further sum of £315 was given to him on condition that he would divide, at a certain fixed rate, the instruments of other makers. The essential principles of Ramsden's machine have been repeated in almost all succeeding engines for dividing circles, and it will be well, therefore, to give a brief description of it.

It consisted of a large brass plate 45 inches in diameter, carefully turned, and movable on a vertical axis. The edge of the plate was ratched with 2160 teeth, into which a tangent screw worked, by means of which the plate could be made to turn through any required angle. Thus six turns of the screw moved the plate through 1°, and $\frac{1}{60}$th of a turn through $\frac{1}{360}$th of a degree. On the axis of the tangent screw was placed a cylinder having a spiral groove cut on its surface. A ratchet-wheel containing 60 teeth was attached to this cylinder, and was so arranged that, when the cylinder moved in one direction, it carried the tangent screw with it, and so turned the plate, but when it moved in the opposite direction, it left the tangent screw, and with it the plate, stationary. Round the spiral groove of the cylinder a catgut band was wound, one end of which was attached to a treadle and the other to a counterpoise weight. When the treadle was depressed the tangent screw turned round, and when the pressure was removed it returned, in obedience to the weight, to its former position without affecting the screw. Provision was also made whereby certain stops could be placed in the way of the screw, which only allowed it the requisite amount of turning according to the graduation required. The work to be divided was firmly fixed on the plate, and made concentric with it. The divisions were cut, while the screw was stationary, by means of a dividing knife attached to a swing frame, which allowed it to have only a radial motion. In this way the artist could divide very rapidly by alternately depressing the treadle and working the dividing knife.

Ramsden also constructed a linear dividing engine on essentially the same principle. If we imagine the rim of the circular plate with its notches stretched out into a straight line and made movable in a straight slot, the screw, treadle, etc., remaining as before, we shall get a very good idea of the linear engine.

In 1793 Edward Troughton finished a circular dividing engine, of which the plate was smaller than in Ramsden's, and which differed considerably otherwise in simplifying matters of detail. The plate was originally divided by Troughton's own ingenious method, already described, and the divisions so obtained were employed to ratch the edge of the plate for receiving the tangent screw with great accuracy.

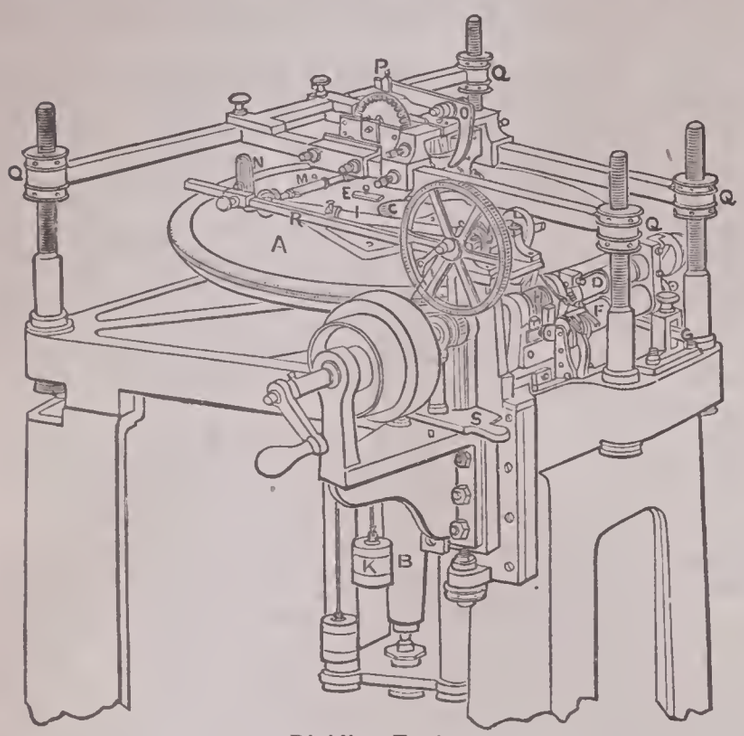
In the *Transactions of the Society of Arts* for 1830–31 there is a full description, with illustrative figures, of a dividing engine, constructed by Andrew Ross, which differs considerably from those of Ramsden and Troughton.

The essential point of difference is that, in Ross's engine, the tangent screw does not turn the engine plate; that is done by an independent apparatus, and the function of the tangent screw is only to stop the plate after it has passed through the required angular interval between two divisions on the work to be graduated. Round the circumference of the plate are fixed 48 projections which just look as if the circumference had been divided into as many deep and somewhat peculiarly shaped notches or teeth. Through each of these teeth a hole is bored parallel to the plane of the plate and also to a tangent to its circumference. Into these holes are screwed steel screws with capstan heads and flat ends. The tangent screw consists only of a single turn of a large square thread which works in the teeth or notches of the plate. This thread is pierced by 90 equally distant holes, all parallel to the axis of the screw, and at the same distance from it. Into each of these holes is inserted a steel screw exactly similar to those in the teeth, but with its end rounded. It is the rounded and flat ends of these sets of screws coming together that stop the engine plate at the desired position, and the exact point can be nicely adjusted by suitably turning the screws.

In the *Memoirs of the Astronomical Society*, of date June, 1843, a description is given of a dividing engine made by William Simms. From experience he became convinced that to copy upon smaller circles the divisions which had been put upon a large plate with very great accuracy was not only more expeditious but better than original graduation, and hence he determined to construct a machine which would do this work as perfectly as possible. That machine involved essentially the same principle as Troughton's, and, with some slight modifications, is at present to be seen at work in the workshop of the eminent firm of Troughton & Simms at Charlton near London. The accompanying figure (see page 28) is taken by permission from a photograph of that instrument.

The plate A is 46 inches in diameter, and is composed of gun-metal cast in one solid piece. It has two sets of 5′ divisions—one very faint on an inlaid ring of silver, and the other stronger on the gun metal. These were put on by original graduation, mainly on the plan of Edward Troughton. One very great improvement in this engine is that the axis B is tubular, as seen at C. The object of this hollow is to receive the axis of the circle to be divided, so that it can be fixed flat to the plate by the clamps E, without having first to be detached from the axis and other parts to which it has already been carefully fitted. This obviates the necessity for resetting, which can hardly be done without some error. D is the tangent screw, and F the frame carrying it, which turns on carefully polished steel pivots. The screw is pressed against the edge of the plate by a spiral spring acting under the end of the lever G, and by screwing the lever down the screw can be altogether removed from contact with the plate. The edge of the plate is ratched by 4320 teeth which were cut opposite the original division by a circular cutter attached to the screw frame. H is the spiral barrel round

which the catgut band is wound, one end of which is attached to the crank L on the end of the axis J and the other to a counterpoise weight not seen. On the other end of J is another crank inclined to L and carrying a band and counterpoise weight seen at K. The object of this weight is to balance the former and give steadiness to the motion. On the axis J is seen a pair of bevelled wheels which move the rod I, which, by another pair of bevelled wheels attached to the box N, gives motion to the axis M, on the end of which is an eccentric for moving the bent lever O, which actuates the bar carrying the cutter. Between the eccentric and the point of the screw P is



Dividing Engine.

an undulating plate by which long divisions, at required intervals, can be cut. It will be seen that the cutting apparatus is supported upon the two parallel rails, which can be elevated or depressed at pleasure by the nuts Q. Also the cutting apparatus can be moved forward or backward upon these rails to suit circles of different diameters The box N is movable upon the bar R, and the rod I is also adjustable as to length by having a kind of telescope joint. The engine is quite self-acting, and can be driven either by hand or by a steam-engine or other motive power. When driven by the latter it can be thrown in or out of gear at once by a handle seen at S. Mr. Simms has also provided an ingenious arrangement whereby that is done automatically directly any piece of work is finished.

Space permits of but the mere mention of Donkin's linear dividing engine, in which the principle employed is a compensating arrangement whereby great accuracy is obtained notwithstanding the inequalities of the screw used to advance the cutting tool. Dividing engines have also been made by Reichenbach and others in Germany, and Gambey in Paris.

In addition to those already mentioned, the following references may be given:—Bird, *Method of dividing Astronomical Instruments*, London, 1767; Duc de Chaulnes, *Nouvelle Méthode pour diviser les Instruments de Mathematique et d'Astronomie*, 1768; Ramsden, *Description of an Engine for dividing Mathematical Instruments*, London, 1777; Troughton's memoir, *Phil. Trans.*, 1809; *Memoirs of the Royal Astronomical Society*, vol. v. p. 325, vol. viii. p. 141, vol. ix. pp. 17 and 35; Holtzapffel, *Turning and Mechanical Manipulation*, pp. 651–955. (J. BL.)

GRÆCIA, MAGNA (ἡ μεγάλη Ἑλλάς), was the name given to the Greek cities along the coast of South Italy, while the people were called Italiotes (Ἰταλιῶται). Like most Greek colonies, they were established first as trading stations, which grew into independent cities. At a very early time a trade in copper was carried on between Greece and the Terinæan Gulf (Homer, *Od.*, i. 181). The trade for long lay chiefly in the hands of the Eubœans; and Cyme in Campania was founded far back in the pre-historic time, when the Eubœan Cyme was still a great city. To strengthen the connection with the far-off Cyme, the Chalcidians, who became early the leaders of Eubœan enterprise, established Rhegium (about 730 B. C.). After this the energy of Chalcis went onward to Sicily, and the states of the Corinthian Gulf carried out the colonization of Italy. Sybaris (720) and Crotona (710) were Achæan settlements; Locri Epizephyrii (about 710) was settled by Ozolian Locrians, and when (about 708) the Spartans wished to get rid of a band of unruly citizens, the connection formed by the trade in purple that was common to the shores of Laconia and Tarentum directed their colony thither. Ionian Grecks fleeing from foreign invasion founded Siris and, much later, Elea (540).

The Italian colonies were planted among friendly, almost kindred, races (comp. the legend in Herod., vii. 183), and grew much more rapidly than the Sicilian Greek states, which had to contend against the power of Carthage. After the Achæan cities had combined to destroy the Ionic Siris, and had founded Metapontum as a counterpoise to the Dorian Tarentum, there seems to have been little strife among the Italiotes. An amphictyonic league, meeting in common rites at the temple of Hera on the Lacinian promontory, fostered a feeling of unity among them. In the 7th and 6th centuries B. C., they reached such a pitch of wealth and power as to justify the name Great Greece in contrast to the poor and weak mother country The Pythagorean and Eleatic systems of philosophy had their chief seat in Magna Græcia. Other departments of literature do not seem to have been so much cultivated among them. The poet Ibycus, though a native of Rhegium, led a very wandering life. They maintained some social intercourse with Greece proper (Herod., iii. 131) and sent competitors to the Olympic games (among them the famous Milo); but politically they appear to have generally kept themselves separate. One ship of Crotona, however, fought at Salamis, though it is not recorded that Greece asked the Italiotes for help when it sent ambassadors to Gelon of Syracuse. Mutual discord first sapped the prosperity of Magna Græcia. In 510 Crotona, having defeated the Sybarites in a great battle, totally destroyed their city. Crotona maintained alone the leading position which had belonged jointly to the Achæan cities (Diod., xiv. 103); but from that time Magna Græcia steadily declined. Foreign enemies pressed heavily on it. The Lucanians and Bruttians on the north captured one town after another. Dionysius of Syracuse attacked them from the south; and after he defeated the Crotoniate league (389 B. C.), Tarentum remained the only powerful city. Henceforth the history of Magna Græcia is only a record of the vicissitudes of Tarentum (see TARENTUM). Repeated expeditions from Sparta and Epirus tried in vain to prop up the decaying Greek states against the Lucanians and Bruttians; and when in 282 the Romans appeared in the Tarentine Gulf the end was close at hand. The aid which Pyrrhus brought did little good to the Tarentines, and his final departure in 274 left them defenceless. During these constant wars the Greek cities had been steadily decaying; and in the second Punic war, when most of them seized the opportunity of revolting from Rome, their very existence was in some cases annihilated. Malaria, which never affects a well-peopled city, increased in strength as the population diminished. We are told by Cicero (*De Am.*, 4), "Magna Græcia nunc quidem deleta est." Many of the cities completely disappeared; some, like Tarentum, maintained a feeble existence into modern times

GRÆVIUS (1632–1703). Johann Georg Gräfe, Greffe, or Grævius, one of the great classical scholars of the 17th century, was born at Naumburg, Saxony, 29th January, 1632, and after receiving the usual school education at the gymnasium of Pforta became a student of law in the university of Leipsic. During a casual visit to Deventer in his eighteenth year, he became acquainted with Gronovius; and this circumstance greatly stimulated a taste for pure scholarship which he had already begun to display somewhat to the detriment of his professional prospects. Finally abandoning jurisprudence shortly afterwards, he studied philology for two years under Gronovius, and subsequently sat under Heinsius at Leyden, and under Morus and Blondel at Amsterdam. During his residence in the last-named city he abandoned Lutheranism and joined the Reformed Church; and in 1656 he was called by the elector of Brandenburg to the chair of belles lettres in the university of Duisburg. Two years afterwards he was, on the recommendation of Gronovius, chosen to succeed that scholar at Deventer; and in 1662 he was trans-

lated to the university of Utrecht, where he occupied first the chair of rhetoric, and afterwards from 1667 until his death (January 11, 1703) that of history and politics. During the later years of his life he enjoyed a great and European reputation, and repeated attempts, which, however, he steadfastly resisted, were made to induce him to transfer his services to other universities and Governments. His lecture-room was crowded by pupils, many of them of distinguished rank, from all parts of the civilized world; and by Louis XIV., as well as by other sovereigns, he was now and again honored with special recognition.

Of his works the two most important are the *Thesaurus Antiquitatum Romanarum*, published in 12 volumes at Utrecht (1694–1699), and the *Thesaurus Antiquitatum et Historiarum Italiæ*, published after his death, and continued by Burmann (1704–1725). His editions of the classics, although at the time of their appearance they marked a distinct advance in scholarship, are now for the most part superseded. They include *Hesiodi Ascræi quæ extant Opera* (1667), *Luciani Pseudosophista* (1668), *Justini Historiæ Philippicæ* (1669), *Suetonius* (1672), *Catullus, Tibullus, et Propertius* (1680), and several of the works of Cicero. The *Oratio Funebris* by P. Burmann (Utrecht, 1703) contains an exhaustive list of the works of this scholar.

GRÄFE, Albrecht von (1828–1870), German oculist, son of Karl Ferdinand von Gräfe, noticed below, was born at Berlin in May, 1828. At an early age he manifested a preference for the study of mathematics, but this was gradually superseded by an interest in natural science, which led him ultimately to the study of medicine. After obtaining Government license at Berlin, he prosecuted his studies at Vienna, Prague, and Paris, devoting special attention to ophthalmology. In 1850 he began practice as an oculist in Berlin, where he founded a private institution for the treatment of the eyes, which became the model of many similar ones in Germany and Switzerland. In 1853 he was appointed teacher of ophthalmology in Berlin university, in 1856 extraordinary professor, and in 1866 ordinary professor. Von Gräfe contributed largely to the perfection of the science of ophthalmology, especially by the establishment in 1855 of his *Archiv für Ophthalmologie*, in which he had Arlt and Donders as collaborateurs. Perhaps his two most important discoveries are his method of treatment for *glaucoma*, until then deemed incurable, and his new method of operation for the extraction of cataract, by which the danger of the operation became minimized. He was also regarded as an authority in diseases of the nerves and brain. He died at Berlin 20th August, 1870. See Alfred Gräfe, *Ein Wort zur Erinnerung an Albrecht von Gräfe*, Halle, 1870.

GRÄFE, Heinrich (1802–1868), educationist, was born at Buttstädt in Weimar, 3d May, 1802, studied mathematics and theology at Jena, and in 1823 obtained a curacy in the stadtkirche of Weimar. Thence he was transferred to Jena as rector of the town school in 1825; in 1840 he was also appointed extraordinary professor of the science of education (Pädagogik) in that university; and in 1842 he became head of the bürgerschule in Cassel. After reorganizing the schools of the town, he became director of the new realschule in 1843; and, devoting himself with great zeal and energy to the interests of educational reform in electoral Hesse, he became in 1849 a member of the school commission, and also entered the house of representatives, where he attached himself to the democratic party and made himself somewhat formidable as an agitator. In 1852 for having been implicated in the September riots and in the movement against the unpopular minister Hassenpflug (who had dissolved the school commission) he was condemned to three years' imprisonment, a sentence which was afterwards reduced to one of twelve months. On his release he withdrew to Geneva, where he engaged in educational work till 1855, when he was appointed director of the school of industry at Bremen. He died in that city 21st July, 1868.

Besides being the author of many text-books and occasional papers on educational subjects, he wrote *Das Rechtsverhältniss der Volksschule von innen u. aussen* (1829); *Die Schulreform* (1834); *Schule u. Unterricht* (1839); *Allgemeine Pädagogik* (1845); *Die Deutsche Volksschule* (1847). Along with Naumann, he also edited the *Archiv für das praktische Volksschulwesen* (1828–35).

GRÄFE, Karl Ferdinand von (1787–1840), German surgeon, was born at Warsaw, 8th March, 1787. He studied medicine at Halle and Leipsic, and after obtaining license from the latter university, he was in 1807 appointed private physician to Duke Alexius of Anhalt-Bernburg. In 1811 he became professor of surgery at Berlin, and during the war with Napoleon he was superintendent of the military hospitals. When peace was concluded in 1815, he resumed his professorial duties. He was also appointed to the medical staff of the army, and he became a director of the Frederick-William Institute, and of the Medico-Chirurgical Academy. He died suddenly, 4th July, 1840, at Hanover, whither he had been called to operate on the eyes of the crown prince. Von Gräfe did much to advance the practice of surgery in Germany, especially in the case of wounds, both by the invention of new instruments and the discovery of new methods of treatment. He improved the rhinoplastic process, and its revival was chiefly due to him. His lectures at the university of Berlin attracted students from all parts of Europe.

The following are his principal works:—*Normen für die Ablösung grosser Gliedmassen*, Berlin, 1812; *Rhinoplastik*, 1818; *Neue Beiträge zur Kunst Theile des Angesichts organisch zu ersetzen*, 1821; *Die epidemisch-kontagiöse Augenblennorrhöe Ægyptens in den europäischen Befreiungsheeren*, 1824; *Jahresberichte über das klinisch-chirurgisch-augenärztliche Institut der Universität zu Berlin*, 1817–34. He also edited, along with Ph. von Walther, the *Journal für Chirurgie und Augenheilkunde*.

GRÄFRATH, a town of Rhenish Prussia, government district of Düsseldorf, circle of Solingen, situated on the small river Itter, 14 miles E. of Düsseldorf. It has iron foundries, and manufactures of steel wares, chemicals, cotton, and ribbons. The population in 1905 was 4569.

GRAGNANO, a town of Italy, in the province of Naples and circle of Castellamare, about 2½ miles E. of Castellamare. It is the seat of a bishop and has a collegiate church, manufactures cloth and maccaroni, and exports an excellent red wine which is well known at Naples. In earlier times it was surrounded with walls and defended by a castle. Population (1901) of town 9254, of commune 14,099.

GRAHAM, Sir James George Robert, Bart. (1792–1861), a well-known British statesman, was born at Naworth, Cumberland, 1st June, 1792. From Westminster school he duly passed to Queen's College, Cambridge; and shortly after quitting the university, while making the "grand tour" abroad, he became private secretary to the British minister in Sicily, in which capacity he not only acquired much useful experience but also rendered some important services. Shortly after his return to England he, in 1818, after a contest of extraordinary keenness, was returned to parliament as member for Hull in the Whig interest; but he was unseated at the election of 1820. In 1824 he succeeded to the baronetcy on his father's death; and in 1826 he again entered parliament as representative for Carlisle. In the same year he published a pamphlet entitled *Corn and Currency*, which brought him into considerable prominence in the political world as a man of advanced Liberal opinions; and having been returned in 1830 for the county of Cumberland, he became one of the most energetic advocates in parliament of the Reform Bill. On the formation of Earl Grey's administration he received the post of first lord of the admiralty, with a seat in the cabinet. From 1832 to 1837 he sat for the eastern division of the county of Cumberland; but dissensions on the Irish Church question led to his withdrawal from the ministry in 1834, and ultimately to his joining the Conservative party. Rejected by his former constituents in 1837, he was in 1838 elected for Pembroke, and in 1841 for Dorchester. In the latter year he took office under Sir Robert Peel as secretary of state for the home department, and this post he retained until 1846. As home secretary he incurred considerable odium, in Scotland at least, by his unconciliating policy on the church question prior to the "disruption" of 1843; and in 1844 the detention and opening of letters at the post-office by his warrant raised a storm of public indignation, which was hardly allayed by the favorable report of a parliamentary committee of investigation. From 1846 to 1852 he was out of office; but in the latter year he joined Lord Aberdeen's cabinet as first lord of the admiralty, in which capacity he acted also for a short time in the Palmerston ministry of 1855, until the appointment of a select committee of inquiry into the conduct of the Russian war put him upon his defence, and ultimately led to his withdrawal from official life. He continued, however, as a private member to exercise a considerable influence on parliamentary opinion

until his death, which occurred at Netherby, Cumberland, 26th October, 1861.

GRAHAM, THOMAS (1804–1869), born at Glasgow on the 21st of December, 1804, was the son of a merchant of that city. In 1819 he entered the university of Glasgow, and graduated in 1824. At this time the chair of chemistry was held by Dr. Thomas Thomson, whose researches bearing on the atomic theory cannot fail to have had much influence in turning Graham's thoughts to the study of molecular physics to which he so patiently devoted his life. The beginning of his career appears to have been much embittered by his father's opposition, who wished him to become a minister of the Established Church. His own views, however, prevailed, and he worked for two years in the laboratory of Dr. Hope of Edinburgh before returning to Glasgow, where he taught mathematics, and subsequently chemistry, until the year 1829, when he was appointed lecturer in the Mechanics' Institute. In 1830 he succeeded Dr. Ure as professor of chemistry in the Andersonian Institution, and, on the death of Dr. Edward Turner, he was transferred to the chair of chemistry in University College, London. He presided over the chemical section of the British Association at the Birmingham meeting in 1839, and in 1841 was chosen as the first president of the Chemical Society of London. He resigned his professorship on being appointed to succeed Sir John Herschel as Master of the Mint, a post he held until his death in September, 1869. This appointment was doubtless offered to him by Government in recognition of his scientific services, but the onerous duties of the important office severely tried his energies; and it is unfortunate that, in quitting a purely scientific career, he should have been subjected to the cares of official life for which he was by temperament singularly unfit. The researches, however, which he conducted between 1861 and 1869 were as brilliant as any of those in which he engaged. Graham was elected a fellow of the Royal Society in 1837, a corresponding member of the Institute of France in 1847, and doctor of civil law in 1855. The presidency of the Royal Society was offered him towards the close of his life, but his failing health caused him to shrink from accepting the honor.

The persistency with which he traced and developed the laws of atomic motion was remarkable. It is interesting therefore to remember that his future work must have been indicated in no small measure by the researches of the illustrious Black, who, at the beginning of the century, rejected the definitions of chemistry proposed by Stahl, Boerhaave, and Fourcroy, and lectured "on the effects produced by heat and mixture in all bodies or mixtures of bodies natural or artificial." Graham communicated papers to the Philosophical Society of Glasgow before the work of that society was recorded in *Transactions*, but his first published paper, "On the Absorption of Gases by Liquids," appeared in the *Annals of Philosophy* for 1826, and is of special interest, as in it he speaks of the liquefaction of gases in much the same terms as those employed in the last paper he wrote. The subject with which his name will always be most prominently associated is the molecular mobility of gases. Priestley observed in 1799 that hydrogen escaped from a fissured glass jar in exchange for external air which "had nothing inflammable in it," and Dalton proved in 1806 that gases confined in glass phials, connected by glass tubes, intermix even against the action of gravity. Graham in his first paper on this subject (1829) thus summarizes the knowledge experiment had afforded as to the laws which regulate the movement of gases. "Fruitful as the miscibility of gases has been in interesting speculations, the experimental information we possess on the subject amounts to little more than the well-established fact that gases of a different nature, when brought into contact, do not arrange themselves according to their density, but they spontaneously diffuse through each other so as to remain in an intimate state of mixture for any length of time." For the fissured jar of Priestley and Döbereiner he substituted a glass tube closed by a plug of plaster of Paris, and with this simple appliance he developed his now well-known law "that the diffusion rate of gases is inversely as the square root of their density."

With regard to the special importance of Graham's law to the chemist and physicist, it may be sufficient to point out that a great number of chemical as well as physical facts are co-ordinated by the assumption that all substances in the state of gas have the same molecular volume or contain the same number of molecules in a given space (Avogadro's law); and, in the second place, it has become evident that the phenomena of heat are simply the manifestations of molecular motion. According to this view the absolute temperature of a gas is proportional to the *vis viva* of its molecules; and since all molecules at a given temperature have the same *vis viva*, it follows that the molecules must move with velocities which are inversely proportional to the square roots of the molecular weights. Moreover, since the molecular volumes are equal, and the molecular weights are therefore proportional to the densities of the aëriform bodies in which the molecules are active units, it also follows that the average velocities of the molecules in any two gases are inversely proportional to the square roots of their respective densities. Thus the simple numerical relations first observed in the phenomena of diffusion are the direct result of molecular motion, and it is now seen that Graham's empirical law is included under the fundamental law of motion.

Graham also studied the passage of gases by transpiration through fine tubes, and by effusion through a minute hole in a platinum disc, and was enabled to show that gas may enter a vacuum in three different ways: (1) by the molecular movement of diffusion, in virtue of which a gas penetrates through the pores of a disc of compressed graphite; (2) by effusion through an orifice of sensible dimensions in a platinum disc (the relative times of the effusion of gases in mass being similar to those of the molecular diffusion, although a gas is usually carried by the former kind of impulse with a velocity many thousand times as great as is demonstrable by the latter); and (3) by the peculiar rate of passage due to transpiration through fine tubes, in which the ratios appear to be in direct relation with no other known property of the same gases,—thus hydrogen has exactly double the transpiration rate of nitrogen, the relation of those gases as to density being as 1 : 14.

He subsequently examined the passage of gases through septa or partitions of india-rubber, and plates of non-crystalline metals such as palladium, and proved that gases pass through these septa neither by diffusion, effusion, nor transpiration, but in virtue of a selective absorption which the septa appear to exert on the gases in contact with them. By this means he was enabled partially to separate oxygen from air, and to calculate the density of metallic hydrogen from the remarkable expansion which attends the absorption of hydrogen by palladium. The experiments led him to believe that palladium with its occluded hydrogen was an alloy, a view that has been greatly strengthened by the recent experiments of MM. Cailletet and Pictet.

His early work on the movements of gases led him to examine the spontaneous movements of liquids, and as a result of the experiments he divided bodies into two classes,—crystalloids, such as common salt, and colloids, of which gum-arabic is a type,—the former having high and the latter low diffusibility. He also proved, by a series of beautiful experiments, that the process of liquid diffusion actually causes partial decomposition of certain chemical compounds, the sulphate of potash, for instance, being separated from the sulphate of alumina in alum by the higher diffusibility of the former salt.

He also extended his work on the transpiration of gases to liquids, adopting the method of manipulation devised by Poiseuille. He found that dilution with water does not effect proportionate alteration in the transpiration velocities of different liquids, and a certain determinable degree of dilution retards the transpiration velocity. Thus in the case of alcohol the greatest retardation is with six equivalents of water, nitric acid with three, and acetone with as much as twelve equivalents.

It is only possible here to indicate the prominent features of Graham's more purely chemical labors. In 1833 he showed that the various compounds of phosphoric acid and water constitute distinct salts, in each of which the hydrogen may be displaced by other metals. He was the first, therefore, to establish the existence of polybasic compounds, in each of which one or more equivalents of hydrogen are replaceable by certain metals, and he further showed that by heating biphosphate of soda a metaphosphate is formed, and from this he obtained a corresponding hydrated acid. In 1824 he demonstrated that the spontaneous inflammability of one variety of phosphuretted hydrogen is due to its admixture with a very small proportion of an oxide of

nitrogen, probably nitrous acid. In 1835 he published the results of an examination of the properties of water as a constituent of salts. Not the least interesting part of this inquiry was the discovery of certain definite salts with alcohol analogous to hydrates, to which the name of alcoholates was given. A brief paper entitled *Speculative Ideas on the Constitution of Matter* deserves notice as possessing special interest in connection with work done since Graham's death. In it he expressed the view that the various kinds of matter now recognized as different elementary substances may possess one and the same ultimate or atomic molecule in different conditions of movement.

Graham's work, viewed as a whole, is remarkable alike for its originality and for the singular simplicity of the methods employed in obtaining most important results.

Biographical notices of Graham will be found in the *Proceedings of the Royal Society*, xviii., 1870, p. xviii.; *Proceedings of the Royal Society of Edinburgh*, vii., 1872, p. 15; *Proceedings of the Royal Institution*, vi., 1872, p. 15; *Deutsch. Chem. Gesellschaft*, Berlin, ii., 1869, p. 753; *München Akad. Sitzungsb.*, 1870, i., p. 408; *American Journal of Science*, i., 1871, p. 115; *Smithsonian Reports*, 1871, p. 177; *Proceedings of American Academy*, viii., 1870, p. 230. His works have been collected and printed by Dr. James Young and Dr. Angus Smith, the latter contributing to the volume a valuable preface and analysis of its contents. (W. C. R.)

GRAHAME, JAMES (1765–1811), author of *The Sabbath* and other poems, was born at Glasgow, April 22, 1765. His father was a successful lawyer, and, by a very common error, he conceived that no other profession could be so suitable or so advantageous for his son. James, dutiful, and shrinking from opposition, as he did all through life, obeyed the parental wish, and after completing his literary course at the university of his native city, went in 1784 to Edinburgh, where he studied law, first to qualify himself for the business of writer to the signet, and subsequently for the Scottish bar, of which he was elected a member in 1795. His inclinations, however, were all for retirement and literature; and finally, when he had reached the mature age of forty-four, he took orders in the English Church, and became curate first at Shipton, Gloucestershire, and then at Sedgefield in the county of Durham. He did not long enjoy an office which he adorned by his pious and eloquent ministrations. Ill health compelled him to try the renovating effects of his native air, but he died shortly after his return, September 14, 1811. The works of Grahame consist of a dramatic poem *Mary Queen of Scots* (published in 1801), *The Sabbath* (1804), *British Georgics* (1804), *The Birds of Scotland* (1806), and *Poems on the Abolition of the Slave Trade* (1810). His principal work is *The Sabbath*—a sacred and descriptive poem in blank verse, characterized by a fine vein of tender and devotional feeling, and by the happy delineation of Scottish scenery. He is the Cowper of Scotland, but wants Cowper's mastery of versification and easy idiomatic vigor of style. The blank verse of Grahame is often hard and constrained, though at times it swells out into periods of striking imagery and prophet-like earnestness. His description of the solemn stillness and unbroken calm of "the hallowed day" in the rural districts of Scotland, and of the Scottish Sabbath preachings among the hills in times of persecution, when

> "The scattered few would meet in some deep dell
> By rocks o'er-canopied,"

are finished pictures that will never fade from our poetry. In his *Georgics* he tried the wider field of rural occupations and manners, and produced some pleasing daguerreotypes of nature,—for he was a careful as well as loving student,—but descended too much into minute and undignified detail. In the notes to his poems he expresses manly and enlightened views on popular education, the criminal law, and other public questions. He was emphatically a friend of humanity—a philanthropist as well as a poet.

GRAHAM'S TOWN, the metropolis of the eastern districts of the Cape Colony, South Africa, is situated in the division of Albany, 80 miles inland from Algoa Bay, 40 miles inland from Port Alfred, and 600 miles from Cape Town. In 1812 the site of the town was first chosen as the headquarters of the British troops engaged in protecting the frontier of the colony from the inroads of the Kaffre tribes, and it was named after Colonel Graham, then commanding the forces. In 1819 an attempt was made by the Kaffres to surprise the place, and a body of 10,000 men attacked it, but were gallantly repulsed by the garrison, which numbered not more than 320 men, infantry and artillery, under Colonel Willshire. From 1820 Graham's Town was the centre of what was termed the "Albany Settlement," and it soon became the chief emporium of frontier trade. The town is built in a basin of the grassy hills forming the spurs of the Zuurberg mountain range, 1760 feet above sea-level. It is a pleasant place of residence, and is regarded as the most English-like town in the colony. The streets are broad, and most of them lined with trees. The principal thoroughfare is the High Street, where stand St. George's English Cathedral, built from designs by Sir Gilbert Scott, and Commemoration Chapel, the chief place of worship of the Wesleyans, erected by the British emigrants of 1820. There are no fewer than twelve churches and chapels in Graham's Town—Church of England, Roman Catholic, Wesleyan, Presbyterian, Baptist, and Independent. It is the seat of the Eastern Districts' Court, presided over by a chief judge and two puisne judges. Among the institutions of the town are an excellent public hospital, a lunatic asylum, colleges and grammar schools, a museum and natural history society, a public library, a club, and masonic, templar, and other societies. There is also a botanic garden, in which there is a memorial of Colonel Fordyce of the 74th regiment, who fell in the Kaffre war of 1851. The population of Graham's Town, according to the last census, is 4004. It is the centre of trade for an extensive pastoral and agricultural country, and has easy communication both with Port Alfred, at the mouth of the Kowie River, and with Port Elizabeth on Algoa Bay.

GRAIL, or GRAYLE, THE HOLY (Saint Graal, Seynt Greal, Sangreal, Sank Ryal), the name given to the legendary wonder-working vessel said to have been brought by Joseph of Arimathea to Britain. The correct spelling is "Graal." In the present article the subject will be considered under the following four heads:—(1) the meaning of the Graal conception; (2) the authorship of the conception; (3) the meaning of the word; (4) the spread of the conception from the land of its origin to other countries.

1. The "Saint Graal" was the name given—if not originally, yet very soon after the conception was started—to the dish, or shallow bowl (in French, *escuelle*), from which Jesus Christ was said to have eaten the paschal lamb on the evening of the Last Supper with his disciples. In the French prose romance of the *Saint Graal*, it is said that Joseph of Arimathea, having obtained leave from Pilate to take down the body of Jesus from the cross, proceeded first to the upper room where the supper was held and found there this vessel; then, as he took down the Lord's dead body, he received into the vessel many drops of blood which issued from the still open wounds in his feet, hands, and side. The last feature, which Tennyson in his beautiful idyll *The Holy Grail* has overlooked, is obviously of the essence of the conception. According to Catholic theology, where the body or the blood of Christ is, there, by virtue of the hypostatic union, are His soul and His divinity. That the Graal, such being its contents, should be marvellous—divine—mysterious, was but logical and natural. The Graal was "the commencement of all bold emprise, the occasion of all prowess and heroic deeds, the investigation of all the sciences, . . . the demonstration of great wonders, the end of all bounty and goodness, the marvel of all other marvels." Nasciens, taking off the paten which covered the Graal, comprehends innumerable marvels, but is struck blind. By the Graal Joseph's life is sustained in prison during forty-two years without food, while as an oracle it instructs him in heavenly knowledge. Nothing could be more fantastic and extravagant than all this, were the Graal conceived of merely as a relic, however venerable; but all is altered when it is brought into close relations, according to the design of its inventors, with the mystery of the eucharist.

2. The authorship of the conception involves one of the most difficult of literary questions. Mr. Price, in the able and eloquent dissertation prefixed to vol. i. of Warton's *History of English Poetry*, seems to maintain the view that it can be attributed to no individual, but was the spontaneous outgrowth of a group of widely prevalent superstitions, in all which a magical cup or divining bowl was the central object. Others, as Fauriel, Simrock, and Schulz, find the original home of the legend in Provence. M. Paulin Paris, who has been engaged for nearly forty years in the

study of Arthurian romance, and whose latest speculations (*Romans de la Table Ronde*, v. 352) bear the recent date of 1876, is of opinion that the original conception came from some Welsh monk or hermit who lived early in the 8th century; that its guiding and essential import was an assertion for the British Church of an independent derivation of its Christianity direct from Palestine, and not through Rome; that the conception was embodied in a book, called *Liber Gradalis* or *De Gradali;* that this book was kept in abeyance by the British clergy for more than 300 years, from a fear lest it should bring them into collision with the hierarchy and make their orthodoxy suspected; that it came to be known and read in the second half of the 12th century; that a French poet, Robert de Boron, who probably had not seen the book, but received information about it, was the first to embody the conception in a vernacular literary form by writing his poem of *Josephe d'Arimathie;* and that, after Boron, Walter Map and others came into the field. Lastly, it is maintained, by English writers generally, that the conception arose certainly on British ground, but in the 12th century, not in the 8th; that it was introduced by some master-hand, probably that of Walter Map, into every branch of Arthurian romance; and that if Map was not the author of the conception, as seems highly probable, he first, by writing the French romances of the *Saint Graal*, the second part of *Lancelot*, and *Mort Artur*, invested it in literary form.

These theories cannot be discussed here; but it may be remarked that, in order to pave the way for any rational theory, it is indispensable to have a clear view of the condition of romance literature at and before the time when the conception arose. The legend of Arthur, which barely rises to the surface in the narrative of Gildas, had in the time of Nennius (9th century) attained to considerable consistency, and through the appearance of the *Historia Britonum* of Geoffrey of Monmouth, which everywhere excited an extraordinary sensation, had become European. To the Norman and French poets it had become known, long before the appearance of Geoffrey's book, through the Breton lays; and the mysticism, the tender depths of sentiment, the wild flights of imagination and fancy which were found in these lays, had so captivated and dazzled them as to induce them almost to desert their own rough *Chansons de Geste*, of which Charlemagne was the chief figure, for this new field. A succession of startling incidents, in which giants, knights, dwarfs, fairies, and goblins were actors, and a nature in mystic sympathy with man was the background, appealed to the feelings of wonder and awe; the instinct of revenge and the lust of war were gratified by battle-recitals innumerable, while around the chief characters of the legends there floated the rapture and the hyperbole of amorous passion. In the *Brut* of Wace, founded on Geoffrey's work, we find the story of Arthur in ample proportions, and the "Round Table" appears for the first time—

> "Fist reis Ertur la Runde Table,
> Dunt Bretun dient meinte fable."

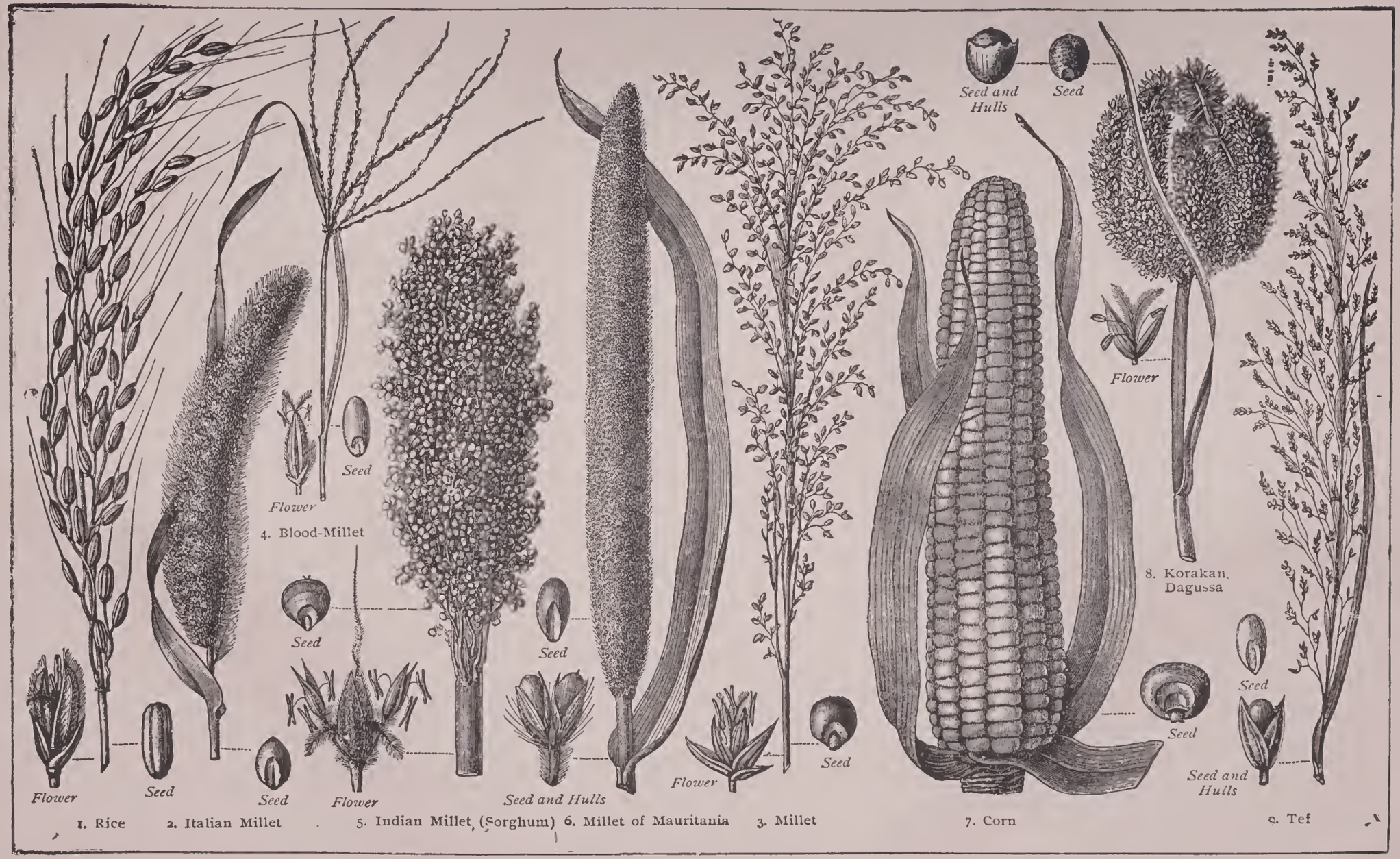
The exuberance of invention here attributed to the Bretons was faithfully imitated by the poets of northern France. Chrestien of Troyes, born near the middle of the 12th century, besides versifying many tales from Ovid, reproduced parts of the Arthur legend in his poem on *King Mark and Yseult the Blonde*, and the *Chevalier au Lion*. In these, however, there is no mention of the Graal. Suddenly a narrative, possibly in Latin but more probably in French prose, makes its appearance, containing the story of the commission of the Holy Graal to Joseph of Arimathea, as given above, of his subsequent adventures in Syria and elsewhere, and of the ultimate arrival of his son, his brother-in-law, and others of his kindred, in Britain, where they settle in the island of Avallon. The birth of Arthur is prophesied in this narrative, but otherwise he is scarcely mentioned. About the same time, the prose romances of *Lancelot* (part i.) and *Tristan*, containing rich developments of the Arthurian legend, made their appearance and were warmly welcomed. The first is ascribed in the MSS. to Walter Map, and the second to Luc or Luces de Gast; but both statements, in the opinion of M. Paulin Paris, are extremely doubtful. At any rate, if Map wrote the first part of *Lancelot*, he continued and finished it in a totally different spirit. The first part is mere love and chivalry, "the most secular," says M. Paulin Paris, "of all romances;" while the second part is the most mystical of all. The first part contains no allusion to the Graal; in the second it is an element of overpowering interest. Lancelot joins in the quest for the Graal, fails to see it or only half sees it, repents, becomes a holy hermit, and dies. *Tristan* in its original form was the legend of a favorite Breton hero; it was then connected with the cycle of Arthur; lastly, perhaps by the same powerful hand that transmuted *Lancelot*, it was brought within the sweep of the Graal conception.

But who invented the story of Joseph of Arimathea? or rather, who connected that story with the Graal legend, and both with Arthur? The importance of a work of William of Malmesbury in assisting us to answer this question has been somewhat overlooked. In his treatise *De Antiquitate Glastoniensis Ecclesiæ*, written probably soon after Henry of Blois, abbot of Glastonbury, to whom it is dedicated, was raised to the see of Winchester (1129), Malmesbury records with considerable detail the legend which brought Joseph to Glastonbury, and made him the first preacher of Christianity to the Britons. Everything connected with Glastonbury had a duodenary character; Joseph was sent to Britain by St. Philip the evangelist as the chief among twelve missioners; the holy men who afterwards tenanted the abbey always sought to maintain the number of twelve; Glasteing, from whom the place was named, was one of twelve brothers; the chief estate of the abbey was called "the Twelve Hides," etc. This same feature distinctly reappears in the Graal legend, where Bron, the brother-in-law of Joseph, has twelve sons, who are all sent to Britain, but one among them, Alain, who renounces marriage, is set over the rest. Again, we read in Malmesbury that Avallon is another name for Glastonbury; and in the Graal legend we read that Joseph's kindred are directed by a divine voice to seek, in the far west, the "valleys of Avaron." Lastly, in the strange story about the altar called "sapphirus," which angels brought from Palestine to St. David, and which after a long disappearance was rediscovered in Malmesbury's own day, we seem to lay our finger, as it were, on the origin, the rudimentary suggestion, of the Graal conception.

Now if we accept the general testimony of the MSS., and assume without further proof that Map composed, whether in Latin or in French, the original book of the *Saint Graal*, the genesis of the work seems not difficult to trace. In early life Map was a canon of Salisbury (see Wright's preface to the *De Nugis Curialium*); either afterwards or at the same time he was parish priest of Westbury near Bristol. Gloucestershire and Wiltshire are both neighboring counties to Somersetshire, in which Glastonbury was the most sacred and celebrated spot. Visiting that ancient abbey, Map would have become acquainted with the legend of Joseph of Arimathea in all its details; and he would have seen the altar said to have been transported by angels from Palestine, and which, long hidden from mortal sight on account of the wickedness of the times, had lately been revealed and reinstated. His versatile and capacious mind would, as a matter of course, have been familiar with the whole Arthur legend as it then (1170–1180) existed, if for no other reason, because he lived in the very part of England which was studded with Arthurian sites. He fully answers to the description of the "great clerks" who, according to Robert de Boron first made and told the history of the Graal. He seems to have conceived the vast design of steeping the Arthurian legend, and through it the whole imaginative literature of the age, in the doctrine of the Christian sacrifice. He is generally credited in the MSS. with the composition of the *Saint Graal* (containing the legend of Joseph of Arimathea), of the *Quest of the Saint Graal*, of *Lancelot* in whole or in part, and of the *Mort Artur*. But it appears that no MS. of any of these romances now exists of an earlier date than 1274, and it is certain that a set of "arrangers" and continuators (like the rhapsodists and cyclic poets of the Homeric epos) commenced their confusing operations on the legend at an early period. Hence it seems impossible now to recover the exact order in which the different romances were composed.

3. On the origin of the word Graal the opinion of M. Paulin Paris seems to be satisfactory. He thinks that graal is a corruption of gradale, or graduale, the Latin name for a liturgical collection of psalms and texts of scripture, so called "quod in gradibus canitur," as the priest is passing from the epistle to the gospel side of the altar. The author of the Graal conception meant by graal, or gradale, not the sacred dish (escuelle), but the mysterious book revealed to the supposed hermit of 717, in which he finds the history of the escuelle. Robert de Boron, mistaking this, transfers

GRAIN



1. Rice 2. Italian Millet 5. Indian Millet, (Sorghum) 6. Millet of Mauritania 3. Millet 7. Corn 9. Tef

the name to the dish, and connects it with *grè* (gratus, gratia) on account of the inward solace connected with it (see *Romans de la T. R.* i. 143). The word rapidly became popular in the sense of bowl, or shallow cup, so that Hélinand (1204) could say, "Dicitur vulgari nomine *graalz*, quia grata et acceptabilis est in ea comedenti." This etymology is the same as Boron's. The older French word *gréel*, meaning service-book (Ducange, article "Gradale"), was displaced by the new *graal* or *greal*. On the other hand, M. Fauriel derives graal from an old Provençal word for a cup, *grazal*. But this *grazal*, according to the article in Ducange, seems to be of Armorican origin; anyhow M. Fauriel has not proved its use in the sense of cup at a period earlier than the rise of the Graal legend.

4. The spread and ascendency to which the Graal conception rapidly attained in all Christian countries made the creations of Arthurian romance the delight of all cultivated minds, from Caerleon to Venice, and from Iceland to the Straits of Gibraltar. From England, which we must regard as the land of its origin, the Graal legend at once passed to France, and found an enthusiastic and capable interpreter in Robert or Robiers de Boron. This Boron was no Englishman of Nottinghamshire, as some English writers have pretended, but, as Paulin Paris conclusively proves, a French poet of the county of Montbeliard in the region of the Vosges. Chrestien de Troyes in his *Percival* (written before 1191, for it is dedicated to Count Philip of Flanders, who died in that year), gives in a metrical dress the legend of Percival, one of the knights of the round table, under the transformation which the introduction of the Graal conception had effected. The continuations of the poem, by Denet and Manessier, come down to about 1240. The famous Mid-German poem of *Parzival*, by Wolfram von Eschenbach, which appeared near the beginning of the 13th century, is founded partly on Chrestien's *Percival*, but partly also on some other, perhaps Provençal, source, which is now lost. A rude English metrical version of the French prose romance of the *Saint Graal*, by one Harry Lonelich, dating from the reign of Henry VI., has been recently edited by Mr. Furnivall for the Roxburghe Club. Flemish, Icelandic, and Welsh reproductions of the Graal romances have been found to exist. One of the first employments of the printing press in England, France, and Germany was to multiply poems or romances embodying this legend. Hence Caxton printed for Sir Thomas Malory (1485) *The Historie of King Arthur and his Noble Knightes*, a version in English prose of the French romances of *Merlin*, *Lancelot*, *Tristan*, the *Quête du Saint Graal*, and *Mort Artur*, or at any rate based upon them. An early French edition of the *Tristan*, of which there is a copy in the British Museum, is dated 1489. *Lancelot du lac* was printed at Paris in 1513; and not long afterwards editions of the *Tristan* and other portions of the Arthur cycle, always as interpenetrated by the Graal legend, appeared both in Italy and Spain (Schulz's *Essay*, p. 114).

See Paulin Paris, *Les Manuscrits de la Bibliotheque Royale*, 1836, and *Les Romans de la Table Ronde*, 1868–77; Madden's *Sir Gawayne*, edited for the Bannatyne Club, 1839; the *Seynt Graal* (part i.), edited by F. Furnivall, with a prefatory essay on the Graal-saga by San Marte (Schulz), 1861–3; several MSS. of the King's Library in the British Museum, Reg. 14 E. iii., 19 C. xii., 20 C. vi., etc.; Fauriel, *Hist. de la Poésie Provençale*; Wolfram von Eschenbach, *Parzival und Titurel*, edited by Pfeiffer, 1870; Warton's *History of English Poetry*, vol. i.; *La France Littéraire*, vol. xv.; Helinand's "Chronicles" (in Migne's *Patrologie*, vol. ccxii.); Schulz's *Essay on the Influence of Welsh Tradition*, Llandovery, 1841, etc., etc. (T. A.)

GRAINS OF PARADISE, Guinea Grains, or Melegueta Pepper (German, *Paradieskörner*; French *Graines de Paradis*, *Maniguette*), the *semina cardamomi majoris* or *piper melegueta* of pharmaceutists, are the seeds of *Amomum Melegueta*, Roscoe, a reed-like plant of the natural order *Zingiberaceæ*, which is a native of tropical western Africa, and of Prince's and St. Thomas's Islands in the Gulf of Guinea, is cultivated in British Guiana, and may with ease be grown in hot-houses in England. The plant has a branched horizontal rhizome; smooth, nearly sessile, alternate leaves, with the blade oblong-lanceolate; large, white, pale pink, or purplish flowers; and an ovate-oblong fruit, ensheathed in bracts, which is of a scarlet color when fresh, and reaches under cultivation a length of 5 inches. The seeds are contained in the acid pulp of the fruit, are commonly wedge-shaped and bluntly angular, are about 1¼ line in diameter, and have a glossy dark-brown husk, with a conical light-colored membranous caruncle at the base, and a white kernel. They contain, according to Flückiger and Hanbury, 0·3 per cent. of a faintly yellowish neutral essential oil, having an aromatic, not acrid taste, and a specific gravity at 15·5° C. of 0·825, and giving on analysis the formula $C_{20}H_{32}O$, or $C_{10}H_{16}+C_{10}H_{16}O$; also 5·83 per cent. of an intensely pungent, viscid, brown resin. Grains of paradise were formerly officinal in British pharmacopœias, and in the 13th and succeeding centuries were used as a drug and a spice, the wine known as hippocras being flavored with them and with ginger and cinnamon. In 1629 they were employed among the ingredients of the twenty-four herring pies which were the ancient fee-favor of the city of Norwich, ordained to be carried to court by the lord of the manor of Carleton (Johnston and Church, *Chem. of Common Life*, p. 355, 1879). Grains of paradise were in past times brought overland from West Africa to the Mediterranean ports of the Barbary States, to be shipped for Italy. They are now exported almost exclusively from the Gold Coast. The amount received by Great Britain in 1871 was upwards of 760 cwts. Grains of paradise are to some extent used in veterinary practice, but for the most part illegally to give a fictitious strength to malt liquors, gin, and cordials. By 56 Geo. III. c. 58, no brewer or dealer in beer shall have in his possession or use grains of paradise, under a penalty of £200 for each offence; and no druggist shall sell the same to a brewer under a penalty of £500. They are, however, devoid of any injurious physiological action, and are much esteemed as a spice by the natives of Guinea.

See Bentley and Trimen, *Medicinal Plants*, part 30, tab. 268; Lanessan, *Hist. des Drogues*, pp. 456–460, 1878.

GRAM, or Chick-pea, called also Egyptian Pea, or Bengal Gram (Hindi, *chaná*; Bengali, *chholá*; Italian, *cece*, Spanish, *garbanzo*), an herbaceous, annual, leguminous plant, the *Cicer arietinum* of Linnæus, so named from the resemblance of its seed to a ram's head, is a native of the south of Europe and India. Its leaves are imparipinnate, with ovate, equal, and serrate leaflets; the flowers are axillary, and of a bluish-purple color, and bloom in India from September to October; and the pods have a length of 1 to 1½ inch, and contain either one or two somewhat pointed and commonly pale yellow seeds, about 3 lines long. Gram is largely cultivated in the East, where the seeds are eaten raw, or cooked and prepared in various ways, both in their ripe and unripe condition, and when roasted and ground are made to subserve the same purposes as ordinary flour. In Europe the seeds are used as an ingredient in soups. They contain, in 100 parts without husks, nitrogenous substances 22·7, fat 3·76, starch 63·18, mineral matters 2·6 parts, with water (Forbes Watson, quoted in Parkes's *Hygiene*). The liquid which exudes from the glandular hairs clothing the leaves and stems of the plant, more especially during the cold season, when the seeds ripen, contains a notable proportion of oxalic acid, and is said to be very injurious to the leather shoes of those who walk through fields of gram. In Mysore the dew containing it is collected by means of cloths spread on the plant over night, and is valued as a remedy for dyspepsia, indigestion, and costiveness. The steam of water in which the fresh plant is immersed is in the Deccan resorted to by the Portuguese for the treatment of dysmenorrhœa. The seed of *Phaseolus Mungo*, Linn., or green gram (Hind. and Beng., *moong*), a variety of which plant, *P. Mungo melanospermus* (*P. Max*, Roxb.), is termed black gram, is an important article of diet among the laboring classes in India, and is annually exported in large quantities from Madras. Soup made from it is considered to be especially suited to sick persons. The meal is an excellent substitute for soap, and is stated by Elliot to be an invariable concomitant of the Hindu bath. *P. Roxburghii*, W. and Arn., or *P. radiatus*, Roxb. (Hind., *urid*; Beng., *máshkalái*), which also is known as green gram, is perhaps the most esteemed of the leguminous plants of India, where the meal of its seed enters into the composition of the more delicate cakes and dishes, and is used in medicine both externally and internally. *P. aconitifolius* goes by the name of Turkish gram. Horse gram, *Dolichos uniflorus*, Lam. (Hind. and Beng., *kulthi*), which supplies in Madras the place of the chick-pea, affords seed which, when boiled, is extensively employed as a food for horses and cattle in South India, where also it is eaten

in curries, and, made into poultices or pastes, is applied to medicinal purposes. Turkish gram is the *Dolichos Catjang* of Roxburgh. White gram, *Glycine* (*Soja*) *hispida*, produces the beans from which soy is made. The quantity of gram exported from India in 1876–77, chiefly to Mauritius, Ceylon, and the Straits, amounted to 316,592 cwt., against 322,661 cwt. in the previous year.

See W. Elliot, "On the Farinaceous Grains and the various kinds of Pulses used in Southern India," *Edin. New Phil. Journ.*, 1862, vol. xvi., p. 16 *sq.*; H. Drury, *The Useful Plants of India*, 1873; U. C. Dutt, *Materia Medica of the Hindus*, Calcutta, 1877.

GRAMMAR. By the grammar of a language is meant either the relations borne by the words of a sentence and by sentences themselves one to another, or the systematized exposition of these. The exposition may be, and frequently is, incorrect; but it always presupposes the existence of certain customary uses of words when in combination. In what follows, therefore, grammar will be generally employed in its primary sense, as denoting the mode in which words are connected together in order to express a complete thought, or, as it is termed in logic, a proposition.

Scope of grammar.

The object of language is to convey thought, and so long as this object is attained the machinery for attaining it is of comparatively slight importance. The way in which we combine our words and sentences matters but little, provided that our meaning is clear to others. The expressions "horseflesh" and "flesh of a horse," are equally intelligible to an Englishman and therefore are equally recognized by English grammar. The Chinese manner of denoting a genitive is by placing the defining word before that which it defines, as in *koue jin*, "man of the kingdom," literally "kingdom man," and the only reason why it would be incorrect in French or Italian is that such a combination would be unintelligible to a Frenchman or an Italian. Hence it is evident that the grammatical correctness or incorrectness of an expression depends upon its intelligibility, that is to say, upon the ordinary use and custom of a particular language. Whatever is so unfamiliar as not to be generally understood is also ungrammatical. In other words, it is contrary to the habit of a language, as determined by common usage and consent.

In this way we can explain how it happens that the grammar of a cultivated dialect and that of a local dialect in the same country so frequently disagree. Thus, in the dialect of West Somerset, *thee* is the nominative of the second personal pronoun, while in cultivated English the plural accusative *you* (Anglo-Saxon, *eow*) has come to represent a nominative singular. Both are grammatically correct within the sphere of their respective dialects, but no further. *You* would be as ungrammatical in West Somerset as *thee* is in classical English; and both *you* and *thee*, as nominatives singular, would have been equally ungrammatical in Early English. Grammatical propriety is nothing more than the established usage of a particular body of speakers at a particular time in their history.

It follows from this that the grammar of a people changes, like its pronunciation, from age to age. Anglo-Saxon or Early English grammar is not the grammar of Modern English, any more than Latin grammar is the grammar of modern Italian; and to defend an unusual construction or inflection on the ground that it once existed in literary Anglo-Saxon, is as wrong as to import a peculiarity of some local dialect into the grammar of the cultivated speech. It further follows that different languages will have different grammars, and that the differences will be more or less according to the nearer or remoter relationship of the languages themselves, and the modes of thought of those who speak them. Consequently, to force the grammatical framework of one language upon another is to misconceive the whole nature of the latter, and seriously to mislead the learner. Chinese grammar, for instance, can never be understood until we discard, not only the terminology of European grammar, but the very conceptions which underlie it, while the polysynthetic idioms of America defy all attempts to discover in them "the parts of speech" and the various grammatical ideas which occupy so large a place in our school-grammars. The endeavor to find the distinctions of Latin grammar in that of English has only resulted in grotesque errors, and a total misapprehension of the usage of the English language.

Subdivision of grammar.

It is to the Latin grammarians,—or, more correctly, to the Greek grammarians, upon whose labors those of the Latin writers were based,—that we owe the classification of the subjects with which grammar is commonly supposed to deal. The grammar of Dionysius Thrax, which he wrote for Roman schoolboys in the time of Pompey, has formed the starting-point for the innumerable school-grammars which have since seen the light, and suggested that division of the matter treated of which they have followed. He defines grammar as a practical acquaintance with the language of literary men, and as divided into six parts,—accentuation and phonology, explanation of figurative expressions, definition, etymology, general rules of flection, and critical canons. Of these, phonology and accentuation, or prosody, can properly be included in grammar only in so far as the construction of a sentence and the grammatical meaning of a word are determined by accent or letter-change; the accentual difference in English, for example, between *incense* and *incénse* belongs to the province of grammar, since it indicates a difference between noun and verb; and the changes of vowel in the Semitic languages, by which various nominal and verbal forms are distinguished from one another, constitute a very important part of their grammatical machinery. But where accent and pronunciation do not serve to express the relations of words in a sentence, they fall into the domain of phonology, not of grammar. The explanation of figurative expressions, again, must be left to the rhetorician, and definition to the lexicographer; the grammarian has no more to do with them than he has with the canons of criticism.

In fact, the old subdivision of grammar, inherited from the grammarians of Rome and Alexandria, must be given up, and a new one put in its place. What grammar really deals with are all those contrivances whereby the relations of words and sentences are pointed out. Sometimes it is position, sometimes phonetic symbolization, sometimes composition, sometimes flection, sometimes the use of auxiliaries, which enables the speaker to combine his words together so that they shall be intelligible to another. Grammar may accordingly be divided into the three departments of composition or "word-building," syntax, and accidence, by which is meant an exposition of the means adopted by language for expressing the relations of grammar when recourse is not had to composition or simple position.

Modes of treatment.

A systematized exposition of grammar may be intended for the purely practical purpose of teaching the mechanism of a foreign language. In this case, all that is necessary is a correct and complete statement of the facts. But a correct and complete statement of the facts is by no means so easy a matter as might appear at first sight. The facts will be distorted by a false theory in regard to them, while they will certainly not be presented in a complete form if the grammarian is ignorant of the true theory they presuppose. The Semitic verb, for example, remains unintelligible so long as the explanation of its forms is sought in the conjugation of the Aryan verb, since it has no tenses in the Aryan sense of the word, but denotes relation and not time.

A good practical grammar of a language, therefore, should be based on a correct appreciation of the facts which it expounds, and a correct appreciation of the facts is only possible where they are examined and co-ordinated in accordance with the scientific method. A practical grammar ought, wherever it is possible, to be preceded by a scientific grammar.

Comparison is the instrument with which science works, and a scientific grammar, accordingly, is one in which the comparative method has been applied to the relations of speech. If we would understand the origin and real nature of grammatical forms, and of the relations which they represent, we must compare them with similar forms in kindred dialects and languages, as well as with the forms under which they appeared themselves at an earlier period of their history. We shall thus have a comparative grammar and an historical grammar, the latter being devoted to tracing the history of grammatical forms and usages in the same language. Of course, an historical grammar is only possible where a succession of written records exists, where a language possesses no older literature, we must be content with a comparative grammar only, and look to cognate idioms to throw light upon its grammatical peculiarities. In this case we have frequently to leave whole forms unexplained, or at most conjecturally interpreted, since the

machinery by means of which the relations of grammar are symbolized is often changed so completely during the growth of a language as to cause its earlier shape and character to be unrecognizable. Moreover, our area of comparison must be as wide as possible; where we have but two or three languages to compare, we are in danger of building up conclusions on insufficient evidence. The grammatical errors of the classical philologists of the last century were in great measure due to the fact that their area of comparison was confined to Latin and Greek.

The historical grammar of a single language or dialect, which traces the grammatical forms and usages of the language as far back as documentary evidence allows, affords material to the comparative grammarian, whose task it is to compare the grammatical forms and usages of an allied group of tongues, and thereby reduce them to their earliest forms and senses. The work thus carried out by the comparative grammarian within a particular family of languages is made use of by universal grammar, the object of which is to determine the ideas that underlie all grammar whatsoever, as distinct from those that are peculiar to special families of speech. Universal grammar is sometimes known as "the metaphysics of language," and it has to decide such questions as the nature of gender, or of the verb, the true purport of the genitive relation, or the origin of grammar itself. Such questions, it is clear, can only be answered by comparing the results gained by the comparative treatment of the grammars of various groups of language. What historical grammar is to comparative grammar, comparative grammar is to universal grammar.

Universal grammar.

Universal grammar, as founded on the results of the scientific study of speech, is thus essentially different from that "universal grammar" so much in vogue at the beginning of the present century, which consisted of a series of *a priori* assumptions based on the peculiarities of European grammar and illustrated from the same source. But universal grammar, as conceived by modern science, is as yet in its infancy; its materials are still in the process of being collected. The comparative grammar of the Aryan languages is alone in an advanced state, those of the Semitic idioms, of the Ugro-Altaic tongues, and of the Bâ-ntu or Kaffre dialects of southern Africa, are still in a backward condition; and the other families of speech existing in the world, with the exception of the Malayo-Polynesian, and the Sonorian of North America, have not as yet been treated scientifically. Chinese, it is true, possesses an historical grammar, and Mr. Van Eys, in his comparative grammar of Basque, has endeavored to solve the problems of that interesting language by a comparison of its various dialects; but in both cases the area of comparison is too small for more than a limited success to be attainable. Instead of attempting the questions of universal grammar therefore, it will be better to confine our attention to three points,—the fundamental differences in the grammatical conceptions of different groups of languages, the main results of a scientific investigation of Aryan grammar, and the light thrown by comparative philology upon the grammar of our own tongue.

Differences in grammar of unallied languages.

The proposition or sentence is the unit and starting-point of speech, and grammar, as we have seen, consists in the relations of its several parts one to another, together with the expression of them. These relations may be regarded from various points of view. In the polysynthetic languages of America the sentence is conceived as a whole, not composed of independent words, but, like the thought which it expresses, one and indivisible. What we should denote by a series of words is consequently denoted by a single long compound,—*kuligatchis* in Delaware, for instance, signifying "give me your pretty little paw," and *aglekkigiartorasuarnipok*, in Eskimo, "he goes away hastily and exerts himself to write." Individual words can be, and often are, extracted from the sentence; but in this case they stand, as it were, outside it, being represented by a pronoun within the sentence itself. Thus, in Mexican, we can say not only *ni-sotsi-temoa*, "I look for flowers," but also *ni-k-temoa sotsitl*, where the interpolated guttural is the objective pronoun. As a necessary result of this conception of the sentence the American languages possess no true verb, each act being expressed as a whole by a single word. In Cherokee, for example, while there is no verb signifying "to wash" in the abstract, no less than thirteen words are used to signify every conceivable mode and object of washing. In the incorporating languages, again, of which Basque may be taken as a type, the object cannot be conceived except as contained in the verbal action. Hence every verbal form embodies an objective pronoun, even though the object may be separately expressed. If we pass to an isolating language like Chinese, we find the exact converse of that which meets us in the polysynthetic tongues. Here each proposition or thought is analyzed into its several elements, and these are set over against one another as so many independent words. The relations of grammar are consequently denoted by position, the particular position of two or more words determining the relation they bear to each other. The analysis of the sentence has not been carried so far in agglutinative languages like Turkish. In these the relations of grammar are represented by individual words, which, however, are subordinated to the words expressing the main ideas intended to be in relation to one another. The defining words, or indices of grammatical relations, are, in a large number of instances, placed after the words which they define; in some cases, however, as, for example, in the Bâ-ntu languages of southern Africa, the relation is conceived from the opposite point of view, the defining words being prefixed. The inflectional languages call in the aid of a new principle. The relations of grammar are denoted symbolically either by a change of vowel or by a change of termination, more rarely by a change at the beginning of a word. Each idea, together with the relation which it bears to the other ideas of a proposition, is thus represented by a single word; that is to say, the ideas which make up the elements of a sentence are not conceived severally and independently, as in Chinese, but as always having a certain connection with one another. Inflectional languages, however, tend to become analytical by the logical separation of the flection from the idea to which it is attached, though the primitive point of view is never altogether discarded, and traces of flection remain even in English and Persian. In fact, there is no example of a language which has wholly forsaken the conception of the sentence and the relation of its elements with which it started, although each class of languages occasionally trespasses on the grammatical usages of the others. In language, as elsewhere in nature, there are no sharp lines of division, no sudden leaps; species passes insensibly into species, class into class. At the same time the several types of speech—polysynthetic, isolating, agglutinative, and inflectional—remain clear and fixed; and even where two languages belong to the same general type, as, for instance, an Aryan and a Semitic language in the inflectional group, or a Kaffre and a Turkish language in the agglutinative group, we find no certain example of grammatical interchange. A mixed grammar, in which the grammatical procedure of two distinct families of speech is intermingled, is almost, if not altogether, unknown.

It is obvious, therefore, that grammar constitutes the surest and most important basis for a classification of languages. Words may be borrowed freely by one dialect from another, or, though originally unrelated, may, by the action of phonetic decay, come to assume the same forms, while the limited number of articulate sounds and conceptions out of which language was first developed, and the similarity of the circumstances by which the first speakers were everywhere surrounded, naturally produce a resemblance between the roots of many unconnected tongues. Where, however, the fundamental conceptions of grammar, and the machinery by which they are expressed are the same, we may have no hesitation in inferring a common origin.

Forms of Aryan grammar.

The main results of scientific inquiry into the origin and primitive meaning of the forms of Aryan or Indo-European grammar may be summed up as follows: We start with stems or themes, by which are meant words of two or more syllables which terminate in a limited number of sounds. These stems can be classed in groups of two kinds, one in which the groups consist of stems of similar meanings and similar initial syllables, and another in which the final syllables alone coincide. In the first case we have what are termed roots, the simplest elements into which words can be decomposed; in the second case stems proper, which may be described as consisting of suffixes attached to roots. Roots, therefore, are merely the materials out of which speech can be made, the embodiments of isolated conceptions with which the lexicographer alone has to deal, whereas stems present us with words already combined in a sentence and embodying the relations of grammar. If we would rightly

understand primitive Aryan grammar, we must conceive it as having been expressed or implied in the suffixes of the stems, and in the order according to which the stems were arranged in a sentence. In other words, the relations of grammar were denoted partly by juxtaposition or syntax, partly by the suffixes of stems.

These suffixes were probably at first unmeaning, or rather clothed with vague significations, which changed according to the place occupied in the sentence by the stem to which they were joined. Gradually this vagueness of signification disappeared, and particular suffixes came to be set apart to represent particular relations of grammar. What had hitherto been expressed by mere position now attached itself to the terminations or suffixes of stems, which accordingly became full-grown words. Some of the suffixes denoted purely grammatical ideas, that is to say, were flections; others were classificatory, serving to distinguish nouns from verbs, presents from aorists, objects from agents, and the like; while others, again, remained unmeaning adjuncts of the root. This origin of the flections explains the otherwise strange fact that the same suffix may symbolize wholly different grammatical relations. In Latin, for instance, the context and dictionary will alone tell us that *mus-as* is the accusative plural of a noun, and *am-as* the second person singular of a verb, or that *mus-a* is the nominative singular of a feminine substantive, *bon-a* the accusative plural of a neuter adjective. In short, the flections were originally merely the terminations of stems which were adapted to express the various relations of words to each other in a sentence, as these gradually presented themselves to the consciousness and were extracted from what had been previously implied by position. Necessarily, the same suffix might be used sometimes in a classificatory, sometimes in a flectional sense, and sometimes without any definite sense at all. In the Greek dative-locative *πόδ-εσ-σι*, for example, the suffix *-ες* is classificatory; in the nominative *πόδ-ες*, it is flectional.

When a particular termination or suffix once acquired a special sense, it would be separated in thought from the stem to which it belonged, and attached in the same sense to other stems and other terminations. Thus in modern English we can attach the suffix *-ize* to almost any word whatsoever, in order to give the latter a transitive meaning, and the Greek *πόδεσσι*, quoted above, really contains no less than three suffixes, *-ες*, *-σν*, and *-ι*, the last two both denoting the locative, and coalescing, through *σϝι*, into a single syllable *-σι*. The latter instance shows us how two or more suffixes denoting exactly the same idea may be tacked on one to another, if the original force and signification of the first of them comes to be forgotten. Thus, in Old English *sang-estre* was the feminine of *sang-ere*, "singer," but the meaning of the termination has so entirely died out of the memory that we have to add the Romanic *-ess* to it if we would still distinguish it from the masculine *singer*. A familiar example of the way in which the full sense of the exponent of a grammatical idea fades from the mind and has to be supplied by a new exponent is afforded by the use of expletives in conversational English to denote the superlative. "Very warm" expresses little more than the positive, and to represent the intensity of his feelings the Englishman has recourse to such expressions as "horribly warm" like the German "schrecklich warm."

Such words as "very," "horribly," "schrecklich," illustrate a second mode in which Aryan grammar has found means of expression. Words may lose their true signification and become the mere exponents of grammatical ideas. Professor Earle divides all words into *presentive* and *symbolic*, the former denoting objects and conceptions, the latter the relations which exist between these. Symbolic words, therefore, are what the Chinese grammarians call "empty words,"—words, that is, which have been divested of their proper signification and serve a grammatical purpose only. Many of the classificatory and some of the flectional suffixes of Aryan speech can be shown to have had this origin. Thus the suffix *tar*, which denotes names of kinship and agency, seems to come from the same root as the Latin *terminus* and *trans*, our *through*, the Sanskrit *tar-âmi*, "I pass over," and to have primarily signified "one that goes through" a thing. Thus too, the English *head* or *hood*, in words like *godhead* and *brotherhood*, is the Anglo-Saxon *hâd*, "character" or "rank;" *dom*, in *kingdom*, the Anglo-Saxon *dôm*, "judgment;" and *lock* or *ledge*, in *wedlock* and *knowledge*, the Anglo-Saxon *lâc*, "sport" or "gift." In all these cases the "empty words," after first losing every trace of their original significance, have followed the general analogy of the language and assumed the form and functions of the suffixes with which they had been confused.

A third mode of representing the relations of grammar is by the symbolic use of vowels and diphthongs. In Greek, for instance, the distinction between the reduplicated present *δίδωμι* and the reduplicated perfect *δέδωκα* is indicated by a distinction of vowel, and in primitive Aryan grammar the vowel *â* seems to have been set apart to denote the subjunctive mood just as *ya* or *i* was set apart to denote the potential. So, too, according to M. Hovelacque, the change of *a* into *i* or *u* in the parent-Aryan symbolized a change of meaning from passive to active. This symbolic use of the vowels, which is the purest application of the principle of flection, is far less extensively carried out in the Aryan than in the Semitic languages. The Semitic family of speech is therefore a much more characteristic type of the inflectional languages than is the Aryan.

The primitive Aryan noun possessed at least eight cases,—nominative, accusative, vocative, instrumental, dative, genitive, ablative, and locative. M. Bergaigne has attempted to show that the first three of these, the "strong cases" as they are termed, are really abstracts formed by the suffixes *-as* (*-s*), *-an-*, *-m*, *-t*, *-i-*, *-â*, and *-ya* (*-i*), the plural being nothing more than an abstract singular, as may be readily seen by comparing words like the Greek *ἔπο-ς* and *ὄπε-ς*, which mean precisely the same. The remaining "weak" cases, formed by the suffixes *-sma*, *-sya*, *-syâ*, *-yâ*, *-i*, *-an*, *-t*, *-bhi*, *-su*, *-i*, *-a*, and *-â*, are really adjectives and adverbs. No distinction, for example, can be drawn between "a cup of gold" and "a golden cup," and the instrumental, the dative, the ablative, and the locative are, when closely examined, merely adverbs attached to a verb. The terminations of the strong cases do not displace the accent of the stem to which they are suffixed; the suffixes of the weak cases, on the other hand, generally draw the accent upon themselves.

According to Hübschmann, the nominative, accusative, and genitive cases are purely grammatical, distinguished from one another through the exigencies of the sentence only, whereas the locative, ablative, and instrumental have a logical origin and determine the logical relation which the three other cases bear to each other and the verb. The nature of the dative is left undecided. The locative primarily denotes rest in a place, the ablative motion from a place, and the instrumental the means of concomitance of an action. The dative Hübschmann regards as "the case of the participant object." Like Hübschmann, Holzweissig divides the cases into two classes,—the one grammatical and the other logical; and his analysis of their primitive meaning is the same as that of Hübschmann, except as regards the dative, the primary sense of which he thinks to have been motion towards a place. This is also the view of Delbrück, who makes it denote tendency towards an object. Delbrück, however, holds that the primary sense of the ablative was that of separation, the instrumental originally indicating concomitance, while there was a double locative, one used like the ablative absolute in Latin, the other being a locative of the object.

The dual was older than the plural, and after the development of the latter survived as a merely useless encumbrance, of which most of the Aryan languages contrived in time to get rid. There are still many savage idioms in which the conception of plurality has not advanced beyond that of duality. In the Bushman dialects, for instance, the plural, or rather that which is more than one, is expressed by repeating the word; thus *tu* is "mouth," *tutu* "mouths." It may be shown that most of the suffixes of the Aryan dual are the longer and more primitive forms of those of the plural which have grown out of them by the help of phonetic decay. The plural of the weak cases, on the other hand (the accusative alone excepted), was identical with the singular of abstract nouns; so far as both form and meaning are concerned, no distinction can be drawn between *ὄπες* and *ἔπος*. Similarly, *humanity* and *men* signify one and the same thing, and the use of English words like *sheep* or *fish* for both singular and plural shows to what an extent our appreciation of number is determined by the context rather than by the form of the noun. The so-called "broken plurals" of Arabic and Ethiopic are really singular collectives employed to denote the plural.

Gender is the product partly of analogy, partly of pho-

aetic decay. In many languages such as Eskimo and Choctaw, its place is taken by a division of objects into animate and inanimate, while in other languages they are separated into rational and irrational. There are many indications that the parent-Aryan in an early stage of its existence had no signs of gender at all. The terminations of the names of *father* and *mother*, *pater* and *mater*, for example, are exactly the same, and in Latin and Greek many diphthongal stems, as well as stems in *i* or *ya* and *u* (like *ναῦς* and *νέκυς*, *πόλις* and *λῑς*), may be indifferently masculine and feminine. Even stems in *o* and *a* (of the second and first declensions), though the first are generally masculine and the second generally feminine, by no means invariably maintain the rule; and feminines like *humus* and *ὁδός*, or masculines like *advena* and *πολίτης*, show that there was a time when these stems also indicated no particular gender, but owed their subsequent adaptation, the one to mark the masculine and the other to mark the feminine, to the influence of analogy. The idea of gender was first suggested by the difference between man and woman, male and female, and, as in so many languages at the present day, was represented not by any outward sign but by the meaning of the words themselves. When once arrived at, the conception of gender was extended to other objects besides those to which it properly belonged. The primitive Aryan did not distinguish between subject and object, but personified objects by ascribing to them the motives and powers of living beings. Accordingly they were referred to by different pronouns, one class denoting the masculine and another class the feminine, and the distinction that existed between these two classes of pronouns was after a time transferred to the nouns. As soon as the preponderant number of stems in *o* in daily use had come to be regarded as masculine on account of their meaning, other stems in *o*, whatever might be their signification, were made to follow the general analogy, and were similarly classed as masculines. In the same way, the suffix *i* or *ya* acquired a feminine sense, and was set apart to represent the feminine gender. Unlike the Semites, the Aryans were not satisfied with these two genders, masculine and feminine. As soon as object and subject, patient and agent, were clearly distinguished from each other, there arose a need for a third gender, which should be neither masculine nor feminine, but denote things without life. This third gender was fittingly expressed either by the objective case used as a nominative (*e. g.*, *regnum*), or by a stem without any case-ending at all (*e. g.*, *virus*).

The adverbial meaning of so many of the cases explains the readiness with which they became crystallized into adverbs and prepositions. An adverb is the attribute of an attribute,—"the rose smells sweetly," for example, being resolvable into "the rose has the attribute of scent with the further attribute of sweetness." In our own language *once*, *twice*, *needs*, are all genitives; *seldom* is a dative. The Latin and Greek *humi* and *χαμαί* are locatives, *facillime* (*facillumed*) and *εὐτυχώς* ablatives, *πάντη* and *ἅμα* instrumentals, *πάρος*, *ἐξῆς*, and *τηλοῦ* genitives. The frequency with which particular cases of particular nouns were used in a specifically attributive sense caused them to become, as it were, petrified, the other cases of the nouns in question passing out of use, and the original force of those that were retained being gradually forgotten. Prepositions are adverbs employed to define nouns instead of verbs and adjectives. Their appearance in the Aryan languages is comparatively late, and the Homeric poems allow us to trace their growth in Greek. The adverb, originally intended to define the verb, came to be construed with the noun, and the government of the case with which it was construed was accordingly transferred from the verb to the noun. Thus when we read in the *Odyssey* (iv. 43), *αὐτοὺς δ' εἰσῆγον θεῖον δόμον*, we see that *εἰς* is still an adverb, and that the accusative is governed by the verb; it is quite otherwise, however, with a line like *Ἀτρείδης δὲ γέροντας ἀολλέας ἦγεν Ἀχαιῶν ἐς κλισίην* (*Il.*, i. 89.) where the adverb has passed into a preposition. The same process of transformation is still going on in English, where we can say indifferently, "What are you looking at?" using "at" as an adverb, and governing the pronoun by the verb, and "At what are you looking?" where "at" has become a preposition. With the growth and increase of prepositions the need of the case-endings diminished, and in some languages the latter disappeared altogether.

Like prepositions, conjunctions also are primarily adverbs used in a demonstrative and relative sense. Hence most of the conjunctions are petrified cases of pronouns. The relation between two sentences was originally expressed by simply setting them side by side, afterwards by employing a demonstrative at the beginning of the second clause to refer to the whole preceding one. The relative pronoun can be shown to have been in the first instance a demonstrative; indeed, we can still use *that* in English in a relative sense. Since the demonstrative at the beginning of the second clause represented the first clause, and was consequently an attribute of the second, it had to stand in some case, and this case became a conjunction. How closely allied the adverb and the conjunction are may be seen from Greek and Latin, where *ὡς* or *quum* can be used as either the one or the other. Our own *and*, it may be observed, has probably the same root as the Greek locative adverb *ἔτι*, and originally signified "going further."

Another form of adverb is the infinitive, the adverbial force of which appears clearly in such a phrase as "A wonderful thing to see." Various cases, such as the locative, the dative, or the instrumental, are employed in Vedic Sanskrit in the sense of the infinitive, besides the bare stem or neuter formed by the suffixes *man* and *van*. In Greek the neuter stem and the dative case were alone retained for the purpose. The first is found in infinitives like *δόμεν* and *φέρειν* (for an earlier *φερε-Fεν*), the second in the infinitives in *-αι*. Thus the Greek *δοῦναι* answers letter for letter to the Vedic dative *dâváne*, "to give," and the form *ψεύδεσθαι* is explained by the Vedic *vayodhai*, for *vayás-dhai*, literally "to do living," *dhai* being the dative of a noun from the root *dhâ*, "to place" or "do." When the form *ψεύδεσθαι* had once come into existence, analogy was ready to create such false imitations as *γράψασθαι* or *γραφθήσεσθαι*. The Latin infinitive in *-re* for *-se* has the same origin, *amare*, for instance, being the dative of an old stem *amas*. In *fieri* for *fierei* or *fiesei*, from the same root as our English *be*, the original length of the final syllable is preserved. The suffix in *-um* is an accusative, like the corresponding infinitive of classical Sanskrit. This origin of the infinitive explains the Latin construction of the accusative and infinitive. When the Roman said, "Miror te ad me nihil scribere," all that he meant at first was, "I wonder at you for writing nothing to me," where the infinitive was merely a dative case used adverbially.

The history of the infinitive makes it clear how little distinction must have been felt at the outset between the noun and the verb. Indeed, the growth of the verb was a slow process. There was a time in the history of Aryan speech when it had not as yet risen to the consciousness of the speaker, and in the period when the noun did not possess a plural there was as yet also no verb. The attachment of the first and second personal pronouns, or of suffixes resembling them, to certain stems, was the first stage in the development of the latter. Like the Semitic verb, the Aryan verb seems primarily to have denoted relation only, and to have been attached as an attribute to the subject. The idea of time, however, was soon put into it, and two tenses were created, the one expressing a present or continuous action, the other an aoristic or momentary one. The distinction of sense was symbolized by a distinction of pronunciation, the root-syllable of the aorist being an abbreviated form of that of the present. This abbreviation was due to a change in the position of the accent (which was shifted from the stem-syllable to the termination), and this change again was probably occasioned by the prefixing of the so-called augment to the aorist, which survived into historical times only in Sanskrit, Zend, and Greek, and the origin of which is still a mystery. The weight of the first syllable in the aorist further caused the person-endings to be shortened, and so two sets of person-endings, usually termed primary and secondary, sprang into existence. By reduplicating the root-syllable of the present tense a perfect was formed; but originally no distinction was made between present and perfect, and Greek verbs like *δίδωμι* and *ἧκω* are memorials of a time when the difference between "I am come" and "I have come" was not yet felt. Reduplication was further adapted to the expression of intensity and desire (in the so-called intensive and desiderative forms). By the side of the aorist stood the imperfect, which differed from the aorist, so far as outward form was concerned, only in possessing the longer and more original stem of the present. Indeed, as Benfey first saw, the aorist itself was primitively an imperfect, and the distinction between aorist

and imperfect is not older than the period when the stem-syllables of certain imperfects were shortened through the influence of the accent, and this differentiation of forms appropriated to denote a difference between the sense of the aorist and the imperfect which was beginning to be felt. After the analogy of the imperfect, a pluperfect was created out of the perfect by prefixing the augment (of which the Greek *ἐμέμηκον* is an illustration); though the pluperfect, too, was originally an imperfect formed from the reduplicated present.

Besides time, mood was also expressed by the primitive Aryan verb, recourse being had to symbolization for the purpose. The imperative was represented by the bare stem, like the vocative, the accent being drawn back to the first syllable, though other modes of denoting it soon came into vogue. Possibility was symbolized by the attachment of the suffix *-ya* to the stem, probability by the attachment of *-a* and *-â*, and in this way the optative and conjunctive moods first arose. The creation of a future by the help of the suffix *-sya* seems to belong to the same period in the history of the verb. This suffix is probably identical with that used to form a large class of adjectives and genitives (like the Greek *ἵπποιο* for *ἵπποσιο*); in this case future time will have been regarded as an attribute of the subject, no distinction being drawn, for instance, between "rising sun" and "the sun will rise." It is possible, however, that the auxiliary verb *as*, "to be," enters into the composition of the future; if so, the future will be the product of the second stage in the development of the Aryan verb when new forms were created by means of composition. The sigmatic or first aorist is in favor of this view, as it certainly belongs to the age of Aryan unity, and may be a compound of the verbal stem with the auxiliary *as*.

After the separation of the Aryan languages, composition was largely employed in the formation of new tenses. Thus in Latin we have perfects like *scrip-si* and *ama-vi*, formed by the help of the auxiliaries *as* (*sum*) and *fuo*, while such forms as *amaveram* (*amavi-eram*) or *amarem* (*ama-sem*) bear their origin on their face. So, too, the future in Latin and Old Celtic (*amabo*, Irish *carub*) is based upon the substantive verb *fuo*, "to be," and the English preterite in *-ed* goes back to a suffixed *did*, the reduplicated perfect of *do*. New tenses and moods, however, were created by the aid of suffixes as well as by the aid of composition, or rather were formed from nouns whose stems terminated in the suffixes in question. Thus in Greek we have aorists and perfects in *-κα*, and the characteristics of the two passive aorists, *γε* and *θε*, are more probably the suffixes of nominal stems than the roots of the two verbs *ya*, "to go," and *dhâ*, "to place," as Bopp supposed. How late some of these new formations were may be seen in Greek, where the Homeric poems are still ignorant of the weak future passive, the optative future, and the aspirated perfect, and where the strong future passive occurs but once and the desiderative but twice. On the other hand, many of the older tenses were disused and lost. In classical Sanskrit, for instance, of the modal aorist forms the precative and benedictive almost alone remain, while the pluperfect, of which Delbrück has found traces in the Veda, has wholly disappeared.

The passive voice did not exist in the parent-Aryan speech. No need for it had arisen, since such a sentence as "I am pleased" could be as well represented by "This pleases me," or "I please myself." It was long before the speaker was able to imagine an action without an object, and when he did so, it was a neuter or substantival rather than a passive verb that he formed. The passive, in fact, grew out of the middle or reflexive, and, except in the two aorists, continued to be represented by the middle in Greek. So, too, in Latin the second person plural is really the middle participle with *estis* understood, and the whole class of deponent or reflexive verbs proves that the characteristic *r* which Latin shares with Celtic could have had at the outset no passive force.

Much light has been thrown on the character and construction of the primitive Aryan sentence by comparative syntax. In contradistinction to Semitic, where the defining word follows that which is defined, the Aryan languages place that which is defined after that which defines it; and Bergaigne has made it clear that the original order of the sentence was (1) object, (2) verb, and (3) subject. Greater complication of thought and its expression, the connection of sentences by the aid of conjunctions, and rhetorical inversion caused that dislocation of the original order of the sentence which reaches its culminating point in the involved periods of Latin literature. Our own language still remains true, however, to the syntax of the parent-Aryan when it sets both adjective and genitive before the nouns which they define. In course of time a distinction came to be made between an attribute used as a mere qualificative and an attribute used predicatively, and this distinction was expressed by placing the predicate in opposition to the subject and accordingly after it. The opposition was of itself sufficient to indicate the logical copula, or substantive verb; indeed, the word which afterwards commonly stood for the latter at first signified "existence," and it was only through the wear and tear of time that a phrase like *Deus bonus est*, "God exists as good," came to mean simply "God is good." It is needless to observe that neither of the two articles was known to the parent-Aryan; indeed, the definite article, which is merely a decayed demonstrative pronoun, has not yet been developed in several of the languages of the Aryan family.

Investigation of English grammar.

We must now glance briefly at the results of a scientific investigation of English grammar and the modifications they necessitate in our conception of it. The idea that the free use of speech is tied down by the rules of the grammarian must first be given up; all that the grammarian can do is to formulate the current uses of his time, which are determined by habit and custom, and are accordingly in a perpetual state of flux. We must next get rid of the notion that English grammar should be modelled after that of ancient Rome; until we do so we shall never understand even the elementary principles upon which it is based. We cannot speak of declensions, since English has no genders except in the pronouns of the third person, and no cases except the genitive and a few faint traces of an old dative. Its verbal conjugation is essentially different from that of an inflectional language like Latin, and cannot be compressed into the same categories. In English the syntax has been enlarged at the expense of the accidence; position has taken the place of forms. To speak of an adjective "agreeing" with its substantive is as misleading as to speak of a verb "governing" a case. In fact, the distinction between noun and adjective is inapplicable to English grammar, and should be replaced by a distinction between objective and attributive words. In a phrase like "this is a cannon," *cannon* is objective; in a phrase like "a cannon-ball," it is attributive; and to call it a substantive in the one case and an adjective in the other, is only to introduce confusion. With the exception of the nominative, the various forms of the noun are all attributive; there is no difference, for example, between "doing a thing" and "doing badly." Apart from the personal pronouns, the accusative of the classical languages can be represented only by position; but if we were to say that a noun which follows a verb is in the accusative case we should have to define "king" as an accusative in such sentences as "he became king" or "he is king." In conversational English "it is me" is as correct as "c'est moi" in French, or "det er mig" in Danish; the literary "it is I" is due to the influence of classical grammar. The combination of noun or pronoun and preposition results in a compound attribute. As for the verb, Mr. Sweet has well said that "the really characteristic feature of the English finite verb is its inability to stand alone without a pronominal prefix." Thus "dream" by itself is a noun; "I dream" is a verb. The place of the pronominal prefix may be taken by a noun, though both poetry and vulgar English frequently insert the pronoun even when the noun precedes. The number of inflected verbal forms is but small, being confined to the third person singular and the special forms of the preterite and past participle, though the latter may with more justice be regarded as belonging to the province of the lexicographer rather than to that of the grammarian. The inflected subjunctive (*be*, *were*, *save* in "God save the Queen," etc.) is rapidly disappearing. New inflected forms, however, are coming into existence; at all events, we have as good a right to consider *wont*, *shant*, *cant* new inflected forms as the French *aimerai* (*amare habeo*), *aimerais* (*amare habebam*). If the ordinary grammars are correct in treating forms like "I am loving," "I was loving," "I did love," as separate tenses, they are strangely inconsistent in omitting to notice the equally important emphatic form "I do love" or the negative form "I do not love" ("I don't love"), as well as

the semi-inflectional "I'll love," "he's loving." It is true that these latter contracted forms are heard only in conversation and not seen in books; but the grammar of a language, it must be remembered, is made by those who speak it and not by the printers.

History of formal grammar.

Our school grammars are the inheritance we have received from Greece and Rome. The necessities of rhetoric obliged the Sophists to investigate the structure of the Greek language, and to them was accordingly due the first analysis of Greek grammar. Protagoras distinguished the three genders and the verbal moods, while Prodicus busied himself with the definition of synonyms. Aristotle, taking the side of Democritus, who had held that the meaning of words is put into them by the speaker, and that there is no necessary connection between sound and sense, laid down that words "symbolize" objects according to the will of those who use them, and added to the *ὄνομα* or "noun," and the *ῥῆμα* or "verb," the *σύνδεσμος* or "particle." He also introduced the term *πτῶσις*, "case," to denote any flection whatsoever. He further divided nouns into simple and compound, invented for the neuter another name than that given by Protagoras, and starting from the termination of the nominative singular, endeavored to ascertain the rules for indicating a difference of gender. Aristotle was followed by the Stoics, who separated the *ἄρθρον* or "article" from the particles, determined a fifth part of speech, the *πανδέκτης* or "adverb," confined the term "case" to the flections of the nouns, distinguishing the four principal cases by names, and divided the verb into its tenses, moods, and classes. Meanwhile the Alexandrian critics were studying the language of Homer and the Attic writers, and comparing it with the language of their own day, the result being a minute examination of the facts and rules of grammar. Two schools of grammarians sprang up,—the Analogists, headed by Aristarchus, who held that a strict law of analogy existed between idea and word, and refused to admit exceptions to the grammatical rules they laid down, and the Anomalists, who denied general rules of any kind, except in so far as they were consecrated by custom. Foremost among the Anomalists was Crates of Mallos, the leader of the Pergamenian school, to whom we owe the first formal Greek grammar and collection of the grammatical facts obtained by the labors of the Alexandrian critics, as well as an attempt to reform Greek orthography. The immediate cause of this grammar seems to have been a comparison of Latin with Greek, Crates having lectured on the subject while ambassador of Attalus at Rome in 159 B.C. The zeal with which the Romans threw themselves into the study of Greek resulted in the school grammar of Dionysius Thrax, a pupil of Aristarchus, which he published at Rome in the time of Pompey, and which is still in existence. Latin grammars were soon modelled upon it, and the attempt to translate the technical terms of the Greek grammarians into Latin was productive of numerous blunders which have been perpetuated to our own day. Thus *tenues* is a mistranslation of the Greek *ψιλά*, "unaspirated;" *genetivus* of *γενική*, the case "of the genus;" *accusativus* of *αἰτιατική*, the case "of the object;" *infinitivus* of *ἀπαρέμφατος*, "without a secondary meaning" of tense or person. New names were coined to denote forms possessed by Latin and not by Greek; *ablative*, for instance, was invented by Julius Cæsar, who also wrote a treatise *De Analogia*. By the 2d century of the Christian era the dispute between the Anomalists and the Analogists was finally settled, analogy being recognized as the principle that underlies language, though every rule admits of exceptions. Two eminent grammarians of Alexandria, Apollonius Dyscolus and his son Herodian, summed up the labors and controversies of their predecessors, and upon their works were based the Latin grammar composed by Ælius Donatus in the 4th century, and the eighteen books on grammar compiled by Priscian in the age of Justinian. The grammar of Donatus dominated the schools of the Middle Ages, and, along with the productions of Priscian, formed the type and source of the Latin and Greek school-grammars of modern Europe.

Learning of grammar of foreign languages.

A few words remain to be said, in conclusion, on the bearing of a scientific study of grammar upon the practical task of teaching and learning foreign languages. The grammar of a language is not to be confined within the rules laid down by grammarians, much less is it the creation of grammarians, and consequently the usual mode of making the pupil learn by heart certain fixed rules and paradigms not only gives a false idea of what grammar really is, but also throws obstacles in the way of acquiring it. The unit of speech is the sentence; and it is with the sentence therefore, and not with lists of words and forms, that the pupil should begin. When once a sufficient number of sentences has been, so to speak, assimilated, it will be easy to analyze them into their component parts, to show the relations that these bear to one another, and to indicate the nature and varieties of the latter. In this way the learner will be prevented from regarding grammar as a piece of dead mechanism or a Chinese puzzle, of which the parts must be fitted together in accordance with certain artificial rules, and will realize that it is a living organism which has a history and a reason of its own. The method of nature and science alike is analytic; and if we would learn a foreign language properly we must learn it as we did our mother tongue, by first mastering the expression of a complete thought and then breaking up this expression into its several elements.

See Steinthal, *Charakteristik der hauptsächlichsten Typen des Sprachbaues*, Berlin, 1860; Schleicher, *Compendium of the Comparative Grammar of the Indo-European Languages*, translated by H. Bendall, London, 1874; Pezzi, *Aryan Philology according to the most recent Researches*, translated by E. S. Roberts, London, 1879; Sayce, *Introduction to the Science of Language*, London, 1879; Lersch, *Die Sprachphilosophie der Alten*, Bonn, 1838–41; Steinthal, *Geschichte der Sprachwissenschaft bei den Griechen und Römern mit besonderer Rücksicht auf die Logik*, Berlin, 1863; Delbrück, *Ablativ Localis Instrumentalis in Altindischen, Lateinischen, Griechischen, und Deutschen*, Berlin, 1864; Jolly, *Ein Kapitel vergleichender Syntax*, Munich, 1873; Hübschmann, *Zur Casuslehre*, Munich, 1875; Holzweissig, *Wahrheit und Irrthum der localistischen Casustheorie*, Leipsic, 1877; Draeger, *Historische Syntax der Lateinischen Sprache*, Leipsic, 1874–76; Sweet, *Words, Logic, and Grammar*, London, 1876. (A. H. S.)

GRAMMONT (Belgian, *Geeraerdsbergen*), a town of Belgium, province of East Flanders, is situated on both sides of the Dender, 21 miles S.S.E. of Ghent. It is surrounded by walls and possesses a college, a town-hall, and a hospital. Its principal manufactures are lace, cotton, and woollen goods, leather, beer, paper, and tobacco; and there are also bleaching and dyeing works. The population in 1900 was 11,997.

GRAMONT, Philibert, Count de (1621–1707). A happy accident has preserved for the instruction of mankind rather than for their edification the portrait and the history of a man who entirely represents one section, fortunately a small section, of the society of his day. Of good family, rich, a gallant soldier, endowed with every kind of cleverness, the Count de Gramont endeavored to live the life of unrestrained enjoyment. In this he so far succeeded that, although the following century furnished more numerous examples of his kind, he may be taken as the most finished specimen. His ideal man was a being without conscience, without principle, without religion, without a soul. At the court of Charles II. he found companions like himself—women without virtue, men without honor, yet disguised and adorned with courtly manners and that external refinement which did duty for principle; and had it not been that his brother-in-law, Hamilton, conceived the design of writing the memoirs which have made him famous, Gramont would have been as entirely forgotten as most of his friends, save for a brief mention by St. Evremond and another by Bussy Rabutin in that little-visited gallery of portraits, the *Histoire Amoureuse*. His grandfather had the distinction of being husband to Diane d'Andouins, *la belle Corisande*, one of the mistresses of Henry IV. The grandson always regretted that the king had not acknowledged his father for his own son, lamenting even in the presence of Louis XIV. that his family had missed the chance of becoming, in this illegitimate fashion, a branch of the royal line. The anecdote is entirely characteristic. It was at first proposed to enter him in the church, but he speedily perceived that his vocation was not ecclesiastical, and joined the army, in which he saw a great deal of active service, and was rewarded with the governorship of the Pays d'Aunis, and with other small posts. He crossed over to England during the protectorate of Cromwell. In the year 1662, two years after the restoration of Charles II., he was exiled from the French court and again repaired to London, where he found such a welcome as was due to his manners, his gayety, his extraordinary good spirits, and his love of gambling, intrigue, gallantry, and pleasure. It is the period of his

residence at the English court which forms the greater part of Hamilton's memoirs. He is described by Bussy Rabutin, as having "laughing eyes, a well-formed nose, a pretty mouth, a little dimple in the chin which gave an agreeable effect to the whole face, a certain finesse in his countenance, and a fairly good stature but for a stoop." In the whole English court there was no one more full of wit, more avid of pleasure, more devoid of all moral restraint, not even Rochester himself, than the Count de Gramont. Naturally, the court being what it was, there was no one more popular. In a court where the women vied with each other for the king's favor, where the men habitually cheated at play, seduced their friends' wives, and corrupted their friends' daughters, that man would be most popular in whom the absence of principle became, by reason of his grace, *esprit*, and elegance, in itself a recommendation. Gramont was as purely a sensualist as any Roman of the later empire.

He married, in London, but on compulsion, the sister of his future biographer, Miss Hamilton, who, her brother tells us in the memoirs, was able to fix his affections. The statement must be received with some qualifications. The count, it is true, was by no means young when he married. At the same time, he "galantisait" for many years afterwards, and, in fact to the very end of a long life. He was the only old man, says Ninon de l'Enclos, who could affect the follies of youth without being ridiculous. In fact, Gramont, like La Fontaine, was a spoiled child, to whom everything was allowed, and who repaid indulgence by perpetual high spirits, and a continual flow of wit and *bons mots*. At the age of seventy-five he had a dangerous illness, during which he became reconciled, in his way, to the church, but on recovery relapsed into his old habits. At eighty he either dictated or revised his own memoirs, written by his brother-in-law Antony Hamilton. When they were finished he sold the manuscript for 1500 francs and kept most of the money himself. Fontenelle, then censor of the press, refused to license the work, from considerations of respect to the old man who had so strangely exposed in its pages the whole of his character. These scruples were overcome by the count himself, who had the pleasure of seeing his biography appear in his own lifetime, and of laughing with the rest of the world at his own rogueries at cards, his amorous adventures, and his secret intrigues.

He died at the great age of eighty-six. His biographer Hamilton died thirteen years later at the age of seventy-four. The memoirs of the Count de Gramont are not to be recommended for general reading; yet they have the merit of being true; in no other work is the reality of that profligate society of St. James's so vividly expressed; in no other contemporary memoirs is there so much wit, such grace of style, such skill in portraiture. Numerous editions and translations have been issued of this work, whose popularity seems destined to continue and grow.

GRAMPUS (*Orca gladiator*, Lacep.), a cetacean belonging to the *Delphinidæ* or dolphin family, and characterized by its rounded head without distinct beak, its high dorsal fin, and its large conical permanent teeth. Its upper part is of a nearly uniform glossy black color, and the under part white, with a strip of the same color over each eye. The name "grampus" is derived from the French *grand poisson*, through the Norman *grapois*. It is also known as the "killer," in allusion to its ferocity in attacking its prey, which consists largely of seals, porpoises, and the smaller species of dolphins. Its fierceness is only equalled by its voracity, which is such that in a specimen measuring 21 feet in length, dissected by Professor Eschricht, the remains of fourteen seals and thirteen porpoises were found, while the animal appeared to have been choked in the endeavor to swallow another seal, the skin of which was found entangled in its teeth. They also pursue and commit great havoc among the bulky but gentle belugas or white whales, which sometimes throw themselves ashore in order to escape from their remorseless persecutors. The grampus is an inhabitant of northern seas, occurring on the shores of Greenland, and having been caught, although rarely, as far south as the Mediterranean. It is not common, although there are numerous instances of its capture, on the British coasts. The latest of these occurred in March, 1876, about a mile to the west of Granton, on the Firth of Forth. The creature on being dragged ashore, while still alive, was said by the onlookers to have given forth shrill piercing cries somewhat resembling in their sharpness a woman's voice. The specimen was an adult male, and measured 21 feet 10 inches along the curve of the back, with a girth of 13 feet. It had 24 teeth in each jaw, the front tooth on each side of the lower jaw being exceedingly small and almost hidden by the overlapping of the gum, while the two immediately succeeding these on each side were worn down almost to the level of the gum. A striking feature in the grampus is the high dorsal fin, which in the specimen mentioned measured within 2 inches of 4 feet in height.

GRAN (the ancient *Istrogranum*, whence Hungarian *Esztergom*, and Latin *Strigonium*), the capital of a county of the same name, seat of the prince primate, and formerly a royal free city, is situated on the right bank of the Danube, nearly opposite the confluence of the Garam (Gran), 25 miles north-west of Buda, 47° 46′ N. lat., 18° 44′ E. long. It may be generally divided into the town proper, the episcopal quarter, also called Viziváros (Watertown), and the communes of St. Thomas and of St. George. The finest terraces and public buildings are to be found in the two first-named portions of the town. On an elevated and commanding position, where once a fortress stood, are the seminary and theological institute for the education of priests, the residences of the chapter, and the basilica. This cathedral, commenced in 1821, consecrated in 1856, and completed in 1870, is built after the model of St. Peter's at Rome, and is one of the finest churches in Hungary. Among the other public edifices and educational establishments, besides several churches and two monastic houses, are the archiepiscopal residence, the county and town halls, a training school for teachers, an upper gymnasium, a hospital, a library, a savings bank, etc. The population in 1870 was 8780, chiefly employed in cloth-weaving, wine-making, and agricultural pursuits. There is connection with the market-town of Párkány on the left bank of the Danube by means of a bridge of boats.

Gran is one of the oldest towns of Hungary, and is famous as the birthplace of St. Stephen, the first prince crowned "apostolic king" of Hungary. During the early times of the Hungarian monarchy it was the most important mercantile centre in the country, and it was the meeting place of the diets of 1016, 1111, 1114, and 1256. It was almost completely destroyed by Tartar hordes in 1241, but was rebuilt and fortified by King Béla IV. In 1543 it fell into the hands of the Turks, from whom it was recovered, in 1595, by Carl von Mansfeld. In 1604 it reverted to the Turks, who held it till 1683, when it was regained by the united forces of John Sobieski, king of Poland, and Prince Charles of Lorraine. In 1708 it was declared a free city by Joseph I. On the 13th April, 1818, it was partly destroyed by fire. Gran lay in the direct route of the victorious revolutionary campaign of April, 1849. Since 1876 its civil privileges have been of a corporate character.

GRANADA, a modern province of Spain, consisting of the central portion of the old kingdom of the same name, is bounded on the N. and N. E. by Jaen, Albacete, and Murcia, on the E. by Almeria, on the S. by the Mediterranean, and on the W. by Malaga and Cordova, having an area of 4928 English square miles and an estimated population (1900) of 492,460. It includes, and indeed chiefly consists of, the western and loftier portion of the Sierra Nevada, which in the peaks Cerro de Mulhacen and Picacho de la Veleta, overlooking the town of Granada, attains the heights of 11,781 and 11,597 feet respectively. From the central chain of this Sierra all the principal rivers of the province take their rise:—the Guadianamenor which, flowing past Guadix in a northerly direction, falls into the Guadalquivir in the neighborhood of Ubeda; the Genil which, after traversing the vega of Granada, leaves the province a little to the westward of Loja, and joins the Guadalquivir betwixt Cordova and Seville; and the Rio Grande which falls into the Mediterranean at Motril. The climate in the lower valleys and the narrow fringe along the coast is warm, but on the higher grounds of the interior is somewhat severe; and the vegetation varies accordingly from the subtropical to the alpine. The soil of the plains is very productive, and that of the vega of Granada is considered the richest in the whole peninsula; from the days of the Moors it has been subjected to most careful and systematic irrigation, and it continues to yield in great abundance and in good quality wheat, barley, maize, wine, oil, sugar, flax, cotton, silk, and almost every variety of fruit. There are productive mines of lead, silver, copper, zinc, and manganese, which, in 1866, gave employment to 1099 persons; mining indeed, with various agricultural and horticultural operations, including bee-farming, constitutes the

staple industry of the province. In the mountains immediately surrounding the city of Granada occur many kinds of alabaster, some of which are very fine; there are also quantities of jasper and other precious stones in considerable variety. Mineral waters, chiefly chalybeate and sulphurous, are abundant, the most important springs being those of Alhama, which have a temperature of 118° Fahr. The chief centres of population are, besides Granada, the capital, Motril, Alhama, Loja, Guadix, and Huescar. Apart from the great highways traversing the province, which are excellent, the means of communication are few, and on the whole bad. The only railway is that which connects Granada with Bobadilla on the Malaga and Cordova line.

During the Roman period, Granada from the time of Augustus formed an undistinguished portion of the province of Bætica, of which the four *conventus juridici* were Cadiz, Cordova, Ecija, and Seville. Along with the rest of Andalucia, as a result of the great invasion from the north in the 5th century, it fell to the lot of the Vandals. Under the caliphs of Cordova, onwards from the 8th century, the town of Granada rapidly gained in importance, and ultimately became the seat of a provincial government, which, after the fall of the Ommiades (1038), ranked with Seville, Jaen, and others as an independent principality. By the conquests of St. Ferdinand in the first half of the 13th century, Granada was left the sole representative of the Mahometan power in Spain; and even it was compelled to pay tribute to the sovereigns of Castile. The limits of the kingdom at that time were nearly identical with those of the province prior to 1833, the modern provinces of Malaga and Almeria being until that date included. It is said to have contained a population of 3,000,000, and to have had considerable commerce, especially with Italy in silk. On the capitulation of Boabdil in January, 1492, Granada was united to the crown of Castile, but with special privileges which were afterwards treacherously withdrawn.

GRANADA, the capital of the above province, is situated at the confluence of the Darro and the Genil, not far from the base of the Sierra Nevada (37° 13′ N. lat,. 3° 41′ W. long.). Different suggestions have been made as to the etymology of the name, which is rather obscure,—the least probable being that it is derived from *granada*, "a pomegranate," in allusion to the abundance of pomegranate trees in its neighborhood. The Moors called it Karnattah or Karnattàh-al-Yahoud, and possibly the name is composed of the Arabic words *kurn*, "a hill," and *nattah*, "stranger"—the "city" or "hill of strangers." Granada is built partly on level ground near the Genil and partly on the slopes of two adjacent hills, at an elevation of about 2300 feet above the sea. The more ancient quarters of the town still retain much of the Moorish style, but the modern part is somewhat commonplace. It contains several squares, of which the most remarkable is the Bibarrambla, where tournaments were formerly held. There is also a beautiful shady walk, called the Alameda, which is one of the most frequented promenades. The old city comprises the faubourgs of Antequeruela, Alcazaba, Alhambra, and Albaicin, the last being named after the settlers who came from Baeza, after the capture of that city by St. Ferdinand. For a detailed account of the Alhambra the reader is referred to the special article, vol. i. p. 503. The Antequeruela and Albaicin are mostly inhabited by the working classes. In the cemetery of the latter there are still a few ruins of an ancient mosque. The town proper contains a great number of churches and other public edifices. The cathedral, a somewhat heavy and irregular building, was begun in 1529 by Diego de Siloe, and finished in 1639. It is profusely ornamented with jasper and colored marble and surmounted by a dome; and it contains several valuable paintings by Alonso Cano, portraits of Ferdinand and Isabella by Rincon, and marble statues of several kings and queens of Spain. In one of its numerous chapels (the Chapel Royal) are buried their "Catholic Majesties," and Philip and Juana. The church of Nuestra Señora de las Angustias has a splendid high altar and fine towers. That of St. José is an elegant modern building. Other remarkable edifices are the monastery of St. Gerónimo, founded by Gonzalo de Cordova, who is buried there; the Carthusian convent (Cartuja), adorned with paintings by Murillo, Morales, and Cano; the university, founded in 1531 by Charles V.; and the library. Granada is the birthplace of many eminent writers and artists, both Mahometan and Christian; among the latter may be mentioned Fray Luis de Granada (1505); Hurtado de Mendoza (1505), the historian of the war of Granada; Alonso Cano (1601), the great painter; and Moya (1610), who was both painter and sculptor. The climate of the town is pleasant and healthy, especially during the spring and summer months. Its manufactures are unimportant, the chief being coarse woollen stuffs, hats, paper, saltpetre, and gunpowder. Silk-weaving was once extensively carried on, and large quantities of silk were exported to Italy, France, Germany, and even America; but the production now is very limited. The education of the lower classes is much neglected, the city having only a few insignificant schools. In the year 1900 the population amounted to about 75,900.

Plan of Granada.

The history of Granada does not go back far, if at all, into the Roman period (for it is not to be confounded with the ancient Illiberis); and even under the Moors it held a place of very subordinate importance until the period of the conquests of St. Ferdinand, when it became the exclusive seat of Islam in Spain, and rose to almost unparalleled splendor, under Mohammed-Ebn-Alahmar, the builder of the Alhambra. It is said in its best days to have had 400,000 inhabitants, 70,000 houses, and 60,000 warriors, but this is probably an exaggeration. In the 15th century it was the last stronghold of the Moors against the Christian forces under Ferdinand and Isabella, and after a long siege it was surrendered by Boabdil on 2d January, 1492. From that time Granada's wealth and magnificence rapidly decreased till 1610, when the Moors were expelled from Spain.

GRANADA, a city of Central America, state of Nicaragua, is situated on the N.W. bank of the lake of Nicaragua, 30 miles N.N.W. of the town of that name. The suburbs are composed of cane huts occupied by the poorer inhabitants, but the city proper is formed of one-storied

houses built of adobes or sun-dried bricks, roofed with tiles. They have balconied windows, and are surrounded by courtyards with ornamental gateways. It possesses several old churches and the remains of ancient fortifications. By means of the lake and the river San Juan, it communicates with the Caribbean Sea, and carries on a considerable trade in cocoa, cochineal, indigo, and hides. The steamer "Coburg" in the end of 1878, after several unsuccessful attempts, forced a passage up the river San Juan from the sea to Lake Nicaragua, thus establishing steam navigation between Granada, the Bay de la Vierge, San George, and other towns, and direct communication between Greytown and Granada. The feat is of importance in view of the project of constructing an oceanic canal by this route.

Granada was founded by Francisco Fernandez de Cordova in 1522, and he erected a fort for its protection. At an early period it surpassed Leon in importance, and was one of the richest cities in North America. It suffered greatly from the attacks of pirates in the latter half of the 17th century, and in 1606 was completely sacked by them. In 1855 it was taken by the filibuster William Walker, and partially destroyed by fire, and though retaken in 1857 it has never recovered its former prosperity, a great part of it being still in ruins. The population is about 35,000.

GRANADA, Luis de (1504–1588), a Spanish preacher and ascetic writer, was born of poor parents at Granada in 1504. At five years of age he was left an orphan, but the Conde de Tendilla, alcalde of Alhambra, having accidentally observed his singular intelligence, took him under his protection and had him educated with his own sons. At the age of nineteen he entered the Dominican convent of Santa Cruz, Granada, whence he went to the college of St. Gregory, Valladolid. After completing his theological education he was named prior of the convent of Scala Cœli, where he exercised his preaching gifts under the direction of the celebrated orator Juan de Avila, whom he subsequently rivalled, if he did not surpass him, in eloquence. Having been invited by Cardinal Henry, infanta of Portugal and archbishop of Evora, to Badajoz in 1555, he founded a monastery there, and two years later was elected provincial of Portugal. He was also appointed confessor and councillor to the queen regent, but he declined promotion to the archbishopric of Braga, and on the expiry of his provincial office in 1561 he retired to a Dominican convent at Lisbon, where he died in 1588. Luis de Granada enjoyed the reputation of being the first ecclesiastical orator of his day, and his description of the "descent into hell" is one of the finest specimens of eloquence in the Spanish language. He also acquired great fame as a mystic writer, his *Guia de Pecadores* or *Guide to Sinners*, first published in 1556, being still a favorite book of devotion in Spain, and having been translated into nearly every European language.

His principal other works are *Libro de la Oracion y Meditacion*, Salamanca, 1567; *Introduccion al simbolo de la Fé*, Salamanca, 1582; *Rhetoricæ Ecclesiasticæ, sive de ratione concionandi, Libri VI.*, Lisbon, 1576; *Silva locorum communium omnibus verbi concionatoribus necessaria*, 1582; and several series of sermons. A collected edition of the works of Luis de Granada was published by Planta at Antwerp, in 1572, at the expense of the duke of Alva, and by Luis Meñozal, Madrid, in 1657, afterwards reprinted at various periods. See preface to this edition of his works; preface to *Guia de Pecadores*, Madrid, 1781; *Biblioteca de Autores Esp.*, tom. vi., viii., xi.; Ticknor's *History of Spanish Literature;* and Eug. Baret, *Hist. de la litt. espagnole*, Paris, 1863.

GRANADILLA, the name applied to *Passiflora quadrangularis*, Linn., a plant of the natural order *Passifloreæ*, a native of tropical America, having smooth, cordate, ovate, or acuminate leaves, petioles bearing from 4 to 6 glands, an emetic and narcotic root, scented flowers, and a large, oblong fruit, containing numerous seeds, imbedded in a subacid edible pulp. The granadilla is sometimes grown in British hothouses. The fruits of several other species of *Passiflora* are eaten. *P. laurifolia* is the "water lemon," and *P. maliformis* the "sweet calabash" of the West Indies.

GRAN CHACO, an extensive region in the heart of South America, which stretches from 20° to 29° of S. lat., and belongs partly to Bolivia and partly to the Argentine Republic, the boundary between the two states coinciding with the parallel 22°. The area is estimated at about 425,000 square miles, or more than twice the area of France, and the greater portion is still unexplored. It all belongs to the La Plata basin and in general terms may be described as a plain inclining towards the S. E. and watered by the Pilcomayo, the Vermejo, and other tributaries of the Paraguay. The northern portion, lying within the region of tropical rains, has a profusion of marshes and lakes, while the southern portion is a dry cactus-growing steppe, except in the neighborhood of the rivers, which annually submerge large areas with the surplus water they bring from the north. The whole of the Gran Chaco is still in the hands of the Indians, who are just beginning to learn a little agriculture, —to grow pumpkins, watermelons, and maize; but the richness and extent of its forests and pastures will certainly secure the country a prosperous future. It possesses more timber suitable for every purpose than the whole of Europe; it already exports large numbers of cattle to the neighboring states; and, according to Major Host, it will be able to furnish abundant supplies of petroleum. "At the foot of the western slope of the Santa Barbara range, 25 leagues from the confluence of the San Francisco river and the Vermejo, there is an extensive petroleum basin called the Laguna de la brea de San Miguel del Rastro, capable of yielding 2000 gallons per day."

See Von Reden, "Die Staaten im Strom-Gebiet des La Plata," in *Petermann's Mitth.*, 1856; Petermann and Burmeister, *Die Südamerikanischen Republiken, Argentina*, etc., 1875; Major Host in *La Plata Monatschrift*, 1873.

GRAND'COMBE, a town of France, in the department of Gard and arrondissement of Alais, is situated on the Gardon, 35 miles N. W. of Nîmes. In the neighborhood there are very extensive coal-mines, and the town possesses manufactures of zinc, lead, and glass. The population in 1901, 6,497.

GRAND HAVEN, a city of the United States, capital of Ottawa county, Michigan, is situated on Lake Michigan, at the mouth of Grand River, opposite Milwaukee, to which, as well as to the principal other towns on the lake, several steamers ply daily. It is a station of the Grand Haven Railway, and the terminus of the Detroit, Grand Haven, and Milwaukee line. On account of its fine situation and its medicinal springs, Grand Haven is becoming a favorite summer resort. It has saw and shingle mills, and manufactories of agricultural implements, of sashes and blinds, and of windmills. Shipbuilding is also carried on. In the neighborhood there are extensive peach forests. Lumber and fruit are the principal shipments. Grand Haven was laid out in 1836, and became a city in 1867. Population (1870) 3147, now about 4,743.

GRANDIMONTANES, or Grammontines (Ordo Grandimontensis), a small religious order confined almost entirely to France. Its origin, which can be traced to about the close of the 11th century, is involved in some obscurity. The founder, St. Stephen of Tigerno or Thiers, was born at Château Thiers, in Auvergne, in 1046, was educated for the church partly at Benevento and partly at Rome, and, returning home about 1073, in obedience to the solicitations of an inner voice which had been making itself heard for years, embraced a life of solitary asceticism. The scene of his retreat was the lonely glen of Muret, about a league eastward from Limoges; as his reputation for piety extended, his cell became a favorite resort with many like-minded persons, and ultimately a community large enough to excite public attention was formed. The nature of the rule observed by them at that time is not accurately known; a reply which, according to tradition, Stephen gave to the papal legates when asked to give some account of himself, forbids alike the belief that he identified himself with any of the religious orders then in existence and the assumption that he had already received permission to establish a new one. Shortly after his death, which occurred on the 8th of February, 1124, the lands at Muret were claimed by the neighboring Augustinian friars of Ambazac,—a circumstance which in 1154 compelled the followers of Stephen to remove their abode, under the leadership of their second "corrector," some miles further eastward, to Grammont or Grandmont, whence the order subsequently took its name. So far as can be ascertained, the rule by which the community was governed was not reduced to writing until the time of Stephen of Lisiac, its fourth corrector. This rule, which was confirmed by Urban III. in 1186, was characterized by considerable severity, especially in the matters of silence, fasting, and flagellation; its rigor, however was mitigated

by Innocent IV. in 1247, and again by Clement V. in 1309. Under Stephen of Lisiac the order greatly flourished in Aquitania, Anjou, and Normandy, where the number of its establishments in 1170 is said to have exceeded sixty. The first Grandimontane house within the dominions of the king of France was that founded at Vincennes near Paris by Louis VII. in 1164; it soon acquired a position of considerable importance. Stephen of Thiers was, at the request of Henry II. of England, canonized by Clement III. in 1189; and the bestowal of this honor seems to have marked a culminating point in the history of the order which he had originated. The Grandimontanes (sometimes also like the followers of Franciseo de Paola called Les bonshommes), owing to an almost endless series of internal disputes at once symptomatic and productive of disunion and disorganization, failed to achieve any considerable plaee in history, and were finally pensioned off and disbanded in 1769. To them belonged, until 1463, the priory of Creswell in Herefordshire, and also until 1441 that of Alberbury or Abberbury in Shropshire.

Tho *Annales* of the order were published at Troyes in 1662; and the *Regula*, sometimes attributed, though erroneously, to Stephen of Thiers, was first printed in tho 17th century. A collection of maxims or instructions, professedly by the same author, has also been largely circulatod in Franee since 1704. Seo Helyot, *Histoire des Ordres Monastiques*, vol. vi.

GRAND RAPIDS, a city of the United States, capital of Kent county, Michigan, is picturesquely situated on both sides of the Grand River near the rapids, 30 miles E. of Lake Michigan. The river is navigable up to this point, and steamers connect the city with Grand Haven and the navigation of Lake Michigan. The city is also the point of intersection of six railways. It possesses two public parks, a county jail, a central school, a large public library, and a scientific institute. It is the seat of the United States circuit and district courts for the western district of Michigan. The manufactures include a great variety of woodware (especially furniture, carriages, and wagons), agricultural implements, machinery, chemical substanees, leather, beer, fruit, bricks of a very fine quality, and gypsum, which is very abundant in the neighborhood. There is also a very extensive trade in lumber. The fall of the river at the rapids is about 18 feet in 1½ miles, and this water power has been taken advantage of for many of the manufactories. Grand Rapids was settled in 1833 and incorporated in 1850. The population has been rapidly increasing; while in 1850 it was only 2686, it was 16,507 in 1870, of whom 5725 were foreigners. **Population in 1900, 87,565.**

GRANDSON. See GRANSON.

GRANDVILLE. See GÉRARD, JEAN I. I.

GRANET, FRANÇOIS MARIUS (1777–1849), was the first painter who felt and attempted to render the æsthetic charm of Middle Age and Renaissance architecture. He was born at Aix in Provence, on the 17th December, 1777; his father was a small builder, but the boy's own strong desires led his parents to place him—after some preliminary teaching from a passing Italian artist—in a free school of art directed by M. Constantin, a landscape painter of some reputation who lived in the town. In 1793 Granet followed the volunteers of Aix to the siege of Toulon, at the close of which he obtained employment as a decorator in the arsenal. Whilst yet a lad he had, at Aix, made the acquaintance of the young Comte de Forbin, and it was upon his invitation that Granet, in the course of the year 1797, proceeded to Paris. De Forbin was one of the pupils of David, and Granet entered the same studio. Later on he got possession of a cell in the convent of Capuchins, which, having served for a manufactory of assignats during the Revolution, was afterwards inhabited almost exclusively by artists. In the changing lights and shadows of the corridors of the Capuchins, Granet found the materials for that one picture to the painting of which, with varying success, he devoted his life. In 1802 he left Paris for Rome, where he remained until 1819, when he returned to Paris, bringing with him besides various other works one of fourteen repetitions of his celebrated Chœur des Capucins, executed in 1811. The figures of the monks celebrating mass are taken in this subject as a substantive part of the architectural effect, and this is the case with all Granet's works, even with those in which the figure subject would seem to assert its importance, and its historical or romantic interest. Stella painting a Madonna on his Prison Wall, 1810 (Leuchtenberg collection); Sodoma à l'Hopital, 1815 (Louvre); Basilique basse de St. François de Assise, 1823 (Louvre); Rachat de Prisonniers, 1831 (Louvre); Mort de Poussin, 1834 (Villa Demidoff, Florence), are among his principal works; all are marked by the same peculiarities, everything is sacrificed tc tone. In 1819 Louis Philippe decorated Granet, and afterwards named him Chevalier de l'Ordre St. Michel, and Conservateur des tableaux de Versailles (1826). He became member of the Institute in 1830; but in spite of these honors, and the ties which bound him to M. de Forbin, then director of the Louvre, Granet constantly returned to Rome. After 1848, he retired to Aix, immediately lost his wife, and died himself on the 21st November, 1849. He bequeathed to his native town the greater part of his fortune and all his collections; these are now exhibited in the Musée, together with a very fine portrait of the donor painted by Ingres in 1811. M. Delécluze, in *Louis David et son temps*, devotes a few pages to Granet and his friend the Comte de Forbin.

GRANITE, a rock so named from the Latin *granum*, a grain, in allusion to the granular texture of many of its varieties. The term appears to have been introduced by the early Italian antiquaries, and it is believed that the first recorded use of the word occurs in a description of Rome by Flaminius Vacca, an Italian sculptor of the 16th century. This description was published by Montfaucon in his *Diarium Italicum*, where we read of certain columns "ex marmore granito Ægyptio" (cap. xvii.), and of others "ex marmore granito Æthaliæ insulæ" (cap. xviii.), showing that the Romans of Vacca's day were acquainted with granite from Egypt and from Elba. Granite is also referred to by Cæsalpinus in his treatise *De Metallicis* (1596), and by Tournefort in his *Rélation d'un Voyage au Levant* (1698); indeed the latter has been cited by Emmerling (*Lehrb. d. Mineral.*) as the first author who uses the term. By these early writers, however, the name was loosely applied to several distinct kinds of granular rock, and it remained for Werner to give it that precise meaning which it at present possesses as the specific designation of a rock.

Granite is a crystalline-granular rock consisting, in its typical varieties, of orthoclase, quartz, and mica, to which a plagioclastic felspar is usually added. These minerals are aggregated together without the presence of any matrix or connecting medium. Thin sections of a true granite, examined under the microscope by transmitted light, show no trace of any amorphous or crypto-crystalline ground-mass. The chemical composition of the rock will, of course, vary with its mineralogical constitution. For an average analysis see GEOLOGY, vol. x. p. 208. The proportion of silica varies from 62 to 81 per cent. Granite belongs therefore to Bunsen's class of *acid* rocks, or those which contain more than 60 per cent. of silica. Dr. Haughton has found an exceptionally low proportion of this oxide in some of the Irish granites (58·44 per cent., *e.g.*, in some Donegal granite, *Quart. Journ. Geol. Soc.*, xviii., 1862, p. 408). The specific gravity of granite varies from 2·59 to 2·73.

Orthoclase, or potash felspar, is the principal constituent of most granites. This mineral occurs either in simple crystals, or in twins formed on what is known as the "Carlsbad type," such crystals being common at Carlsbad in Bohemia. In porphyritic granites, such as those of Cornwall and Devon, the orthoclase crystals may attain to a length of several inches, and the twinning is marked on the fractured crystals by a line running longitudinally down the middle, and dividing the crystal into two halves. In color the orthoclase generally varies between snow-white and flesh-red. The green felspar known as Amazon stone, which occurs in certain granites, has lately been shown by Des Cloiseaux to belong to the species *microcline*, and not, as previously supposed, to orthoclase (*Annales d. Ch.*, 5 ser., ix., 1876, p. 433). The plagioclastic, anorthic, or triclinic felspar of granite occurs in crystals which are generally smaller than those of the orthoclase, and which exhibit, even to the naked eye, their characteristic twin striation. Moreover the lustre is frequently resinous or fatty, while that of the orthoclase is pearly on the cleavage-planes. In most cases the plagioclase is the soda-lime felspar called *oligoclase;* but in some granites it is *albite* or soda felspar, as shown by Haughton in many of the Irish and Cornish granites (*Proc. Roy. Soc.*, xvii., 1869, p. 209). When a granite becomes weathered, the felspar may decompose into *kaolin* or *china-clay;* the commencement of this alteration is indicated under the microscope by the turbidity of the felspar, by the ill-defined edges of the crystals, and in the case of plagioclase by disappearance of the characteristic striæ.

The quartz of granite occurs generally in irregularly-shaped angular grains; but occasionally in distinct crystals which are double hexagonal pyramids with or without the corresponding prism. Colorless quartz is most common, but gray, brown, or bluish varieties also occur. Whatever its color, it is as a rule transparent in microscopic sections, though sometimes rendered milky by the presence of vast numbers of minute cavities containing liquid (see GEOLOGY, *ut supra*, and for Sorby's original researches *Quart. Journ. Geol. Soc.*, xiv. p. 453). In many granites the quartz fills up the spaces between the crystals of felspar and of mica, and receives impressions from these minerals. This fact has been advanced against the view that granite has existed in a state of fusion; since it is assumed that, as the quartz is the most infusible of the three component minerals, it would have been the first to solidify on the cooling of the magma, whereas the relation of the quartz to the associated minerals in most cases shows that it must have solidified after the crystallization of the felspar and mica. In some granites, however, the quartz is developed in free crystals, thus pointing to an early solidification of this mineral. The mica, which is usually the least abundant constituent of the granite, occurs in thin scales of irregular shape or in hexagonal plates. It is either a white biaxial potash mica (*muscovite*) or a dark-brown magnesian mica, generally uniaxial (*biotite*). Both species may occur in the same granite. Haughton has shown that some of the white mica of the Cornish granites is *lepidolite*, or lithia mica; while some of the black mica in the same rocks is the iron-potash mica, *lepidomelane* (*Proc. Roy. Soc.*, xvii. p. 209). Professor Heddle finds that the black mica of most Scottish granites is a distinct species, which he calls *Haughtonite* (*Mineralog. Mag.*, No. 13, 1879, p. 72). A large number of accessory minerals occur in granite, no fewer than forty-four being cited by Zirkel (*Lehrb. d. Petrog.*, i. p. 481). Upon the presence of these supplementary minerals numerous varieties of granite have been founded. Thus, if tourmaline be present, the rock is a *schorlaceous* or *tourmaline granite;* when cassiterite or tin-stone occurs, it forms a *stanniferous granite;* the presence of epidote gives rise to an *epidote granite;* and so on with other minerals. The most common accessory constituent of granite is hornblende, a mineral which appears to replace to some extent the mica, and thus produces a *hornblendic* or *syenitic granite.* This rock was formerly, and by some petrographers is still, termed *syenite:* it is the *syenites* of Pliny, so named from Syene in Upper Egypt, where a similar rock was quarried by the ancient Egyptians. By modern petrographers, however, the term syenite is usually restricted to a rock which is an aggregate of orthoclase and hornblende,—in other words, a granite in which the quartz has disappeared while the mica has been superseded by hornblende. A beautiful schorlaceous rock, which is apparently a variety of granite, has been described by Pisani under the name of *luxullianite* (*Comptes Rendus*, lix., 1864, p. 913). It occurs in the parish of Luxullian, near Lostwithiel, in Cornwall, where it is found in the form of boulders, but has not been detected *in situ.* This rock is composed of tourmaline, or schorl, with quartz and orthoclase; the last named mineral occurring in large flesh-colored crystals, which by contrast with the dark base produce a very beautiful effect. Two varieties of tourmaline, one brown and the other bluish, have been detected by Professor Bonney (*Mineralog. Mag.* No. 7, 1877, p. 215). The sarcophagus of the duke of Wellington, in St. Paul's Cathedral, is wrought out of a splendid block of luxullianite. Many varieties of granite are founded upon structural characteristics. Occasionally the constituents are developed in such large individuals as to form a *giant granite.* Crystals of orthoclase, associated with quartz in a peculiar parallel arrangement, produce the variety known as *graphic granite* or *Lapis Judaicus*—names which refer to the resemblance which the rock presents, when cut in certain directions, to lines of Hebrew characters. Graphic granite was termed by Hauy *pegmatite*, but this name is now generally applied to a coarse admixture of orthoclase, quartz, and silvery mica. When any of the component minerals occur in large crystals, embedded in a fine-grained base, a *porphyritic granite* is produced. Generally the crystals are those of orthoclase, as in many of the West of England granites, and in the characteristic rock of Shap Fell in Westmoreland. *Granitite* is a name applied to a variety of granite made up of orthoclase and quartz, with more or less plagioclase and a small proportion of mica. A granite composed of only felspar and quartz is called *haplite* or *semi-granite.* Some of the micaless varieties are known as *granulite.* When, instead of the mica disappearing, the felspar is absent, the resulting aggregate of quartz and mica is termed *greisen;* it is frequently a tin-bearing rock. Occasionally the granite, when fine in grain, loses its mica, and an intimate mixture of orthoclase and quartz is thus obtained; such a rock is known as a felstone. Crystals of orthoclase disseminated through a felsitic matrix, either compact or microcrystalline, give rise to a felspar *porphyry;* while crystals or rounded grains of quartz in a similar felsitic base produce a *quartz-porphyry* or *quartz-felsite.* By Cornish miners these quartz-porphyries are termed *elvans* (*elvanite* of Jukes); but this name is also applied to fine-grained granites and to almost any rock which occurs as a dyke running through the killas or clay slate.

Few questions have been more warmly discussed than the origin of granite. When this rock is found forcing its way through older rocks, and appearing at the surface in large bosses from which veins are sent forth in all directions, there can be little doubt of its eruptive character. The small width of some of these granitic veins, or apophyses, suggests that the rock must have existed in a condition of perfect fusion or complete liquidity, and not simply as a viscous paste, before it could have been injected into such narrow fissures as those which are now occupied by granite. In many cases, the rocks which are penetrated by the granitic veins are altered in such a manner as to indicate a considerable elevation of temperature; a limestone in the neighborhood of the veins may become saccharoidal, and shales may become indurated or even converted into hornstone, while new minerals are often developed in the vicinity of the intruded veins. In these veins the granite is apt to change its mineralogical constitution, becoming either fine-grained or felsitic, or even reduced at the extremities of the vein to quartz. From the days of Hutton it has been generally admitted that most granite is of igneous origin. Since it appears to have been solidified at great depths beneath the surface, it has been distinguished as a *plutonic* rock, while those eruptive rocks which have risen to the surface, and have there consolidated, are termed *volcanic* rocks. The older geologists regarded granite as the primitive rock of the earth's crust, forming the floor of all stratified deposits and the nucleus of mountain chains. Such a view, however, has been long exploded. It is known indeed that granite, so far from being in all cases an original rock, may be of almost any geological age. Some is undoubtedly as old as the Silurian period, while other granites are certainly as young as the Tertiary rocks, and perhaps of even more recent date. By many field-geologists granite has of late years been regarded as a metamorphic rather than as a truly igneous rock. Metamorphism, however, is a term which has been so vaguely used that most of our eruptive rocks may, in a certain sense, be said to be metamorphic. Still, in the case of granite, it has often been pointed out that a passage may be traced from this rock into gneiss, and that gneiss itself may be regarded as an altered sedimentary rock. Thus so experienced an observer as Professor Ramsay expresses his opinion that "granite is sometimes merely gneiss still further metamorphosed by heat in the presence of moisture" (*Phys. Geol. of Gt. Brit.*, 5 ed., 1878, p. 42). For a number of instances in which granite is said to pass into gneissose rocks, and these in turn, by numerous gradations, into undoubtedly stratified deposits, see Green's *Geology*, part i. p. 307, and also GEOLOGY, vol. x. p. 274.

Chemists have also brought forward arguments against the igneous origin of granite. Thus it has been argued that the specific gravity of the quartz of granite is about 2·6, while that of silica after fusion is only 2·2. It must be remembered, however, that the quartz of granite has solidified under great pressure, as proved by Mr. Sorby's observations, and it is probable that such pressure would increase the density of the silica. Moreover, it has been pointed out by the late D. Forbes (*Geol. Mag.*, iv., No. 10, 1867, p. 443) that the siliceous tests of certain infusoria, which assuredly have not been fused, are as low as 2·2. Another argument which has been advanced against the igneous origin of granitic rocks is based on the fact that they contain minerals of a basic character which could not have existed in a state of fusion in the presence of free silica, without forming a combination with the latter. Again, some of the accessory minerals in granite would

suffer change by an elevation of temperature, while many of them contain water which, it is assumed, would be expelled on fusion. Probably, however, these minerals are in most cases of secondary origin, and have been produced by the alteration of the granite. The mere presence of water is not incompatible with a pyrognostic origin; and Forbes has asserted (*op. cit.*) that specimens of lava, taken from a current on Etna while the lava was still flowing, contained crystals of stilbite, a mineral containing 16 per cent. of water. Mr. Sorby has shown, too, that the quartz of volcanic rocks contains microscopic cavities enclosing liquid. It appears, indeed, that in the fusion of all eruptive rocks water has played a very important part. Dr. Haughton has sought to reconcile the opposing views as to the origin of granite by admitting what he calls a *hydrometamorphic* origin for this rock. He believes that the rock, having been poured into veins and dykes when in a state of fusion, was subsequently altered by the action of water at temperatures which, though high, were insufficient for the fusion of the granite (*On the Origin of Granite: an Address to the Geol. Soc. of Dublin*, 1862).

Granitic rocks are extensively used for constructive and decorative purposes, though their industrial applications are necessarily restricted by the expense of working so hard a material. Although some granites are apt to decompose on exposure to atmospheric influences, the felspar passing into china-clay, other varieties are remarkable for their extreme durability, as attested by the monuments of ancient Egypt, on which the incised hieroglyphics still retain their sharpness. It appears that in England granite was not brought into extensive use much before the beginning of the present century (Creasy). It is now largely employed for massive structures, such as bridges and sea-walls, as also for kerbs and paving-sets. The best known granites are the gray variety from Aberdeen and the red granite of Peterhead, 30 miles north of Aberdeen. The granite of Dartmoor in Devonshire, and of the huge bosses which protrude through the clay slate of Cornwall, are largely worked as building and ornamental stones (for description of these granites see Sir H. T. de la Beche's *Report on the Geol. of Cornwall and Devon*). In Ireland there is much fine granite, which is quarried to a limited extent,—the Castlewellan granite having been used in the Albert Memorial in Hyde Park (Hull's *Building and Ornam. Stones*, 1872). The hornblendic varieties of granite are remarkably tough, and are largely employed for road-metal. For this purpose great quantities are quarried in the Channel Islands. Red granite occurs in abundance on the coasts of Maine, U. S., as well as in New Brunswick, and gray granite at Quincy and elsewhere in Massachusetts. Granite is frequently polished when used for monumental and decorative purposes. The polishing is effected by an iron tool, worked first with sand and water, then with emery, and lastly with putty-powder or oxide of tin; when the emery and putty are used, a surface of flannel is interposed between the granite and the iron tool[1] ("On Granite Working," by Geo. W. Muir, *Journ. Soc. Arts*, xiv., 1866, p. 470).

As an element of scenery granite generally forms rounded hills, scantily clad with vegetation; but it sometimes rises into sharp pinnacles, as in the *aiguilles* of the Alps. By denudation the rock may break up into cuboidal blocks, which often remain piled upon each other, forming the characteristic "tors" of Cornwall and Devon. Hills of granite are frequently surmounted by masses of weathered rock of spheroidal form, such as the Cornish rocking-stones or logan stones. The weathering of granite often produces boulder-shaped masses in such numbers as to form, around the summit of the hill, a "sea of rocks" (*Felsenmeer*).

In addition to the references given in the body of this article, the following authorities may be cited:—*Lehrbuch der Petrographie*, by F. Zirkel, 2 vols., Bonn, 1866; *Elemente der Petrographie*, by Von Lasaulx, Bonn, 1875; Cotta's *Lithology*, translated by P. H. Lawrence, 2d ed., London, 1878; *The Study of Rocks*, by F. Rutley, London, 1879; and the numerous contributions by the Rev. Prof. Haughton in *Proc. Irish Acad.*, and *Quart. Journ. Geol. Soc. Lond.* For chemical composition of Cleopatra's Needle, by G. W. Wigner, see the *Analyst*, 1878, p. 382. (F. W. R.*)

GRANMICHELE, or GRAMMICHELE, a market-town of Sicily, in the province of Catania, about 8 miles from Caltagirone on the road to Catania. It lies on the side of a hill, the summit of which is crowned by a castle which, along with the town itself, was formerly a fief of the Brancatelli Butera family. Beautiful marble is found in the vicinity, and the inhabitants, who in 1905 numbered 15,075, trade in oil.

GRANSON, GRANDSON, or GRANDSEE, a small town in Switzerland, canton of Vaud, is situated near the south-western extremity of the Lake of Neufchâtel. It possesses the ruins of an old castle, containing a collection of antiquities, and has a very ancient church, once connected with a Benedictine abbey, with a number of pre-Christian images. The town is of Roman origin. It was captured in 1475 by the Eidgenossen, and retaken in the following year by Charles the Bold; but in March of that year the Eidgenossen again defeated him near Granson with great slaughter. From that time till 1803 it was one of their lordships. The site of the battle is marked by three great blocks of marble. The population of the town in 1870 was 1587.

GRANT, MRS. ANNE (1755–1838), a Scottish authoress, generally known as Mrs. Grant of Laggan, was born at Glasgow, 21st February, 1755. Her father Duncan MacVicar, who held a commission in the army, went in 1757 with his regiment to America, and his family followed him in 1758. He received an allotment of land on retiring from the army in 1765, but ill health compelled him to return to Scotland in 1768, and after the outbreak of the revolutionary war his lands were confiscated. In 1779 Anne married the Rev. Mr. Grant of Laggan, near Fort Augustus, Inverness, and on his death in 1801 she was left with a large family and only a very small income. It being known to several of her friends that she occasionally wrote verses, a proposal was made that she should publish a volume of poems, and this being acceded to, the names of as many as 3000 subscribers were obtained. The volume appeared in 1803 under the title of *Original Poems, with some Translations from the Gaelic*, and met with a rather favorable reception, on account of its easy versification and the truth and tenderness of the sentiment of some of its smaller pieces. In 1806 she published *Letters from the Mountains, being a Selection from the Author's Correspondence with her Intimate Friends from 1773 to 1804*, which, by its spirited descriptions of Highland scenery, character, and legends, awakened a large amount of interest. Her other works are *Memoirs of an American Lady, with Sketches of Manners and Scenery in America as they existed previous to the Revolution* (1808), containing reminiscences of her stay with Mrs. Schuyler, the lady with whom she spent four years of her childhood in America; *Essays on the Superstitions of the Highlanders of Scotland* (1811); and *Eighteen Hundred and Thirteen, a Poem* (1814). After the death of her husband, Mrs. Grant resided for some time on a small farm near Laggan; but in 1803 she removed to Woodend near Stirling, in 1806 to Stirling, and in 1810 to Edinburgh, in the society of which she was until her death a prominent figure, being much esteemed for her conversational powers, her tact and good sense, her cheerfulness of disposition, and her thorough kindness of heart. For the last twelve years of her life she received a pension from Government; and this, along with her other sources of income, not only placed her in easy circumstances, but enabled her to gratify her generosity by giving to others. She died November 7, 1838.

See *Memoir and Correspondence of Mrs. Grant of Laggan, edited by her son J. P. Grant*, 3 vols., 1844.

GRANT, SIR FRANCIS (1803–1878), an English portrait painter, and president of the Royal Academy in London, was the fourth son of Francis Grant of Kilgraston, Perthshire, and was born at Edinburgh in 1803. He was educated for the bar, and, according to the testimony of Sir Walter Scott in his diary, it was originally his intention after spending his small patrimony in field sports to make his fortune by the law. By the time, however, that the first part of his purpose had been accomplished, he had resolved to adopt painting in preference to law as his profession, and at the age of twenty-four he began at Edinburgh systematically to study the practice of art. On completing a course of instruction he removed to London, and as early as 1843 exhibited at the Royal Academy. At the beginning of his career he utilized his sporting experiences by painting groups of huntsmen, horses, and hounds, such as the Meet of H. M. Staghounds and the Melton Hunt; and doubtless if he had chosen to devote himself to the careful treatment of this class of subjects his success might have been more thorough and permanent, if less brilliant and lucrative, than it was. If, however, the reputation he acquired as a

[1] [Twenty-eight of the United States in 1889 quarried over 62,000,000 cubic feet, valued at $14,500,000. The stone is now worked for decorative purposes by lathes and the McCoy pneumatic tool.—AM. ED.]

fashionable portrait-painter was aided by his social position and gentlemanly manners, it rested also on certain special artistic qualifications. The first and chief of these was his power of thoroughly reproducing the outward tone and manner of fashionable life, or, as Sir Walter Scott called it, his "sense of beauty derived from the best source, that is, the observation of really good society." If also his execution was superficial and thin, it was bright, clear, facile, and unconstrained. In drapery he had the taste of a connoisseur, and rendered the minutest details of costume with felicitous accuracy. In female portraiture he achieved considerable success, although rather in depicting the highborn graces and external characteristics than the true and individual personality. Among his portraits of this class may be mentioned Lady Glenlyon, the marchioness of Waterford, Lady Rodney, and Mrs. Beauclerk. In his portraits of generals and sportsmen he proved himself more equal to his subjects than in those of statesmen and men of letters. He painted many of the principal celebrities of the time—especially those occupying high social position—including Scott, Macaulay, Lockhart, Disraeli, Hardinge, Gough, Derby, Palmerston, and Russell, his brother Sir J. Hope Grant, and his friend Sir Edwin Landseer. From the first his career was rapidly prosperous, and his recognition by the Academy fully kept pace with his reputation as an artist. In 1842 he was elected an associate, and in 1851 an Academician; and in 1866 he was chosen to succeed Sir C. Eastlake in the post of president, for which his chief recommendations were his social distinction, tact, urbanity, and friendly and liberal consideration of his brother artists; and its difficult and often invidious duties he performed so as both to increase the harmony and influence of the institution and to enhance its efficiency. Shortly after his election as president he received the honor of knighthood, and in 1870 the degree of D.C.L. was conferred upon him by the university of Oxford. He died October 5, 1878.

GRANT, Sir James Hope (1808–1875), an English general, brother of the preceding, and fifth and youngest son of Francis Grant of Kilgraston, Perthshire, was born July 22, 1808. He entered the army in 1826 as cornet in the 9th Lancers, and became lieutenant in 1828 and captain in 1835. In 1842 he acted as brigade-major to Lord Saltoun in the Chinese War, and specially distinguished himself at the capture of Chin-Keang, after which he received the rank of major and was nominated companion of the Bath. In the first Sikh War of 1845–46 he took part in the battle of Sobraon; and in the Punjab campaign of 1848–49 he held command of his old regiment the 9th Lancers, and won high reputation in the battles of Chillianwalla and Gujrat. In 1854 he became brevet-colonel, and in 1856 brigadier of cavalry. He took a leading part in the suppression of the Indian mutiny in 1857, holding for some time the command of the cavalry division, and afterwards of a movable column of horse and foot. After rendering valuable service in the operations before Delhi and in the final assault on the city, he directed the victorious march of the cavalry and horse artillery despatched in the direction of Cawnpore to open up communication with the commander-in-chief Sir Colin Campbell, whom he met near the Alumbagh, and who raised him to the rank of brigadier-general, and placed the whole force under his command during what remained of the perilous march to Lucknow for the relief of the residency. After the retirement towards Cawnpore he greatly aided in effecting there the total rout of the rebel troops, by making a detour which threatened their rear; and following in pursuit with a flying column, he defeated them with the loss of nearly all their guns at Serai Ghat. He also took part in the operations connected with the recapture of Lucknow, shortly after which he was promoted to the rank of major-general, and appointed to the command of the force employed for the final pacification of India, a position in which his unwearied energy, and his vigilance and caution united to high personal daring, rendered very valuable service. Before the work of pacification was quite completed he was created K.C.B. In 1859 he was appointed to the command of the British land forces in the United French and British Expedition against China, whose object was accomplished three months subsequent to the landing of the forces at Peh-tang, 1st August, 1860, Pekin having surrendered at discretion after the Chinese army had thrice suffered defeat in the open and the Taku forts had been carried by assault. For his conduct in this, which has been called "most successful and the best carried out of England's little wars," he received the thanks of parliament, and was gazetted G.C.B. In 1861 he was made lieutenant-general and appointed commander-in-chief of the army of Madras; on his return to England in 1865 he was made quartermaster-general at headquarters; and 1872 he was transferred to the command of the camp at Aldershot. In the same year he was gazetted general. He died at London, March 7, 1875.

Incidents in the Sepoy War of 1857–58, compiled from the Private Journal of General Sir Hope Grant, K. C. B., together with some explanatory chapters by Capt. H. Knollys, Royal Artillery, was published in 1873, and *Incidents in the China War of 1860* appeared posthumously under the same editorship in 1875.

GRANTHAM, a municipal and parliamentary borough and market-town of England, county of Lincoln, is situated on both sides of the Witham, at the junction of several railways with the Great Northern line, 105 miles N.N.E. of London and 22 miles S.S.W. of Lincoln. The parish church, a spacious Gothic edifice of the 13th century, has been restored by Sir G. G. Scott. It is surmounted by an elegant spire 274 feet high, and has an elaborately carved front, and some splendid monuments. At the free grammar school, founded by Bishop Fox in 1528, Sir Isaac Newton received part of his education. Among the other public buildings are the guild-hall, with a spacious assembly-room, the two exchanges, the town-hall, the literary institution, the jail, the dispensary, and the workhouse. A bronze statue of Sir Isaac Newton was erected in 1858. The principal trade is that of malting, which is carried on to a considerable extent. There are also tanneries and coach factories, and a large agricultural implement factory and iron foundry. Grantham returns two members to parliament. The population of the municipal borough (area, 406 acres) in 1901 was 17,593, and of the parliamentary borough (area, 5811 acres) 25,500.

GRANVELLA, Antoine Perrenot, Cardinal de (1517–1586), one of the ablest and most influential of the princes of the church during the great political and ecclesiastical movements which immediately followed the appearance of Protestantism in Europe, was born 20th August, 1517, at Ornans, Burgundy, where his father, Nicolas Perrenot de Granvella, who afterwards became chancellor of the empire under Charles V., was at that time engaged in practice as a junior at the provincial bar. On the completion of his studies in law at Padua and in divinity at Louvain, he for a short time held a canonry at Besançon, but his talents had already marked him for a higher sphere, and he was promoted to the bishopric of Arras when barely twenty-three (1540). In his episcopal capacity he attended several diets of the empire, as well as the opening meetings of the council of Trent; and the influence of his father, now become chancellor, led to his being entrusted with many difficult and delicate pieces of public business, in the execution of which he developed a rare native talent for diplomacy, and at the same time acquired an intimate acquaintance with most of the currents of European politics. One of his specially noteworthy performances was the settlement of the terms of peace after the defeat of the Smalkaldic league at Mühlberg in 1547, a settlement in which, to say the least, some particularly sharp practice was exhibited. In 1550 he succeeded his father in the offices of secretary of state and chancellor of the empire; in this capacity he attended Charles in the war with Maurice, accompanied him in the flight from Innsbruck, and afterwards drew up the treaty of Passau (August, 1552). In the following year he conducted the negotiations for the marriage of Mary of England and Philip of Spain, to whom in 1555, on the abdication of the emperor, he transferred his services. In April, 1559, Granvella was one of the Spanish commissioners who arranged the peace of Cateau Cambrésis, and on Philip's withdrawal from the Netherlands in August of the same year he was appointed prime minister to the regent, Margaret of Parma. The policy of repression which in this capacity he pursued during the next five years secured for him many tangible rewards; in 1560 he was elevated to the archiepiscopal see of Malines, and in 1561 he received the cardinal's hat; but the growing hostility of a people whose moral and religious convictions he had studiously set himself to trample under foot, ultimately made it impossible for him to continue in the Low Countries; and by the advice of his royal master he in 1564 retired to Franche Comté. Nominally this withdrawal was only of a tempo-

rary character, but it proved to be final. The following six years were spent in comparative quiet, which was devoted chiefly to study and to the society of learned men; but in 1570 Granvella, at the call of Philip, resumed public life by accepting a mission to Rome as representative of the interests of Spain in framing the proposed treaty of alliance with Venice and the papal see against the Turks. In the same year he was advanced to the viceroyalty of Naples, a post of some difficulty and danger, which for five years he occupied with ability and success. Summoned to Madrid in 1575, to be president of the supreme council of Italy and afterwards of that of Castile, he still continued to find ample scope for his rare aptitudes. Among the more delicate negotiations of his later years were those of 1580, which had for their object the ultimate union of the crowns of Spain and Portugal, and those of 1584, which resulted in a check to France by the marriage of the Spanish infanta to Duke Philip of Savoy. In the same year he was made archbishop of Besançon, but meanwhile a lingering disease had laid an unrelenting grasp upon his iron frame; he never was enthroned, but died at Madrid, 21st September, 1586. His body was removed to Besançon, where his father had been buried before him.

Numerous letters and memoirs of Granvella are preserved in the archives of Besançon. These were to some extent made use of by Prosper Levêque in his *Mémoires pour servir* (1753), as well as by the Abbé Boisot in the *Tresor de Granvella*. A commission for publishing the whole of the letters and memoirs was appointed by Guizot in 1834, and the result has been the issue of nine volumes of the *Papiers d'État du Cardinal de Granvelle*, edited by Weiss (1841–52). They form a part of the *Collection de documents inédits sur l'histoire de France*. See also the anonymous *Histoire du Cardinal de Granville*, attributed to Courchetet D'Esnans (Paris, 1761), and Motley's *Rise of the Dutch Republic*.

GRANVILLE, a fortified seaport town of France, department of Manche, is situated at the mouth of the Bosq and at the foot of a steep rocky promontory projecting into the English Channel, 30 miles S.W. of St. Lô. It is surrounded by strong walls, and is built principally of granite, and its streets are mostly steep and narrow. The parish church dates from the 15th century. Among the other public buildings are the tribunal of commerce, the hospital, the public baths, and the naval school. Granville occupies the seventh place in point of importance among the seaports of France, and the harbor is accessible to vessels of the largest tonnage. There is regular steam communication with Jersey and Guernsey. The principal exports are fruits, vegetables, oysters, fish, corn, wood, and cattle. A large number of the inhabitants are engaged in the cod and oyster fisheries, and among the other industries are the manufacture of brandy, chemicals, cod-liver oil, and leather. Shipbuilding is also carried on. Granville was founded by the English in the beginning of the 15th century, taken by the French in 1450, bombarded and burned by the English in 1695, and partly destroyed by the Vendean troops in 1793. The population in 1901 was 10,326.

GRANVILLE, John Carteret, Earl (1690–1763), English statesman, son of George, Lord Carteret, was born 22d April, 1690, and in his fifth year succeeded to his father's title. He was educated at Westminster school and at Christ Church, Oxford, and even early in life had acquired a knowledge of the classics, of philosophy, of general literature, and of modern languages, which rendered him perhaps superior to all his contemporaries in the extent of his intellectual accomplishments. Soon after taking his seat in the House of Lords in 1711, he began to distinguish himself by his eloquent advocacy of the Protestant succession, and his zeal was rewarded when George I. came to the throne, by the appointment in 1715 of bailiff of the island of Jersey, and in 1716 of lord-lieutenant of Devon; and his mother was also created countess of Granville. In 1719 he was sent on an embassy to Sweden; and in 1720 he was named ambassador-extraordinary to the congress of Cambray. In May of the following year he was appointed secretary of state under Walpole's administration; but Walpole's jealousy of his influence with the king led to his resignation on the 3d April, 1724, and on the same day he was appointed lord-lieutenant of Ireland, an office which he held till 1730, when differences with the ministry led to his resignation. After his return he became the leader of the opposition, the duties of which office he discharged with great versatility of resource and with frequent effectiveness, but with a negligent rashness which rendered him almost as dangerous to his friends as to his opponents. In 1742 he was at last successful in overthrowing Sir Robert Walpole's Government, and was immediately thereafter appointed secretary of state. He now obtained a complete ascendency over the mind of George II., whose German policy he carried out irrespective of the opinions of his colleagues; but his imperiousness soon gained him both their enmity and the hatred of the people, and enabled his opponents, for whom he cherished unmitigated contempt, to effect his political annihilation. Pitt, afterwards earl of Chatham, spoke of him as "an execrable, a sole minister, who had renounced the British nation, and seemed to have drunk of the potion described in poetic fiction, which made men forget their country." In 1744 he found it necessary, from the resignation of his colleagues and his inability to find proper successors, to tender his resignation; and, according to Horace Walpole, he "retired from St. James's laughing." Shortly before this he had, by the death of his mother, become Earl Granville. His administration was popularly distinguished by the epithet "drunken"—a title which had reference to his character both as a politician and as a private individual. Notwithstanding his want of political success, contemporary opinion is unanimous in affirming that he was not only the most brilliant debater but the ablest statesman of his time. Chatham declared that he owed all that he was to his friendship and instruction, and Swift, Smollett, Chesterfield, and Horace Walpole have borne equally laudatory testimony to his abilities. He was besides regarded as an authority in questions of scholarship by the most eminent classicists of his time, and Bentley was greatly indebted to his assistance in preparing his edition of Homer. His fatal defects appear to have been his careless arrogance and his deficiency in definite political principle and purpose. After the resignation of the Pelham ministry he was again appointed secretary of state, but almost immediately resigned, holding office, according to a political squib, for only forty-eight hours, three quarters, seven minutes, and eleven seconds. In 1749 he was created knight of the garter and appointed president of the council; but, though he retained his influence with the king, the part he thenceforth played in English politics was indirect and subordinate. He died January 2, 1763.

Various information regarding Earl Granville will be found in Chesterfield's *Characters;* Lord Hervey's *Memoirs of the Reign of George II.;* Horace Walpole's *Letters and Memoirs of the Reign of George II.;* and the *Autobiography of Shelburne*. See also Lecky's *History of England in the Eighteenth Century*.

GRAPE. See Vine.

GRAPHITE. See Carbon, vol. v. p. 77, and Furnace, vol. ix. p. 741.

GRAPHOTYPE is a name which has been given to an ingenious process of autographic engraving, by which typographic printing blocks are produced. The general principles of the process are as follows. A block of chalk or some similar material is reduced to a level surface, and on this surface a design is drawn with a glutinous ink, this ink being sufficiently fluid to penetrate some little distance into the porous chalk. The ink having become dry, gentle friction is applied to the surface of the block, so as gradually to rub away those parts of the chalk which are not indurated by the glutinous ink. The lines of the drawing being thus left in relief, a perfect model of the required printing block is obtained, and this model is next hardened by immersion in a bath containing a solution of an alkaline silicate, after which it is dried and reproduced by the stereotype or the electrotype process. This method of typographic engraving was brought to a practical form, and patented in 1860 (No. 2309) by an American wood engraver, Mr. de Witt Clinton Hitchcock. The first step in his process is to reduce French chalk or talc to an extremely fine state of division by repeated grindings, elutriations, and siftings, after which a layer of the material, rather over an eighth of an inch in thickness, is forced down upon, and made to adhere to, a thick zinc plate—the necessary pressure being obtained by means of an hydraulic press, the platen of which is faced with a polished steel plate, so as to communicate a good surface to the layer of compressed French chalk. The device is now drawn (of course, reversed) on the prepared block with an ink consisting of a weak solution of glue colored by lamp black or some other pigment. In drawing on the prepared block care must be taken not to

damage the somewhat tender surface of the compressed chalk, and the safest instrument with which to apply the glutinous ink is a fine sable brush, but an ordinary pen may be employed if the operation of drawing is performed with caution. A pad of silk velvet or a fitch brush may be used for rubbing the block so as to leave the lines in relief, and it is quite sufficient to continue the friction until a depth equal to the thickness of an ordinary playing card is produced,—the spaces corresponding to any extended whites of the engraving being then cut out by means of a tool. A 10 per cent. solution of silicate of sodium may be used for hardening the block, and when dry nothing remains but to take a mould from it and to reproduce it in metal.

GRASLITZ, or GRASSLITZ (Bohemian *Kraslice*), a town in the northwest of Bohemia, near the Saxon frontier, in the circle of Elbogen, 88 miles N. W. of Prague, 50° 21′ N. lat., 12° 27′ E. long., is advantageously situated in a valley between high hills, at the confluence of the Silberbach and Zwoda. It is the headquarters of a military district, the seat of a court of justice, and has a custom-house, a handsome church built in 1618 and dedicated to Corpus Christi, and several manufactories of cotton and woollen stuffs, and of musical and mathematical instruments, looking-glasses, brass, copper, and wire goods, and paper. Graslitz is one of the most important industrial towns in Bohemia, and the centre of the lace-weaving districts of the Erzgebirge. In 1900 the population, inclusive of the small suburb of Glasberg, amounted to 11,800.

GRASSE, a town of France, capital of an arrondissement in the department of Alpes-Maritimes, 20 miles W. of Nice. It occupies a picturesque situation on the southern declivity of a hill facing the Mediterranean, from which it is about 7 miles distant; and it possesses a climate remarkably mild and salubrious. It is well supplied with water from a rivulet which rises above it. The streets are narrow, steep, and winding, but the houses are generally well built. The town was formerly the seat of a bishop, and possesses a Gothic cathedral with a beautiful tower, an old chapel dating from the 11th century, now used as a powder magazine, a hospital, a town-hall, an exchange, a theatre, a communal college, and a public library. The chapel of the hospital contains three pictures by Rubens. Next to Paris, Grasse carries on the largest manufacture of perfumery in France. Citrons, oranges, lemons, figs, pomegranates, and the flowers used by the perfumers, are grown in the gardens of the town and neighborhood, and fine marble, alabaster, and jasper are found in the vicinity. Grasse was founded in the 6th century by Jews from Sardinia. The population in 1901 was 9,426.

GRASSES (*Gramineæ—Gramina*) are monocotyledonous flowering-plants, possessing certain characters in common, and constituting the order *Gramineæ*. No plant is correctly termed a grass which is not a member of this family, but the word is in common language also used, generally in combination, for many plants of widely different affinities which possess some resemblance (often slight) in foliage to truly graminaceous species; *e. g.*, knot-grass (*Polygonum aviculare*), cotton-grass (*Eriophorum*), rib-grass (*Plantago*), scorpion-grass (*Myosotis*), sea-grass (*Zostera*). In agriculture the word has an extended signification to include the various fodder-plants, chiefly leguminous, often called "artificial grasses" (see AGRICULTURE). Indeed, formerly *grass* (also spelt *gœrs*, *gres*, *gyrs*, in the old herbals) meant any green herbaceous plant of small size.

Yet the first attempts at a classification of plants recognized and separated a group—considered even of primary value—of *Gramina*, and this, though bounded by nothing more definite than habit and general appearance, contained the *Gramineæ* of modern botanists. The older group, however, even with such systematists as Ray (1703), Scheuchzer (1719), and Micheli (1729), embraced in addition the *Cyperaceæ*, *Juncaceæ*, and some other monocotyledons with inconspicuous flowers. Singularly enough, the sexual system of Linnæus (1735) served to mark off more distinctly the true grasses from these allies, since very nearly all of the former then known fell under his Triandria Digynia, whilst the latter found themselves under other of his artificial classes and orders.

I. STRUCTURE.—The general type of true grasses is familiar in the cultivated cereals of temperate climates—wheat, barley, rye, oats, and in the smaller plants which make up our pastures and meadows and form a principal factor of the turf of natural downs. Less familiar are the grains of warmer climes—rice, maize, millet, and sorgho, or the sugar cane. Still further removed are the bamboos of India and America, the columnar stems of which reach to the height of forest trees. All are, however, formed on a common type, which we proceed to examine.

Root.—Most cereals and many other grasses are annual, and possess a tuft of very numerous slender root-fibres, much branched, and of great length. The greater part of the order are of longer duration, and have the roots also fibrous, but fewer, thicker, and less branched. In such cases they are very generally given off from just above each node (often in a circle) of the lower part of the stem or rhizome, perforating the leaf-sheaths. In some bamboos they are very numerous from the lower nodes of the erect culms, and pass downwards to the soil around them, whilst those from the upper nodes shrivel up and form circles of spiny fibres.

Stem.—The root-stock of perennial grasses is usually well developed, and often forms very long creeping or subterranean rhizomes, with elongated internodes and sheathing scales; it is also frequently short, with the nodes crowded. The very large root-stock of the bamboos (fig. 1) is a striking example of "definite" growth; it is much branched, the short thick curved branches being given off below the apex of the older ones and at right angles to them, the whole forming a series of connected arched axes, truncate at their ends which were formerly continued into leafy culms. The root-stock is always solid, and has the usual internal structure of the monocotyledonous stem.

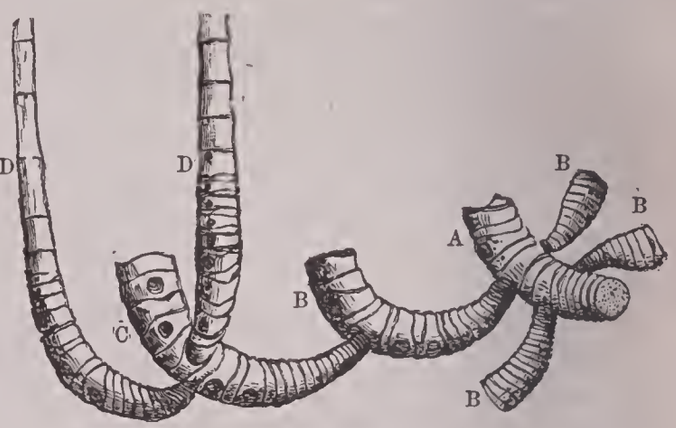


FIG. 1.—Rhizome of Bamboo. A, B, C, D, successive series of axes, the last bearing aerial culms.

The aerial leaf-bearing branches (culms) are a characteristic feature of grasses. They are generally numerous, erect, cylindrical (rarely flattened), and conspicuously jointed with evident nodes. The nodes are solid, a strong plate of tissue passing across the stem, but the internodes are commonly hollow, although examples of completely solid stems are not uncommon (many Andropogons, sugar-cane). The general character is thus not unlike that of *Umbelliferæ*. The exterior of the culms is more or less concealed by the leaf-sheaths; it is usually smooth and often highly polished, the epidermal cells containing an amount of silica sufficient to leave after burning a distinct skeleton of their structure. Tabasheer is a white substance, mainly composed of silica, found in the joints of several bamboos. A few of the lower internodes may become enlarged and sub-globular, forming nutriment-stores, and grasses so changed are termed "bulbous" (*Arrhenatherum*, *Poa bulbosa*, etc.). In internal structure grass-culms, save in being hollow, conform to that usual in monocotyledons; the vascular bundles run parallel in the internodes, but a horizontal interlacement occurs at the partitions. Nearly all grasses branch to some extent, and many extensively; the branches are strictly distichous, and many buds are abortive, or the resulting branches short and stunted. In many bamboos they are long and spreading or drooping and copiously ramified, in others reduced to hooked spines. *Dinochloa* is truly scandent, and climbs over trees 100 feet or more in height. *Olyra latifolia* is also a climber on a humbler scale.

Grass-culms grow with great rapidity, as is most strikingly seen in bamboos, where a height of over 100 feet is attained in from two to three months, and many species grow two, three, or even more feet in twenty-four hours. Silicic hardening does not commence till the full height is

nearly attained. The largest bamboo recorded is 170 feet, and the diameter is usually reckoned at about 4 inches to each 50 feet. A specimen in the British Museum is over 8 inches in diameter. In the same collection are some remarkable monstrosities, in which the septa are oblique and the internodes triangular or rhomboidal; Kurz has also figured one in the Calcutta Museum in which the cavities are confluent into a continuous spiral.

Leaves.—These present special characters usually sufficient for ordinal determination. They are always solitary at each node and strictly distichous, and consist of two distinct portions, the sheath and the blade. The *sheath* is often of great length, and generally completely surrounds the culm; as a rule it is split down its whole length, thus differing from that of *Cyperaceæ*, which is almost invariably (*Eriospora* is an exception) a complete tube. In a few grasses (*Melica*, *Bromus*) the edges are soldered together as in the latter order. The sheaths are much dilated in *Alopecurus vaginatus* and in a species of *Potmaochloa*, in the latter serving as floats. At the summit of the sheath, above the origin of the blade, is the *ligule*, a usually membranous process of small size (occasionally reaching an inch in length) erect and pressed around the culm. It is rarely quite absent, but may be represented by a tuft of hairs (very conspicuous in *Pariana*). *Melica uniflora* possesses, in addition to the ligule, a green erect tongue-like process, from the line of junction of the edges of the sheath.

The *blade* is frequently wanting or small and imperfect in the basal leaves, but in the rest is long and set on to the sheath at an angle. The usual form is familiar,—sessile, more or less ribbon-shaped, tapering to a point, and entire at the edge. The chief modifications are the articulation of the (deciduous) blade on to the sheath, which occurs in all the *Bambuseæ* (except *Planotia*) and in *Spartina stricta*, and the interposition of a petiole between the sheath and the blade, as in *Leptaspis*, *Pharus*, *Pariana*, *Lophatherum*, etc. In the latter case the form of the leaf usually becomes oval, ovate, or even cordate or sagittate, but these forms are found in sessile leaves also (*Olyra Panicum*). The venation is strictly parallel, the midrib usually strong, and the other ribs more slender. In *Anomochloa* there are several nearly equal ribs, and in some broad-leaved grasses (*Bambuseæ*, *Pharus*, *Leptaspis*) the venation becomes tesselated by transverse connecting veins. The thick prominent veins in *Agropyrum* occupy the whole upper surface of the leaf. Epidermal appendages are rare, the most frequent being marginal, saw-like, cartilaginous teeth, usually minute, but occasionally (*Danthonia scabra*, *Panicum serratum*) so large as to give the margin a serrate appearance. *Alopecurus lanatus* and one or two Panicums have woolly leaves.

Inflorescence.—This possesses an exceptional importance in grasses, since, their floral envelopes being much reduced and the sexual organs of very great uniformity, the characters employed for classification are mainly derived from the arrangement of the flowers and their investing bracts. The subject also presents unusual difficulties from the various interpretations which have been given to these glumaceous organs and the different terms employed for them by various writers. It may, however, be now considered as settled that the whole of the bodies known as glumes and paleæ, and distichously arranged externally to the flower, form no part of the floral envelopes, but are of the nature of bracts. These are so arranged round the small flowers as to form *spikelets* (locustæ), and each spikelet may contain one, two, three, or a greater number of flowers (in some species of *Eragrostis* nearly 60). The flowers are, as a rule, placed laterally on the axis (rachis) of the spikelet, but in uniflorous spikelets they appear to be terminal, and are probably really so in *Anthoxanthum* (fig. 9, 2) and in two anomalous genera, *Anomochloa* and *Streptochæte*.

In immediate relation with the flower itself, and often entirely concealing it, is the *palea* or *pale* ("upper pale" of most systematic agrostologists; "paleola interior," Dumortier; "spathella," Döll). This organ (fig. 3, 1) is peculiar to grasses among *Glumiferæ*, and is almost always present, certain *Oryzeæ* and *Phalarideæ* being the only exceptions. It is of thin membranous consistence usually obtuse, often bifid, and possesses no central rib or nerve, but is furnished with two lateral ones, one on either side; the margins are frequently folded in at the ribs, which thus become placed at the sharp angles. This structure points to the fusion of two organs, and the pale was by R. Brown considered to represent two portions soldered together of a trimerous perianth-whorl, the third portion being the "lower pale" to be immediately mentioned. By Bentham the homology of the organ is suggested to be with the two bracteoles found in *Hypolytrum pungens* and *Platylepis*, and with the perigynium of the female flower of *Carex* in *Cyperaceæ*. It is rarely (*Triachyrum*, *Diachyrium*) found split into two separate organs.

The flower with its pale is sessile, and is placed in the axil of another bract in such a way that the pale is exactly opposed to it, though at a slightly higher level. It is this second bract which has been generally called by systematists the "lower pale," and with the "upper pale" considered to form an outer floral envelope ("calyx," Jussieu; "perianthium," Brown; "stragulum," Palisot de Beauvois; "glumella," Dumortier). In the writings of most botanists even though this view is not held, yet, where the term "flower" is employed, it includes these organs. It is, however, certain that the two bracts are on different axes, one secondary to the other, and cannot therefore be parts of one whorl of organs. This was made out from the study of so-called "viviparous" grasses, in which the lower pales become transformed into ordinary foliage leaves, first by Von Mohl in 1845, and more clearly by Germain de St. Pierre in 1852, who terms the lower pale the "glume fertile." Döll and Bentham have also independently arrived at the same result, and the latter in 1858 first published the terminology here adopted, and used for the same organ the name *flowering glume*. The two bracts are usually quite unlike one another, but in some genera (*e. g.* most *Festucaceæ*) they are considerably similar in shape and appearance.

The flowering-glume has generally a more or less boat-shaped form, is of firm consistence, and possesses a well-marked central midrib and frequently several lateral ones. The midrib in a large proportion of genera extends into an appendage termed the *awn* (fig. 10, 2), and the lateral veins more rarely extend beyond the glume as sharp points (*e. g.*, *Pappophorum*). The form of the flowering-glume is very various, this organ being plastic and extensively modified in different genera. In *Leptaspis* it is formed into a closed cavity by the union of its edges, and encloses the flower, the styles projecting through the pervious summit. Valuable characters are obtained from the awn. This presents itself variously developed from a mere subulate point to an organ several inches in length, and when complete (as in *Andropogoneæ*, *Aveneæ*, and *Stipeæ*) consists of two well-marked portions, a lower twisted part and a terminal straight portion, usually set in at an angle with the former, sometimes trifid and occasionally beautifully feathery. The lower part is most often suppressed, and in the large group of the *Paniceæ* awns of any sort are very rarely seen. The awn may be either terminal or may come off from the back of the flowering-glume, and Duval Jouve's observations have shown that it represents the blade of the leaf of which the portion of the flowering-glume below its origin is the sheath; the twisted part (so often suppressed) corresponds with the petiole, and the portion of the glume extending beyond the origin of the awn (very long in some species, *e. g.*, of *Danthonia*) with the ligule of the developed foliage-leaf. When terminal the awn has three fibro-vascular bundles, when dorsal only one; it is covered with stomate-bearing epidermis.

The flower with its palea is thus sessile in the axil of a floriferous glume, and in a few grasses (*Leersia* (fig. 2), *Coleanthus*, *Nardus*) the spikelet consists of nothing more, but usually (even in uniflorous spikelets) other glumes are present. Of these the two placed distichously opposite each other at the base of the spikelet never bear any flower in their axils, and are called the *basal* or *empty glumes* (fig. 10, 1). They are the "glumes" of most writers ("paleæ" of Dumortier), and together form what was called the "gluma" by R. Brown ("tegmen," Palisot de Beauvois). They rarely differ much from one another, but one may be smaller or quite absent (*Panicum* (fig. 8, 2), *Vulpia*, *Paspalum*, *Lolium*), or both be altogether suppressed, as above noticed. They are commonly firm and strong, often enclose the spikelet, and are rarely provided with long points or imperfect awns. Generally speaking they do not share in the special modifications of the flowering-glumes,

Fig. 2.—Spikelet of *Leersia*.

and but rarely themselves undergo modification, chiefly in hardening of portions (*Sclerachne, Manisuris, Antephora, Peltophorum*), so as to afford greater protection to the flowers or fruit. But it is usual to find, besides the basal glumes, a few other empty ones, and these are in two- or more-flowered spikelets (fig. 11, 2) at the extremity (numerous in *Lophatherum*), or in uniflorous ones (fig. 8, 2) below, interposed between the floral glume and the basal pair. Descriptive writers have been accustomed to call these empty glumes "barren" or "neutral flowers," a misleading use of terms.

The axis of the spikelet, when short and rounded, has been termed the *callus*, when long the *rachillus*. It is frequently jointed and breaks up into articulations above each flower. Tufts or borders of hairs are frequently present (*Calamagrostis, Phragmites, Andropogon*), often so long as to surround and conceal the flowers. The axis is often continued beyond the last flower or glume as a bristle or stalk.

Involucres or organs outside the spikelets are not unfrequent, the morphology of which is various. Thus in *Setaria, Pennisetum*, etc., the one or more circles of simple or feathery hairs represent abortive branches of the inflorescence; in *Cenchrus* these become consolidated, and the inner ones flattened out so as to form a very hard globular spiny case to the spikelets. The cup-shaped involucre of *Cornucopiæ* is a dilatation of the axis into a hollow receptacle with a raised border. In *Cynosurus* the pectinate involucre which conceals the spikelet is a barren or abortive spikelet. True *bracts* of a more general character subtending branches of the inflorescence are singularly rare in *Gramineæ*, in marked contrast with *Cyperaceæ*, where they are so conspicuous. They however occur in a whole section of *Andropogon*, in *Anomochloa*, and at the base of the spike in *Sesleria*. The remarkable ovoid involucre of *Coix*, which becomes of stony hardness, white, and polished (then known as "Job's tears"), is also a modified bract or leaf-sheath. It is entirely closed except at the apex, and contains the female spikelet, the stalks of the male inflorescence and the long styles emerging through the small apical orifice.

Any number of spikelets may compose the inflorescence, and their arrangement is very various. In the spicate forms, with sessile spikelets on the main axis, the latter is often dilated and flattened (*Paspalum*), or is more or less thickened and hollowed out (*Stenotaphrum, Rottboellia, Tripsacum*), when the spikelets are sunk and buried within the cavities. Every variety of racemose and paniculate inflorescence obtains, and the number of spikelets composing those of the large kinds is often immense. Rarely the

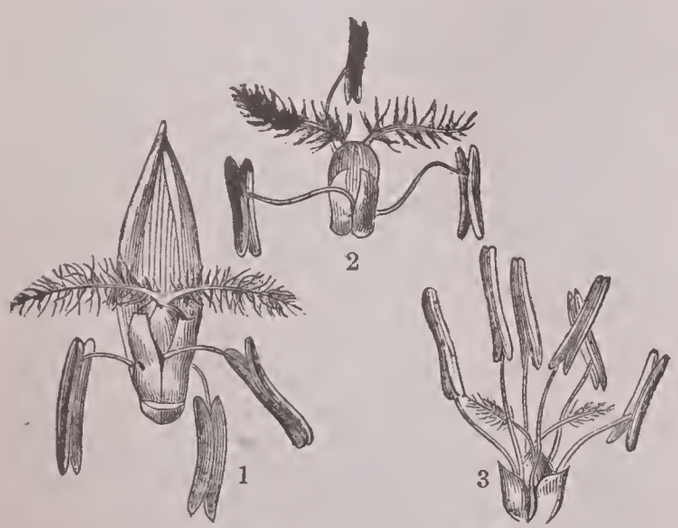


Fig. 3.—Flowers of Grasses. 1, *Piptatherum*, with the palea; 2, *Poa*; 3, *Oryza*.

inflorescence consists of very few flowers; thus *Lygeum Spartum*, the most anomalous of European grasses, has but two or three large uniflorous spikelets, which are fused together at the base, and have no basal glumes, but are enveloped in a large hooded spathe-like bract.

Flower.—This is characterized by remarkable uniformity. The *perianth* is represented by very rudimentary, small, fleshy, hypogynous scales called *lodicules* ("squamulæ," Kunth; "nectarium," Schreber); they are elongated or truncate, sometimes fringed with hairs, and are in contact with the ovary. Their usual number is two, and they are placed collaterally at the anterior side of the flower, that is, within the flowering glume. They are generally considered to represent the inner whorl of the ordinary monocotyledonous (liliaceous) perianth, the outer whorl of these being suppressed as well as the posterior member of the inner whorl. This latter is present almost constantly in *Stipeæ* and *Bambuseæ*, which have three lodicules, and in the latter group they are occasionally more numerous (five, spreading and persistent in *Pseudostachyum*; six to eight in *Beesha*). In *Anomochloa* they are represented by hairs. In *Streptochæte*, according to Döll, there are six lodicules, alternately arranged in two whorls. They are often quite absent. In some cases lodicules are of the nature of stipules to the palea, and appear as though split off from its sides at the base. Such stipular lodicules often co-exist along with the perianthial ones, and are then either free from or combined with the two anterior ones.

Sexual Organs.—Grass-flowers are usually hermaphrodite, but there are very many exceptions. Thus it is very common to find one or more imperfect (usually male) flowers in the same spikelet with bisexual ones, and their relative position is important in classification. *Holcus* and *Arrhenatherum* are examples in English grasses; and as a rule in species of temperate regions separation of the sexes is not carried further. In warmer countries monœcious and diœcious grasses are more frequent. In such cases the male and female spikelets and inflorescence may be very dissimilar, as in the maize, Job's tears, *Euchlæna Spinifex*, etc.; and in some diœcious species this dissimilarity has led to the two sexes being referred to different genera (*e. g., Antephora axilliflora*, Steud., is the female of *Buchloe dactyloides*, Engelm., and *Neurachne paradoxa*, Br., of a species of *Spinifex*). In other grasses, however, with the sexes in different plants (*e. g. Brizopyrum, Distichlis, Eragrostis capitata, Gynerium*), no such dimorphism obtains. *Amphicarpum* is remarkable in having cleistogamic flowers borne on long radical subterranean peduncles which are fertile, whilst the conspicuous upper paniculate ones, though apparently perfect, never produce fruit. Something similar occurs in *Leersia oryzoides*, where the fertile spikelets are concealed within the leaf-sheaths.

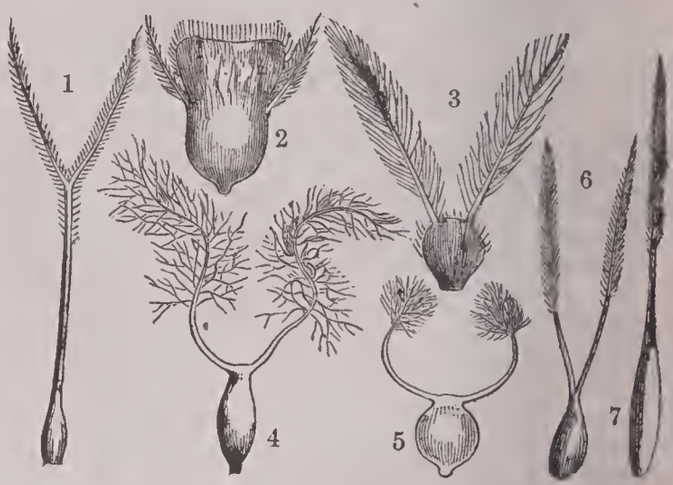


Fig. 4.—Pistils of Grasses. 1, *Alopecurus*; 2, *Bromus*; 3, *Arrhenatherum*; 4, *Glyceria*; 5, *Melica*; 6, *Mibora*; 7, *Nardus*.

Androecium.—In the vast majority there are three stamens alternating with the lodicules, and therefore one anterior, *i. e.*, opposite the flowering glume, the other two being posterior and in contact with the palea. They are hypogynous, and have long and very delicate filaments, and large, linear or oblong two-celled anthers, dorsified and ultimately very versatile, deeply indented at each end, and commonly exserted and pendulous. Suppression of the anterior stamen sometimes occurs (*e. g., Anthoxanthum*), or the two posterior ones may be absent (*Uniola, Cinna, Phippsia, Festuca bromoides*). On the other hand there is in some genera (*Oryza*, most *Bambuseæ*) another row of three stamens, making six in all (fig. 3, 3); and *Anomochloa* and *Tetrarrhena* possess four. The stamens become numerous (ten to forty) in the male flowers of a few monœcious genera (*Pariana, Luziola*). In *Beesha* they vary from seven to thirty, and in *Gigantochloa* they are monadelphous.

Gynœcium.—There is but little variation here from a

bicarpellary pistil, with a small rounded one-celled ovary containing a single laterally attached or ascending ovule, capped by two styles quite distinct or connate at the base, and with densely hairy or feathery stigmas (fig. 4). Occasionally there is but a single style (*Nardus, Lygeum*), and this may attain to a great length (6 inches in the maize); or three styles may be present (some *Bambuseæ, Leptaspis, Streptochæte*). Nees has described a case in which three complete carpels were found in *Schedonorus elatior*.

We thus see that, comparing the flower of *Gramineæ* with the normal liliaceous plan (fig. 5), it differs in the complete

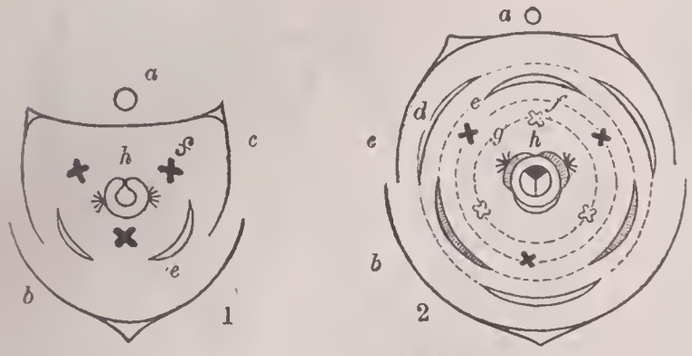


Fig. 5.—Diagrams of the ordinary grass-flower. 1, actual condition; 2, theoretical, with the suppressed organs supplied. *a*, axis; *b*, flowering glume; *c*, palea; *d*, outer row of perianth leaves; *e*, inner row; *f*, outer row of stamens; *g*, inner row; *h*, pistil.

suppression of the outer row and the posterior member of the inner row of the perianth-leaves, of the whole inner row of stamens, and of the anterior carpel, whilst the remaining members of the perianth are in a rudimentary condition. But each or any of the usually missing organs are to be found normally in different genera, or as occasional developments.

Fruit.—The ovary ripens into a usually small ovoid or rounded fruit, which is entirely occupied by the single large seed, from which it is not to be distinguished, the thin pericarp being completely united to its surface. To this peculiar fruit the term *caryopsis* has been applied (more familiarly "grain"); it is commonly furrowed longitudinally down one side (usually the inner, but in *Coix* and its allies, the outer), and an additional covering is not unfrequently provided by the adherence of the persistent palea, or even also of the flowering glume ("chaff" of cereals). From this type are a few deviations; thus in *Sporobolus*, etc. (fig. 6), the pericarp is not united with the seed but is quite distinct, dehisces, and allows the loose seed to escape. Sometimes the pericarp is membranous, sometimes hard and brittle, whilst, on the other hand, in some genera of *Bambuseæ*, it becomes thick and fleshy, forming a "berry," or rather a drupe. In *Melocanna baccifera* this forms a fruit 3 or 4 inches long, with a pointed beak of 2 inches more; it is indehiscent, and the small seed germinates whilst the fruit is still attached to the tree, putting out a tuft of roots and a shoot, and not falling till the latter is 6 inches long. A similar germination also occurs in *Pseudostachyum compactum*, which has the largest fruit of the order.

Fig. 6. — Fruit of *Sporobolus*, showing the dehiscent pericarp and seed.

Seed.—The testa is thin and membranous but occasionally colored, and the embryo small, the great bulk of the seed being occupied by the hard farinaceous endosperm

Fig. 7.—A grain of wheat. 1, back, and 2, front view; 3, vertical section, showing (*b*) the endosperm, and (*a*) embryo; 4, commencement of germination, showing (*b*) the pileola and (*c*) the secondary rootlets surrounded by their coleorrhizæ.

(albumen) on which the nutritive value of the grain depends. The embryo presents many points of interest. Its position is remarkable, closely applied to the surface of the endosperm at the base of its outer side. This character is absolute for the whole order, and effectually separates *Gramineæ* from *Cyperaceæ*. The part in contact with the endosperm is flat and plate-like, and is known as the *scutellum*. Some difference of opinion is held on the nature of this but it is probably correctly regarded (as by Van Tieghem) as the main portion of the cotyledon, the white epigœal sheath (*pileola*) protecting the plumule—which is often described as the cotyledon—being the ligule only of that organ greatly developed. The radicle is inferior, broad, and blunt; the primary root is very slightly developed in germination, but several secondary lateral ones burst through above its point, and thus become surrounded at their base with little sheaths (coleorrhizæ).

II. Classification.—*Gramineæ* are thus sharply defined from all other plants, and there are no genera as to which it is possible to feel a doubt whether they should be referred to it or not. The only order closely allied is *Cyperaceæ*, and the points of difference between the two have been alluded to above, but may be here brought together. The best distinctions are found in the position of the embryo in relation to the endosperm—lateral in grasses, basal in *Cyperaceæ*—and in the possession by *Gramineæ* of the 2-nerved palea below each flower. Less absolute characters, but generally trustworthy and more easily observed, are the feathery stigmas, the always distichous arrangement of the glumes, the usual absence of more general bracts in the inflorescence, the split leaf-sheaths, and the hollow, cylindrical, jointed culms,—some or all of which are wanting in all *Cyperaceæ*. The same characters will distinguish grasses from the other glumiferous orders, *Restiaceæ*, *Eriocauloneæ*, and *Desvauxiaceæ*, which are besides further removed by their capsular fruit and pendulous ovules. To other monocotyledonous families the resemblances are merely of adaptive or vegetative characters. Some *Commelynaceæ* and *Marantaceæ* approach grasses in foliage; the leaves of *Allium*, etc., possess a ligule; the habit of some palms reminds one of the bamboos; and *Juncaceæ* and a few *Liliaceæ* possess an inconspicuous scarious perianth.

The great uniformity among the very numerous species of this vast family renders its classification very difficult. The difficulty has been increased by the confusion resulting from the multiplication of genera founded on slight characters, and from the description of identical plants under several different genera in consequence of their wide distribution.

No characters for main divisions can be obtained from the flower proper or fruit; though both Kunth and Reichenbach have used them—especially the form of the styles and stigmas, the lodicules and the caryopsis—they have not been generally employed by botanists, who have found it necessary to trust to characters derived from the usually less important inflorescence and bracts.

The earlier authors made the general arrangement of the spikelets (spicate, paniculate, etc.) the basis of their classifications. Palisot de Beauvois's main divisions are founded on the existence in the same inflorescence of similar or diverse spikelets. Fries has proposed a division into *Euryantheæ* and *Clisantheæ*, according to the condition of the flowering glume and pale, separated or close during inflorescence. Dumortier gives a classification into *Rachideæ*, *Rachilliflorœ*, and *Calliflorœ;* the first with the spikelets inserted into excavations of the rachis, the second with the flowers of the free spikelet inserted on its axis (rachillus), and the last with the flower or flowers borne on the short callus of the glumes. Both these systems, and others which have been suggested, possess merits of their own, but they have not as yet been found capable of application to the order as a whole, having been framed for the accommodation mainly of European genera.

For such general treatment no better primary divisions have been found than those proposed by Robert Brown in 1810 and further elaborated in 1814, which have been accepted by Munro (1868) and Bentham (1878) in their most recent revisions of the Cape and Australian genera. The basis of Brown's division of the whole order into *Paniceæ* and *Poaceæ* is the position of the most perfect flower in the spikelet; this is the upper (apparently) terminal one in the first, whilst in the second it occupies the lower posi-

tion, the more imperfect ones (if any) being above it. Munro has supplemented this by another character easier of verification, and of even greater constancy, in the articulation of the pedicel in the *Paniceæ* immediately below the glumes; whilst in *Poaceæ* this does not occur, but the axis of the spikelet frequently articulates *above* the pair of empty basal glumes. Neither of these two great divisions will well accommodate certain genera allied to *Phalaris*, for which Brown proposed tentatively a third group (since named *Phalarideæ*); this, or at least the greater part of it, is placed by Bentham under the *Poaceæ*.

The following arrangement is based on the writings of these authors, but it cannot be considered very satisfactory. Probably no serial disposition can represent the tangled network of genera related in different ways and various degrees which make up this very natural but complicated family, and though some of the following tribes are fairly natural, the limits of others are but ill-defined, and the position of many genera uncertain.

I. PANICACEÆ.—Pedicel articulated below the glumes. Spikelet with one or two flowers, the more perfect fertile one above, the male or barren one, if present, below it.

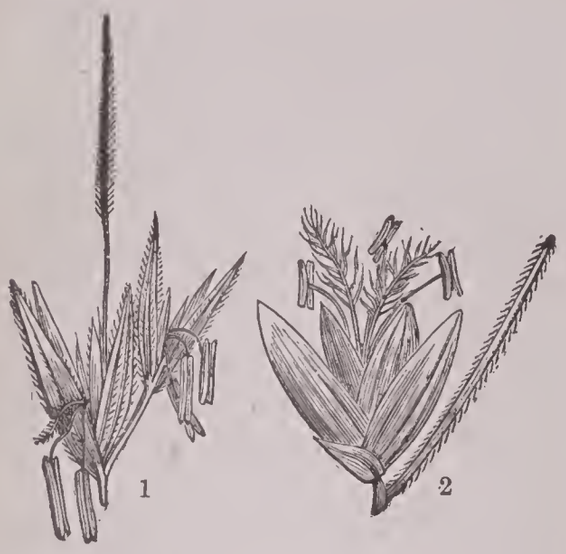


FIG. 8.—*Panicaceæ*. 1, a pair of spikelets of *Andropogon*; 2, spikelet of *Setaria*, with an abortive branch beneath it.

1. *Paniceæ*. — Spikelets with an apparently terminal hermaphrodite or female flower with or without a male one beneath it. Glumes three or four, the upper flowering one of a firm texture, the lowest usually small, sometimes absent. Awns rarely found; if present, neither twisted nor kneed. Fruit enclosed in the hardened flowering glume and palea.
   EXAMPLES:—*Paspalum, Panicum, Setaria, Pennisetum, Antephora, Thouarea, Spinifex.*
2. *Tristegineæ*.—Spikelets as in *Paniceæ*, but flowering glume with a twisted and bent awn.
   EXAMPLES:—*Arundinella, Tristachya, Polypogon* (?).
3. *Andropogoneæ*.—Spikelets as in the last, but usually in pairs (rarely three or solitary), one being sessile and fertile, the other stalked and usually male or neuter. Glumes four (rarely fewer), one of the outer ones the largest and enclosing the fruit, the upper flowering one very thin and transparent, usually bearing a twisted and bent awn or reduced to the awn.
   EXAMPLES:—*Ischæmum, Pollinia, Andropogon, Imperata, Sorghum, Anthistiria, Erianthus, Eulalia, Saccharum.*
4. *Rottboellieæ*.—Spikelets as in the last; one of each pair fertile, sessile, and sunk in alternate notches or cavities of the jointed simple rachis, the other stalked or absent; no awns.
   EXAMPLES:—*Hemarthria, Manisuris, Rottboellia, Ophiurus, Psilurus, Lepturus.*
5. *Mayadeæ*.—Spikelets monœcious, very unlike, the male numerous in a terminal panicle, the female few at the base of the male inflorescence or more numerous in a separate one.
   EXAMPLES:—*Coix, Zea, Chionachne, Tripsacum, Sclerachne.*
6. *Olyreæ*. — Spikelets monœcious, or some hermaphrodite and some male in the same panicle; the flowering glume large, sometimes utricular. Stamens three, six, or more. Leaves often broad and petiolate.
   EXAMPLES:—*Leptaspis, Pharus, Olyra, Pariana.*

II. PHALARIDEÆ.—Pedicel either articulated below the glumes or not, but the rachis of the spikelet articulated above the two lowest ones. Spikelets with (one or) three flowers, the perfect fertile one above, the two male, if present, below it. Two-nerved palea usually absent.
EXAMPLES:—*Phalaris, Anthoxanthum, Ehrharta, Hierochloe, Alopecurus, Phleum, Crypsis, Lygeum* (?).

FIG. 9.—*Phalarideæ*.—1, spikelet of *Hierochloe*; 2, spikelet of *Anthoxanthum*.

III. POACEÆ. — Pedicel not articulated below the glumes. Rachis of spikelet often articulated above the two lowest glumes. Spikelets with one, two, or more fertile flowers, the male or imperfect ones (if any) above them. Rachis of spikelet often continned as a point or bristle beyond the flowers.

1. *Oryzeæ*. — Spikelets one-flowered. Empty basal glumes very small or wanting. Two-nerved palea usually absent. Stamens usually six.
   EXAMPLES:—*Oryza, Leersia, Potamophila, Zizania, Anomochloa* (?).
2. *Stipeæ*.—Spikelets one-flowered. Flowering glume with a terminal twisted and bent awn. Palea small and thin Lodicules three.
   EXAMPLES:—*Stipa, Aristida, Piptatherum.*
3. *Agrostideæ*. — Spikelets one-flowered. Flowering glume usually with a terminal or dorsal bent awn. Palea small and thin. Lodicules two.
   EXAMPLES:—*Agrostis, Deyeuxia, Calamagrostis, Coleanthus* (?).
4. *Aveneæ*.—Spikelets generally two- rarely three- or more-flowered. Flowering glumes with a terminal or dorsal bent and twisted awn. Palea large, enclosing with the flowering glume the fruit.
   EXAMPLES:—*Aira, Holcus, Arrhenatherum, Avena, Trisetum, Danthonia, Lagurus.*

FIG. 10.—*Poaceæ*. 1, spikelet of *Agrostis*; 2, spikelet of *Aira*.

[2, 3, and 4 together form Bentham's tribe *Streptatheræ*.]

5. *Pappophoreæ*.—Spikelets one- or several-flowered. Flowering glumes rounded on the back, terminating in three or more teeth often carried out into straight awns.
   EXAMPLES:—*Pappophorum, Triraphis, Cottea, Triodia.*
6. *Chlorideæ*.—Spikelets one- or several-flowered, sessile on one-sided spikes. Flowering glumes rarely awned.
   EXAMPLES:—*Cynodon, Chloris, Eleusine, Leptochloa, Spartina, Ctenium, Nardus.*
7. *Milieæ*.—Spikelets one- or several-flowered, paniculate.

Flowering glumes usually rounded and unawned. Palea large.

EXAMPLES:—*Milium, Cœlachne, Sporobolus.*

8 *Festuceæ.*—Spikelets several- or many-flowered, stalked, paniculate or capitate. Flowering glumes entire, obtuse or acute, or with a straight awn; one or more empty ones above the fertile flowers.

EXAMPLES:—*Festuca, Bromus, Lamarkia, Briza, Poa, Eragrostis, Dactylis, Cynosurus, Arundo, Phragmites, Melica.*

9 *Bambuseæ.*—Spikelets one-, several-, or many-flowered, usually sessile, paniculate or capitate. Lodicules three.

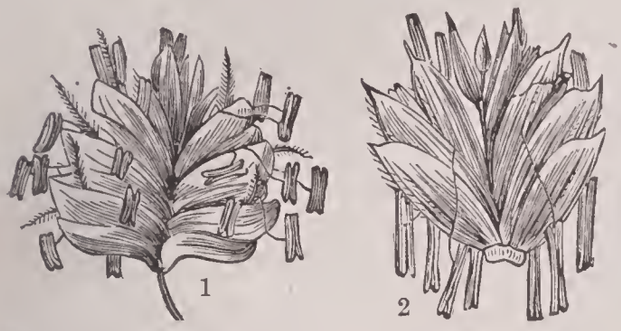


FIG. 11.—*Poaceæ.* 1, spikelet of *Briza*; 2, spikelet of *Triticum*.

Stamens generally six. Stems very large and tall (called arboreous or shrubby). Blade of leaf articulated with the sheath.

EXAMPLES:—*Arundinaria, Chusquea, Nastus, Bambusa, Melocanna, Beesha.*

10. *Hordeæ.*—Spikelets one- or several-flowered, sessile on the opposite sides of the main axis of the spike. Otherwise as in *Festuceæ.*

EXAMPLES:—*Hordeum, Agropyrum, Ægilops, Triticum, Lolium, Lepturus, Elymus.*

[5 to 10 compose Bentham's tribe *Astreptæ.*]

III. DISTRIBUTION.—Grasses are the most universally diffused over the globe of all flowering-plants. There is no district in which they do not occur, and in nearly all they are a leading and dominant feature of the flora. In actual number of species *Gramineæ* comes considerably after *Compositæ* and *Leguminosæ*, the two most numerous orders of phanerogams, but in number of individual plants it probably far exceeds either; whilst from the wide extension of many of its species, the proportion of *Gramineæ* to other orders in the various floras of the world is much higher than its whole number of species would lead one to expect. This number can, however, scarcely be put much below 6000, which is probably somewhat more than a fifth of all monocotyledons. This is only about $\frac{1}{10}$th of the phanerogams as a whole, yet in any given locality, with a very few exceptions, this proportion is largely exceeded. In tropical regions, where *Leguminosæ* is the leading order, grasses closely follow as the second, whilst in the warm and temperate regions of the northern hemisphere, in which *Compositæ* takes the lead, *Gramineæ* again occupies the second position. As the colder latitudes are entered the grasses become relatively more numerous, and are the leading family in Arctic and Antarctic regions. The only countries where the order plays a distinctly subordinate part are some extra-tropical regions of the southern hemisphere, Australia, the Cape, Chili, etc. The actual proportion of graminaceous species to the whole phanerogamic flora in different countries is found to vary from nearly $\frac{1}{4}$th in the Arctic regions to about $\frac{1}{25}$th at the Cape; in the British Isles it is about $\frac{1}{72}$th. The following are proportions per cent. in various floras, from Decandolle's *Geogr. Botanique*, which must, however, be taken as merely approximations in most cases:—

In the tropics:—Cape Verd Islands, 13; Abyssinia and Nubia, 12; Mexico, 10; Hawaiian Islands, 10; Congo, 8; Mauritius, 8; neighborhood of Quito, 10; Barbados, 6; Surinam, 6; Tunis, 6; New Guinea, 4; New Grenada, 4. In temperate regions of the northern hemisphere:—Banda and some other districts of India, 15 to 17; Egypt, 12; Texas, 12; Azores, 12; Madeira, 11; Algeria, 9½; Canaries, 8; United States, 8; Sardinia, 9; Holland, 10; Sweden, 8½; Great Britain, 8½; France, 7½; Germany, 7; China, 8; Altai, 5½; Japan, 5½. In northern regions (beyond 60° N. lat.):—Melville Island, 21; Spitzbergen, 18; Iceland, 11. In extratropical regions of the southern hemisphere:—Chili, 6; Cape Colony, 4½; Swan River district, 2. In Antarctic islands:—Kerguelen, 25; Tristan da Cunha, 15.

The principal climatic cause influencing the number of graminaceous species appears to be amount of moisture; it is only in very dry countries that they become distinctly less numerous. A remarkable feature of the distribution of grasses is its uniformity; there are no great centres for the order, as in *Compositæ*, where a marked preponderance of endemic species exists; and the genera, except some of the smallest or monotypic ones, have usually a wide distribution. Speaking generally, however, the *Panicaceæ* are tropical and warm temperate plants, whilst the grasses of temperate and colder regions are members of the *Poaceæ*. The former are very sparingly represented in Europe by a few species of the vast tropical genera *Andropogon* and *Panicum*. *Poaceæ*, on the other hand, form a fair proportion of tropical *Gramineæ*, especially in the higher districts where, as in the mountains of Abyssinia, are several endemic genera and many species. The largest tropical genus of *Poaceæ* is *Eragrostis*.

The distribution of the tropical tribe *Bambuseæ* is interesting. There are 170 or more species, which are about equally divided between the Indo-Malayan region and tropical America, only one species being common to both. Apparently there is but a single native species on the African continent, where it has a wide range, and none are recorded for Australia, though species may perhaps occur on the northern coast. One species of *Arundinaria* reaches northwards as far as Virginia, and the elevation attained in the Andes by some species of *Chusquea* is very remarkable —one, *C. aristata*, being abundant from 15,000 feet up to nearly the level of perpetual snow.

Many grasses are almost cosmopolitan, such as our common reed, *Phragmites communis*; and many range throughout the warm regions of the globe, *e. g.*, *Cynodon Dactylon, Eleusine indica, Imperata arundinacea, Sporobolus indicus*, etc., and such weeds of cultivation as species of *Setaria, Echinochloa*, which are found over both Old and New Worlds. The recent masterly revision of the whole of the Australian species by Bentham well exhibits the wide range of the genera of the order in a flora generally so peculiar and restricted as that of Australia. Thus of the 90 indigenous genera (many monotypic or very small) only 14 are endemic, 1 extends to South Africa, 3 are common to Australia and New Zealand, 18 extend also into Asia, whilst no less than 54 are found in both the Old and New Worlds, 26 being chiefly tropical and 28 chiefly extratropical.

Of specially remarkable species *Lygeum* is found on the sea-sand of the eastern half of the Mediterranean basin, and the minute *Coleanthus* has only occasionally occurred at intervals in three or four isolated spots in Europe (Norway, Bohemia, Normandy). Many remarkable endemic genera occur in tropical America, including *Anomochloa* of Brazil, and most of the large aquatic species with separated sexes are found in this region. The only genus of flowering plants peculiar to the arctic regions is the beautiful and rare grass *Pleuropogon Sabinii*, R. Br. of Melville Island.

Bibliography.—R. Brown, *Prod. Flor. Nov. Holland.* (1810); Id., appendix to *Flinders's Voyage*, p. 580 (1814); Id. and J. J. Bennett in *Plant. Javan. Rar.*, p. 8 (1838); Palisot de Beauvois, *Étude d'Agrostographie* (1812); Dumortier, *Observations sur les Graminées de Belgique* (1823); Id., *Étude Agrostographique* (1868); Trinius, *Fundamenta Agrostographiæ* (1820); Id., *De Gram. Uniflor.* (1824); Kunth, *Enumeratio Plantarum*, i. (1833); Id., *Distrib. Méthodique des Gram.* (1835); Von Mohl, in *Bot. Zeitung*, 1845, p. 33; E. Fries, *Summa Veg. Scandinaviæ* (1846); Döll, *Flora des Grossh. Badens*, bd. i. (1857); Id., in *Jahresber. des Mannheimer Ver. f. Naturkunde*, 1868, p. 30; Id., *Flora Brasiliensis, Gramineæ*, i. (1871), ii. (1877), iii. (1878); Bentham, *Handbook of Brit. Flora* (1858); Id., in *Journ. Linn. Soc. Lond.*, xv. p. 390 (1877); Id., *Flora Australiensis*, vii. (1878); Munro in Harvey, *Genera S. African Plants*, ed. 2 (1862); Id., *Bambuseæ* in *Trans. Linn. Soc. Lond.*, xxvi. p. 1 (1868); Duval Jouve, in *Mém. de l'Acad. des Sciences de Montpelier* (1871); Van Tieghem, in *Ann. des Sc. Nat.*, ser. 5, xv. p. 236 (1872); Eichler, *Bluthendiagramme*, i. (1875); Fournier, in *Bull. Soc. Bot. Belg.*, xv. p. 459 (1876). (H. T.)

GRASSHOPPER (French *Sauterelle*, Italian *Grillo*, German *Grashüpfer, Heuschrecke*, Swedish *Gräshoppa*), a collective term applied to certain orthopterous insects belonging to the families *Locustidæ* and *Acrydiidæ*, according to the now generally received classificatory views. They are especially remarkable for their saltatory powers, due to the great development of the hind legs, which are

much longer than the others and have stout and powerful thighs, and also for their stridulation, which is not always an attribute with them of the male only. The distinctions between the two families may be briefly stated as follows:—the *Locustidæ* have very long thread-like antennæ, and four-jointed tarsi; the *Acrydiidæ* have short stout antennæ, and three-jointed tarsi. As the term "grasshopper" is almost synonymous with Locust, the subject will be more extensively treated under the latter heading (*q. v.*). Under both "grasshopper" and "locust" are included members of both families above noticed, but the majority belong to the *Acrydiidæ* in both cases. In Britain the term is chiefly applicable to the large green grasshopper (*Locusta viridissima*) common in most parts of the south of England, and to smaller and more obscure species of the genera *Stenobothrus*, *Gomphocerus*, and *Tettix*, the latter remarkable for the great extension of the pronotum, which often reaches beyond the extremity of the body. All are vegetable feeders, and, as in all orthopterous insects, have an incomplete metamorphosis, so that their destructive powers are continuous from the moment of emergence from the egg till death. The notorious migratory locust (*Pachytylus migratorius*) may be considered only an exaggerated grasshopper, and the too-famous Rocky Mountain locust (*Caloptenus spretus*) is still more entitled to the name. In Britain the species are not of sufficient size, nor of sufficient numerical importance, to do any great damage, and their cheerful "song" more than counteracts the slight mischief they may cause in devouring grasses and other plants. The colors of many of them assimilate greatly to those of their habitats; the green of the *Locusta viridissima* is wonderfully similar to that of the herbage amongst which it lives, and those species that frequent more arid spots are protected in the same manner. Yet many species have brilliantly colored under-wings (though scarcely so in English forms), and during flight are almost as conspicuous as butterflies; but when settled it is nearly impossible to detect them, even although the spot where they dropped may have been carefully marked; and they rise again almost under the feet of the observer. Those that belong to the *Acrydiidæ* mostly lay their eggs in more or less cylindrical masses, surrounded by a glutinous secretion, in the ground. Some of the *Locustidæ* also lay their eggs in the ground, but others deposit them in fissures in trees and low plants, in which the female is aided by a long flattened ovipositor, or process at the extremity of the abdomen, whereas in the *Acrydiidæ* there is only an apparatus of valves. The stridulation or "song" is mainly produced by friction of the hind legs against portions of the wings or wing-covers; but variation exists in the exact method. To a practised ear it is perhaps possible to distinguish the "song" of even closely allied species, and some are said to produce a sound differing by day and night. The British species are not numerous; but in some parts of the world (and even in Europe) their numbers are very great, both in species and individuals.

GRATIANUS, Augustus (359–383), Roman emperor, son of Valentinianus I., was born in 359. In the ninth year of his age he received from his father the title of Augustus, but on his father's death in 375 he was compelled to share the Western empire with his infant brother, Valentinianus II., of whom he was appointed guardian, while his uncle Valens ruled over the Eastern empire. In 378 he gained a victory over the Alemanni near the site of the present town of Colmar. Through the death of Valens in the same year, there devolved upon him the government of the Eastern empire, but feeling himself unable to resist unaided the incursions of the barbarians, he ceded it to Theodosius, January 19, 379. For some years Gratianus conducted the government of his empire with energy and success, but gradually he sank into indolence and occupied himself chiefly with the pleasures of the chase. By adopting as the guards of his person a body of the Alani, and appearing in public in the dress of a Scythian warrior, he awakened the contempt and resentment of his Roman troops. A Roman named Maximus took advantage of this feeling to raise the standard of revolt in Britain, and invaded Gaul with a large army, upon which Gratianus, who was then in Paris, being deserted by his troops, fled to Lyons, where, through the treachery of the governor, he was delivered over to one of the rebel generals and assassinated, August 25, 383.

GRATIANUS, Franciscus, compiler of the *Concordia discordantium Canonum* or *Decretum Gratiani*, and founder of the science of canon law, was born about the end of the 11th century at Chiusi in Tuscany or, according to another account, at Carraria near Orvieto. In early life he appears to have been received into the Camaldulian monastery of Classe near Ravenna, whence he afterwards removed to that of San Felice in Bologna, where he spent many years in the preparation of the *Concordia*. The precise date of this important work cannot be ascertained, but it contains references to the decisions of the Lateran council of 1139, and the statement is vouched for by tolerably good authority that it was completed while Pope Alexander III. was still simply professor of theology at Bologna,—in other words, prior to 1150. The labors of Gratian are said to have been rewarded with the bishopric of Chiusi, but if so he appears never to have been consecrated; at least his name is not to be found in any authentic list of those who have occupied that see. The year of his death is unknown.

For some account of the *Decretum Gratiani* and its history see Canon Law. The latest edition is that of Friedberg (*Corpus Juris Canonici*, Leipsic, 1876). Compare Schulte, *Zur Geschichte der Literatur über das Decret Gratians* (1870), *Die Glosse zum Decret Gratians* (1872), and *Geschichte der Quellen und Literatur des Kanonischen Rechts* (1875).

GRATIUS FALISCUS, a Roman poet, contemporary with Virgil and Ovid, and author of a poem on hunting (*Cynegetica*), of which somewhat more than 536 lines have been preserved. Of his personal history nothing is known; but it has been doubtfully conjectured from his cognomen that he was a native of Falerii. The only reference to him to be met with in any writer of antiquity (Ovid, *Pont.*, iv. 16, 33) is of the most incidental kind, and his poem seems very early to have fallen into comparative oblivion. Our knowledge of it is derived chiefly from a manuscript of the 10th century, preserved at Vienna, but partly also from one of nearly the same age at Paris. It describes, somewhat after the manner of Xenophon, various kinds of game, the means to be employed for their pursuit and capture, the best breeds of horses and dogs; and in doing so it seldom rises above the dull level of the driest technicality, although occasionally there are faint reminiscences of Virgil.

The *editio princeps* of this author was published in Venice in 1534; his work was also included by Ulitius (1645–55) and Havercamp (1728) in their editions of *Auctores Rei Venaticæ*, as well as by Burmann (1731) and Warnsdorf (1780) in the *Poetæ Latini Minores*, and by Weber in the *Corpus Poetarum Latinorum*. The most recent editions are those of Stern (1832) and Haupt (1838). A rendering into English verse was published by Christopher Wase in 1654; there is also a German translation by Perlet (1826).

GRATTAN, Henry (1746–1820), Irish statesman and orator, was born 3d July, 1746. His father, a Protestant, was for many years recorder of the city of Dublin, and from 1761 to 1766 its representative in the Irish parliament; and his mother was a daughter of Thomas Marlay, chief justice of Ireland. Both at school and at Trinity College, Dublin, which he entered in 1763, young Grattan greatly distinguished himself, especially in the study of the classics; and several well-authenticated anecdotes indicate also that the more prominent moral characteristics displayed in his public career had begun to assert their strength at a very early period. While still attending the university he discarded the Tory principles of his father, who, dying in 1766 before his irritation had time to moderate, testified his resentment by depriving him of the paternal mansion, and of all property not secured by settlement. Having inherited, however, a small inalienable patrimony he resolved to study for the bar, and in 1767 he entered the Middle Temple, London. He was called to the Irish bar in 1772, but never obtained a large practice; and indeed from the time that he left the university he seems to have concentrated his attention chiefly on politics and the study of popular oratory. He early acquired a passionate admiration of the great orators of Greece and Rome, and while in London he spent the most of his evenings in the galleries of the House of Commons or at the bar of the Lords, anxious to profit by every opportunity of obtaining an insight into the art of eloquence, his enthusiasm for which had received additional stimulus from the genius of Lord Chatham. Of the eloquence of Chatham he has given a detailed and graphic description in one of his letters, and he also wrote an admirable portraiture of his character, which was inserted as a note in the political publication *Rarataria* conducted by Sir

Hercules Langrishe. The knowledge obtained from the study of the best specimens of ancient and modern oratory, and that gained from witnessing the debates in the English parliament, Grattan began sedulously to apply to the purposes of his own discipline. By the constant practice of recitation to imaginary audiences, and by taking part frequently in private theatricals, he succeeded in overcoming to a remarkable extent his great physical defects, so as to acquire a clear and rounded articulation, an emphasis in some respects admirably consonant with his meaning, and a certain ease in a style of elocution which was effective partly by reason of its very singularity. At the same time, by practising the habit of writing out the principal passages of his speeches, and subjecting them to a constant mental revision, he attained to the possession of a diction which for clearness, epigrammatic vigor, polished beauty of phrase, and the power of illuminating a whole subject by sudden flashes of meaning conveyed in a single sentence, is unsurpassed in modern oratory. He was equally diligent also in perfecting his political knowledge by a careful study of the history and political constitution both of ancient and modern nations; and the minor accomplishment of proficiency as a pistol shot, at that time essential to every Irish politician who would be prepared for all emergencies, was cultivated by him with the same dogged perseverance which he displayed in other matters.

When therefore, under the auspices of Lord Charlemont, Grattan in 1775 entered the Irish parliament, he had already all his powers under full command, and had so trained and disciplined his natural genius that it was able to exert its influence with untrammelled freedom. The period at which he began public life was one of the most critical in his country's history; and it is within the limits of strict truth to affirm that he inaugurated a new era in her political condition, and that, whether for good or for evil, and whether by the direct success of his efforts or by the modifying or opposing influences they called into exercise, he has had a greater share than any other individual in determining her present relation to the United Kingdom. Through the writings of Molyneux and Swift, the beginnings of a true national sentiment had been previously awakened; and the first step in the path of constitutional reform had been taken, when by the advocacy of Flood the Octennial Bill of 1768 was passed, which limited the duration of parliaments to eight years, instead of as formerly making their continuance depend upon the life of the sovereign; but Flood himself—whose friendship and influence were a powerful element in determining Grattan to adopt a political career—had, like less formidable agitators, succumbed to the intrigues of the "castle," and, although possessed of a private fortune which placed him beyond the suspicion of being governed chiefly by mercenary considerations, had consented to hamper his political action by accepting a sinecure office; and it seemed as if the germs of a better future had already begun to rot in a soil of such political corruption. The difficulty of the task which Grattan had set before him was also increased by a peculiarity in the case of Ireland which requires to be emphasized. Her political constitution, and, with the exception of the restrictions which paralyzed her trade, the laws which were inflicting upon her such moral and physical misery, did not nominally differ to any great extent from those of the country by which she was in reality governed. She possessed intact her separate nationality; she was blessed with the boon of a national parliament; she had a legal administration of her own, including the right of trial by jury; and she enjoyed something resembling the privileges of municipal government. She possessed these things, however, scarcely more than in form; and she possessed them in such a form that, instead of being the guarantees of her liberty, they increased her sense of bondage, and directly fostered discontent and chronic mutiny. Though the Test Act and the penal laws were actually enforced with less rigor than in England, yet from the numbers who came within their sweep their disastrous influence was incalculably increased. They excluded four-fifths of her otherwise eligible population from the jury box and from municipal and parliamentary suffrage; they had produced confiscations on almost a national scale with all the evils consequent on absenteeism; and from their operation there had resulted an ignorance, a poverty, a violation of the rights of conscience, not confined to a few thousands, helplessly dispersed throughout the kingdom, but afflicting the great mass of the people, and both by their direct and their reflex action poisoning the springs of the whole national life. Her judges besides were liable to dismissal at pleasure, and her parliament had no independent authority, and by its very constitution was subject to corrupt influences far exceeding those in operation in the English parliament, and such as virtually to deprive it of independence of vote, almost as completely as it had been deprived of the power of legislation. Still that parliament constituted a kind of centre for political discussion and for the propagation and diffusion of political ideas, and it was by means of it that Grattan and his associates determined to work out the political and social regeneration of their country. Almost as soon as he entered parliament, Grattan became the acknowledged leader of the opposition, not only from the influence exerted by his oratory within the House, but from its power to kindle the enthusiasm of the people, and to create out of the chaos of shapeless and discordant elements the united sympathy and purpose of a true national life. In this he received an assistance from external events which was embarrassing as well as helpful;—from the American rebellion, which was the result of a struggle for rights similar to those he was contending for; from the war with France, which led to the creation of a volunteer army in Ireland that became a kind of political convention; and ultimately from the French Revolution, which in Ireland, more than in any other country of Europe, aroused wild desires after political freedom.

In February, 1778, Grattan moved an address to the crown, to the effect that the condition of Ireland was no longer endurable, and although the motion was supported by only a small minority, the discussion bore fruit in the same year by the concession of free export of all produce except woollens, and by the modification of the penal laws to the extent of allowing the Catholics to hold leases for 999 years. In the following year the volunteers by their determined attitude crowned with success his efforts, along with Flood and Burgh, to effect the total repeal of the restriction Acts, and the same year saw also the repeal of the Test Act. With a view to increase and take advantage of the rising tide of national sentiment, Grattan on April 19th, 1780, moved his famous resolutions that the "king with the consent of the parliament of Ireland was alone competent to enact laws to bind Ireland, and that Great Britain and Ireland were indissolubly united, but only under a common sovereign;" but so satisfied was he with the tone of the debate that, unwilling needlessly to irritate or embarrass the English Government, he did not press his motion to a division. An agitation was, however, begun in the following year against Poyning's Act and the Mutiny Act, and Grattan besides supported the introduction of a bill permitting the Catholics to inherit and hold property on the same terms as other subjects. In order also to bring pressure to bear on the English Government, Grattan, Flood, and Charlemont met privately in the beginning of 1782, and drew up for the consideration of the volunteers' delegates two resolutions in reference to independence; and to these Grattan, on his own responsibility and without the knowledge of Flood and Charlemont, added a third in favor of the measure for the relaxation of the penal laws against the Catholics. All these resolutions were adopted by the delegates unanimously, and Grattan, strong in armed support, repeated his motion for a declaration of independence, which, although it was lost, aroused such general enthusiasm that, when on the 16th April he rose to move a Declaration of Rights, he in a brilliant oration congratulated his hearers and his country on the triumphant issue of the struggle, his first words being—"I am now about to address a free people." So completely did his eloquence rise to what was deemed the greatness of the occasion that its effect has seldom been equalled in the annals of oratory; and in the state of high-wrought excitement that prevailed, the Government, then doubtful as to the result of the siege of Gibraltar by the French and Spaniards, did not dare to refuse the boon which had already been in reality appropriated without their permission, and on the 17th May resolutions were passed unanimously, pledging the English parliament to redress the grievances complained of. In recognition of Grattan's services the Irish parliament was prepared to have voted him a grant of £100,000; but he was with difficulty persuaded to accept half that sum, and only agreed to do so from the consideration that, by relieving him from the necessity of practising at the bar, it would enable him to

devote the whole of his energies to politics. He determined, however, that this gift should not in any way bias his political action, and when Flood, supported by the volunteer convention, brought forward his motion for repeal. he at the expense of his popularity moved its rejection—a procedure which also gave rise to an extraordinary scene of mutual recrimination between the two orators. For the next ten years Grattan carried on the struggle for the reform of Irish abuses with almost no success; and his Place and Pension Bill, and bills to make the great officers of government responsible for their proceedings, to prevent revenue officers from voting at elections, and to abolish ecclesiastical tithes, were all rejected. Pitt, at one time disposed to promote emancipation, became lukewarm in his zeal after the rejection in 1785 of Mr. Orde's bill for the removal of trade restrictions, which, on account of a clause binding the parliament to re-enact England's navigation laws, was opposed by Grattan as involving a principle that implied a revocation of the constitution; nor did the action of the Irish parliament in the regency dispute of 1789 tend to smooth the relations between the two countries. At last in 1793 parliamentary suffrage was conceded to the Catholics as a sop to the fury of the United Irishmen; but the concession served only to whet the appetite for further redress, and when the hope of obtaining this, after reaching the verge of certainty by the appointment of Fitzwilliam as lord-lieutenant, was suddenly dashed by his recall, the spirit of brooding discontent increased until ultimately it resulted in the bloody rebellion of 1798. Previous to its occurrence Grattan had withdrawn from parliament. It has been surmised by Mr. Froude that in urging on the question of emancipation Grattan wished to effect a complete separation from England, and perhaps calculated, though a Protestant, on obtaining as the reward of his services the first place in the new commonwealth; but besides that the conjecture is unnecessary, since it was quite a possible supposition that emancipation might have proved the best method of confirming the loyalty of the Catholics,—and it was most certainly a better method than union without emancipation,—it is without a shadow of proof to support it, and would also have implied treachery on his part of the blackest kind, while treachery of any kind is belied by the whole course of his political life. In 1800 Grattan, though in feeble health, entered the Irish parliament as member for Wicklow, specially to oppose the motion for union, a measure whose bitterness was not rendered less distasteful to him from the time, manner, and means employed for its accomplishment. He regarded its success as almost the nullification of Ireland's partial freedom, and the indefinite postponement of the attempt to remedy her wrongs. Though knowing from the beginning that to contend against the influence of the Government was hopeless, he exerted all his eloquence in condemnation of the measure; and his last words in the Irish Parliament were—"I will remain anchored here with fidelity to the fortunes of my country, faithful to her freedom, faithful to her fall." In the course of these debates Grattan was three times virulently attacked by Mr. Corry, chancellor of the exchequer, but at last retaliated with overwhelming effect. In the duel which followed Corry was wounded.

After the Union Grattan withdrew for a time from public life, but, in order to lend his assistance to the passing of the Catholic Relief Bill, he in 1805 entered the English parliament as member for Malton; and in the following year he was returned by Dublin, which he had formerly represented in the Irish parliament. Although his speeches in the new arena did not detract from his fame, the union had effected so great a change in his political standpoint that the inspiration which had formerly given to his eloquence such a glow of confident ardor, and had braced his powers to such supreme efforts, was no longer present. He refused to take office in the Fox ministry, but he nevertheless gave the Whigs his support on all important occasions; and by voting with the Government on the Irish Insurrection Bill of 1807, he showed that his regard for the general welfare of the empire was unaffected by the great political disappointment of his life. After the rejection of the Catholic Relief Bill of 1813, which was accompanied by a clause reserving to the English sovereign the power of veto in the election of Catholic bishops, the Catholic board repudiated the proposed compromise and declined to entrust Grattan further with their cause. He, however, gave it the same energetic support as formerly, and after 1815 he never spoke in the English parliament on any other subject. In 1819 his motion was defeated by the small majority of two; and on the reassembling of parliament in the following May, he undertook, contrary to the advice of his physician, a journey to London in order again to bring forward the subject, but died a few days after his arrival, 4th June, 1820. He received the honor of a public funeral and a grave in Westminster Abbey, where he lies near the tombs of Pitt and Fox.

Lord Byron, who had heard Grattan only in the English House of Commons, says that he would have come near to his ideal of a perfect orator but for his harlequin manner; and he also states that Curran was in the habit of taking him off by bowing to the very ground and thanking God that he had no peculiarities of gesture or appearance. His features were large and plain, and he was low in stature and so awkwardly formed that probably he never could have acquired a very graceful gesture; but the gravity and impressiveness of his bearing banished all sense of the ridiculous, and perhaps even the oddness and violence of his attitudes assisted to dissipate the feeling in his hearers of his personal insignificance. His voice, though not harsh, was deficient both in mellowness and volume, and when not elevated by emotion into shrillness had a low drawling accent. He succeeded, however, by virtue of appropriate emphasis and of concentrated energy, in bringing home to his hearers all the various shades of the passion and purpose of his discourse, and this perhaps with greater vividness than if it had been accomplished by means of an elocution which, if less faulty, would not have expressed so well his own peculiar individuality. In private life he was simple, genial, and courteous, and the felicity of his language, flavored by an enunciation and manner that were all his own, lent to his conversation a rare and peculiar charm.

His speeches suffer much from imperfect reporting, but their leading characteristics can be determined with considerable accuracy. Great labor, direct and indirect, was bestowed on their preparation, and few speeches show so many traces of art; but it is art transfused and palpitating with enthusiasm, and therefore, though defective in ease and simplicity, they cannot be charged with artificiality or affectation. In regard to the chief fault of his style,—the excessive use of epigram,—it must be remembered that he made it supply the place both of wit and of direct argument; and that it never wearied his audience by a monotony of stilted smartness, but, by its incisive vigor and its startling originality, rendered his speeches perhaps unequalled for sustained brilliancy and interest. His oratorical triumphs were won, not by the stately marshalling of arguments and illustrations towards a climax, but by sudden surprises from so many directions, and so closely following each other that resistance to his attacks soon became impossible. In regard to subject-matter his speeches do not suffer from comparison even with those of Burke. His favorite method of enforcing his arguments was by illustrations either of similarity or of contrast drawn from history or from contemporary events; and while in this way he exhibited in every possible light the plausibility of his contentions, he gave dignity and elevation to his theme by removing it from the narrow sphere of party politics, and connecting it with principles of universal and permanent consequence. Much of the effect of his eloquence was due to the boldness of his statements and of his allusions and imagery, a boldness which, though often amounting to hardihood, never overstepped the boundaries between the sublime and the ridiculous. In remarkable contrast to other Irish orators, and especially to his great contemporary Curran, he possessed neither wit nor humor, and this no doubt accounts for the sustained and pitiless vehemence of his invectives against opponents who had thoroughly aroused his anger These attacks were rendered the more formidable from his power of delineating character by epithets, the graphic force of which had an almost electrical effect. This power he exercised, however, more frequently for purposes of laudation than censure, and perhaps the finest examples of it in his speeches are two short incidental allusions to Fox and Burke. A remarkable union of boldness with moderation and restraint characterized his statesmanship as it did his oratory, for while he embraced within his scheme of reform the whole circle of Ireland's wrongs and disabilities, and was prepared to face the consequences of all constitutional changes, however great, which justice seemed to demand, his unswerving aim, in the face both of strong provocation

from the Government and of the powerful assaults of popular clamor, was not to loosen but to cement the ties which bound Ireland to Great Britain. That his political conduct was governed too much by abstractions, and had too little regard to expediency, is a conclusion which has been both affirmed and denied, but in any case it will be admitted by most that his beneficial influence on Irish politics has been less felt by the direct accomplishment of his aims than through the moral effect of his enlightened and incorruptible patriotism, and the gradual change which has taken place in the mental attitude of English statesmen towards his country.

Grattan's *Speeches, with prefatory observations, the whole comprising a brief review of the most important political events in the history of Ireland*, were published at Dublin in 1811. His *Speeches in the Irish and in the Imperial Parliament*, edited by his son, in 4 volumes, appeared at London in 1822, and his *Miscellaneous Works* also in the same year. See his *Memoirs*, by his son, Henry Grattan, Esq., M. P., in 5 volumes, London, 1839–46; Lecky's *Leaders of Public Opinion in Ireland*, 2d edition, 1872; and, among various notices by contemporaries, especially that in vol. vii. of the *Dublin University Magazine*, which, notwithstanding political bias, gives a remarkably unprejudiced representation of his character and abilities, and that by Lord Brougham in the 1st vol. of his collected works. The political events of the period are of course graphically narrated by Mr. Froude in his *English in Ireland*, vols. ii. and iii., but his principal design is to show the pernicious effects of Grattan's efforts. Among the ablest criticisms of Mr. Froude's work is that by W. E. H. Lecky in *Macmillan's Magazine* for January, 1873, and June, 1874. (T. F. H.)

GRATZ, or GRAZ,[1] the capital of the Austrian crownland of Styria, is situated in the broad and fertile valley of the Mur, and the beauty of its position has given rise to the punning French description, *La ville des Graces sur la rivière de l'Amour*. From Vienna it is distant about 90 miles as the crow flies, and about 139 miles by rail. Its latitude is 47° 49′ N., its longitude 15° 27′ E., and its height above the sea 1499 feet. The main town lies on the left bank of the river, at the foot of the Schlossberg or castle-hill, but two of the principal suburbs, Lend and Gries, occupy an extensive area on the right bank, and communication is maintained by four bridges besides the railway bridge. Among the numerous churches of the city the most important is the Gothic cathedral of St. Ægidius, founded by the emperor Frederick III. in 1450–1462, on the site of a previous church mentioned as early as 1157. It has been several times modified and redecorated, more particularly in 1718. The present copper spire dates from 1663. The interior, which measures 200 feet in length by 92 feet in breadth, is richly adorned with stained glass windows of modern date, costly shrines, paintings, and tombs. In the immediate neighborhood of the cathedral is the mausoleum church of St. Catharine's, erected by Ferdinand II. as a burial place for himself and his family. It has an imposing façade with Corinthian columns, two cupolas, and a tower. Worthy of mention also are the church of the Sacred Blood, which has been the municipal church since 1585, and which possesses an altar-piece by Tintoretto; the Augustinian church, commonly called Stiegenkirche, appropriated to the service of the university since 1827; and the church of St. Anthony of Padua, connected with the lunatic asylum, and popularly known as the Narrenthurmkirche. Besides the old imperial castle, formerly the residence of the Styrian princes, and now the seat of the statthalterei, Gratz contains the palace of the prince-bishop of Seckau, the palace of Count Attem, with a fine picture gallery, and the old palace of the archduke John, now in possession of the counts of Meran. The landhaus, where the estates hold their sittings, was erected in the 16th century; among its curiosities are the Styrian hat and the great silver cup called the *Landschadenbund*. The rathhaus, built by Stadler between 1802 and 1807, is of interest mainly for its collection of instruments of torture. At the head of the educational institutions is the university, founded in 1586 by Charles Francis, and restored in 1817 after an interruption of forty-five years. The old buildings dating from between 1573 and 1609 are being replaced by a fine modern erection. Of greater celebrity than the university is the Joanneum, originally instituted in 1811 by the archduke John Baptist as a national museum, but now developed into a complex organization for the higher education, with a regular professorate, a library of 50,000 volumes, archives peculiarly rich in Oriental MSS., a botanical garden, and other auxiliary departments. Mohs, Schrötten, and Unger are among the eminent names associated with its chairs. The Styrian hospital, founded in 1788, the town hospital, the civic hospital, the military hospital, the children's hospital, and the lunatic asylum are among the principal benevolent institutions. An official money-lending establishment has been in existence since 1755. Of the minor institutions of various kinds which prove the prosperity of the town the list would be a long one. An active trade, fostered by abundant railway communication both with north and south, is combined with no small manufacturing industry in the departments of iron and steel wares, paper, chemicals, sugar, vinegar, liqueurs, watches, and mathematical instruments. Few towns are better supplied with public pleasure grounds and holiday resorts. The Schlossberg, which rises 380 feet above the valley, was laid out by General Welden shortly after the destruction of the castle; and a great park of 42 acres has been made almost to encompass the inner city. The Calvarienberg lies in the north-west of the town; and not far off is the castle of Eggenberg. The population of Gratz, in spite of a high rate of mortality which prevailed for some time, amounted in 1869 to 81,119, exclusive of the garrison of 4000 men. In 1901 the population was 138,080.

Plan of Gratz.

1 Citadel.
2. Franzen's Platz and Monument.
3. Theatre.
4. Cathedral.
5. Mausoleum.
6. University.
7. Rathhaus.
8. Landhaus.
9. Joanneum.
10. Municipal church.
11. Picture gallery.
12. City theatre.
13. Barracks.

History.—Gratz may possibly have been a Roman site, but the first mention of it under its present name is in a document of 881 A.D. Ottocar V. of Traungau chose it as his residence in 1056, and in 1163 it is designated for the first time the *Landesfürstliche Stadt*. Its privileges were confirmed by King Rudolf in 1281. Surrounded with walls and fosses in 1435, it was able in 1481 to defend itself against the Hungarians under Matthias Corvinus, who attempted to get possession of his promised bride at refuge within. In 1529 and 1532 the Turks attacked it with as little success. As early as 1530 the Lutheran doctrine was preached in Gratz by Seifried and Jacob von Eggenberg, and in 1540 Eggenberg founded the Paradies or Lutheran school in which Kepler afterwards taught. But

[1] The name was frequently written Grätz, Gretz, or Grez, but in 1843 it was decided, through the influence mainly of Hammer-Purgstall, that the official form should be Graz, in accordance at once with the local pronunciation and the derivation of the word, which was originally, it is believed, the Slavonic for "little castle," Gradats or Gratsa in Servian, and Hradek in Bohemian.

Charles II. burned 20,000 Protestant books in the square of the present lunatic asylum, and succeeded by his oppressive measures in bringing the city again under the authority of Rome. New fortifications were constructed in the end of the 16th century by Franz von Poppendorf, and in 1644 the town afforded an asylum to the family of Ferdinand III. The French were in possession of the place in 1797 and again in 1805; and in 1809 Marshal Macdonald, having in terms of the peace of Vienna entered the citadel which he had vainly besieged, blew it all up with the exception of the bell-tower and the citizens' or clock tower.

See Benditsch, *Thopographische Kunde der Hauptstadt Grätz*, Grätz, 1808; Polsterer, *Grätz und seine Umgebungen*, Grätz, 1827; Baldauf, *Geschichte der merkwürdigsten Begebenheiten in Grätz*, Grätz, 1843; Schreiner, *Histor.-statist.-topogr. Gemälde der Stadt Gratz und seine Umgebung*, Grätz, 1843; Weidmann, *Illust. Fremdenführer durch Grätz*, 1856; Ilwof and Peters, *Gräz: Geschichte und Topographie*, Grätz, 1876.

GRAUBÜNDEN. See GRISONS.

GRAUDENZ (Polish *Grudziadz*), a town of Prussia, chief town of a circle in the province of West Prussia, government district of Marienwerder, is situated on the right bank of the Vistula, which is here crossed by a railway bridge, 18 miles S. S. W. of Marienwerder and 40 miles N. N. E. of Thorn. It has a Protestant and a Catholic church, a garrison church, two synagogues, a royal gymnasium, a Catholic normal school, an Evangelical normal school, a city school of the middle grade, a higher female school, three hospitals, three orphanages, and a reformatory. The industries include ironfounding, brewing, dyeing, wool-spinning, and the manufacture of tapestry, cigars, shoes, and brushes. The population of the town in 1875 was 14,522, and including the fortress, 16,615.

Graudenz was founded about 1250, and received town rights in 1291. At the peace of Thorn in 1466 it came under the lordship of Poland. From 1665 to 1759 it was held by Sweden, and in 1772 it came into the possession of Prussia. The fortress of Graudenz, which since 1873 has been used merely as a barracks and a military depot and prison, is situated on a steep eminence about 1½ miles north of the town and outside its limits. It was completed by Frederick the Great in 1776, and has been rendered famous through its defence by Courbière against the French in 1807. Population, 1905, 35,953.

GRAUN, CARL HEINRICH (1701–1759), a celebrated composer, was born May 7, 1701, at Wahrenbrück in Saxony, the youngest of three brothers, all more or less musical. His father held a small post under Government, but he gave his children a careful education. Graun's beautiful soprano voice was noticed at the school where he was educated, and soon secured him an appointment in the choir of the city of Dresden. His masters were Grundig and Petzold, and at an early age he composed a number of sacred cantatas and other pieces for the church service. He completed his studies under Schmidt, and profited much by the Italian operas which were performed at Dresden under Lotti, the celebrated composer. After his voice had changed to a tenor, he made his début at the opera of Brunswick, in a work by Schurmann, an inferior composer of the day; but not being satisfied with the arias assigned him he rewrote them, so much to the satisfaction of the court that he was commissioned to write an opera for the next season. This work, *Pollidoro* (1726), and five other operas written for Brunswick, spread his fame all over Germany. Other works, mostly of a sacred character, including two settings of the *Passion*, also belong to the Brunswick period. It was there that Frederick the Great, at that time crown prince of Prussia, heard the singer, and immediately engaged him for his private chapel at Castle Reinsberg. There Graun remained for five years, and wrote a number of cantatas, mostly to words written by Frederick himself in French, and translated into Italian by Boltarelli. On his accession to the throne in 1740, Frederick sent Graun to Italy to engage singers for a new opera to be established at Berlin. Graun remained a year on his travels, earning universal applause as a singer in the chief cities of Italy. After his return to Berlin he was appointed royal chapel-master, with a salary of 2000 thalers (£300). In this capacity he wrote twenty-eight operas, all to Italian words, of which the last, *Merope* (1756), is perhaps the most perfect. But of infinitely greater importance than these is his oratorio the *Death of Jesus*, which is still annually performed at Berlin. It is here that Graun shows his skill as a contrapuntist, and his originality of melodious invention. In the Italian operas he imitates the florid style of his time, but there also considerable dramatic power is occasionally shown in the recitatives. Graun died on the 8th of August, 1759, at Berlin, in the same house in which, thirty-two years later, Meyerbeer was born.

GRAVELINES (Flemish *Gravelinghe*, German *Gravelingen*), a fortified seaport town of France, in the department of Nord and arrondissement of Dunkirk, is situated near the mouth of the Aa, 11 miles S. W of Dunkirk. The principal buildings are a church of the 16th century, the magazine, and the town hall. The harbor is only accessible at flood tide, but there is a considerable shipping trade in fish, apples, vegetables, and eggs. Shipbuilding is also carried on, and there are salt refineries, sail and linen manufactories, saw mills and meal mills. The fortifications were constructed anew by Vauban in the reign of Louis XIV. For its defence the land, to the distance of a mile all round, can be laid under water at pleasure. The population in 1901 was 2,077.

Gravelines was formed in 1160 by Count Thierry of Flanders, was conquered by the English in 1383, and came into the possession of the duke of Burgundy in 1405. It is celebrated for the victory gained by the Spanish under Egmont over the French under Marshal de Thermes, 13th July, 1558. It was taken by the duke of Orleans in 1644, retaken by Archduke Leopold in 1652, and again taken by the French under Vauban in 1658, after which it was confirmed to France by the treaty of the Pyrenees in 1659.

GRAVESEND, a municipal and parliamentary borough, river-port, and market-town in the county of Kent, England, is situated on the right bank of the Thames opposite Tilbury Fort, 30 miles below London by the river, and 24 miles by rail. It extends about 2 miles along the river bank, occupying a slight acclivity which reaches its summit at Windmill Hill, whence extensive views are obtained of the river, with its windings and shipping. The older and lower part of the town is irregularly built, with narrow and inconvenient streets, but the upper and newer portion contains several handsome streets, squares, and terraces. Gravesend is the boundary of the port of London. It has three piers, the town pier, erected in 1836, and belonging to the corporation, the terrace pier, built about 1840, and a new pier and station lately erected by the London, Tilbury, and Southend Railway Company. The town is a favorite resort of the inhabitants of London, both for excursions and as a summer residence. The principal buildings are the town-hall, a neat and conspicuous Doric edifice erected in 1836; the parish church of Gravesend, erected on the site of an ancient building destroyed by fire in 1727; Milton parish church, in the Late Decorated style, erected in the time of Edward II.; the county courts, the clubhouse of the Royal Thames Yacht Club, the custom-house, the assembly-rooms, the workmen's hall, the free grammar school, the almshouses for aged persons, and the dispensary and infirmary. East of the town are the earthworks designed to assist Tilbury Fort in obstructing the passage of an enemy's force. They were originally constructed on Vauban's system in the reign of Charles II., and some years ago they were strengthened at the cost of nearly £150,000. Gravesend has some import trade in coal and timber, and fishing, especially of shrimps, is carried on extensively. The principal other industries are boat-building, ironfounding, brewing, and soap-boiling. Fruit and vegetables are largely grown in the neighborhood for the London market. Since 1867 Gravesend has returned a member to parliament. The municipal borough includes the parishes of Gravesend and Milton. The population of the municipal borough in 1871 was 21,265, and of the parliamentary 27,493.

Gravesend occurs in Domesday Book under the name Gravesham. It was burnt by the French in 1377. In 1573 it obtained a charter of incorporation from Queen Elizabeth, who also renewed the right, first conferred by Richard II., of regulating the "Long Ferry" (or passage from London) and enacting a fee from the "barges, till-boats, light-horsemen (hohellers), and wherries" on the river. Pop. in 1901, 27,175.

GRAVINA, a city of Italy, in the province of Bari, is situated on a hill to the left of the river Gravina, 7 miles from Altamura, and 37 S. W. of Bari. It is surrounded by tower-flanked walls, and has a cathedral, and a castle which belongs to the Orsini family, of which the eldest branch still keeps the title of duke of Gravina. A great cattle fair is held in the town on April 20; a fine breed of horses is raised in the neighborhood; nitre is collected from the tufa rock of the district; and cheese, macaroni, and earthenware are manufactured. Population in 1901, 18,252.

GRAVINA, GIOVANNI VINCENZO (1664–1718), an

Italian litterateur and jurisconsult, was born at Roggiano, a small town near Cosenza in Calabria, January 20, 1664. He was descended from a distinguished family, and under the direction of his maternal uncle, Gregorio Caloprese, who possessed some reputation as a poet and philosopher, received a learned education, after which he studied at Naples civil and canon law. In 1689 he came to Rome, where in 1695 he united with several others of literary tastes in forming the Academy of Arcadians. A schism occurred in the academy in 1711, and Gravina and his followers founded in opposition to it the Academy of Quirina. From Innocent XII. Gravina received the offer of various ecclesiastical honors, but declined them from a disinclination to enter the clerical profession. In 1699 he was appointed to the chair of civil law in the college of La Sapienza, and in 1703 he was transferred to the chair of canon law. He died at Rome, January 6, 1718. He was the adoptive father of Metastasio.

Gravina is the author of a number of works of great erudition, the principal being his *Origines Juris Civilis*, completed in 3 vols. in 1713, and his *De Romano Imperio*, 1712. A French translation of the former appeared in 1775, of which a second edition was published in 1822. His collected works were published at Leipsic in 1737, and at Naples, with notes by Mascovius, in 1756.

GRAVITATION.—I. GRAVITATION AT THE SURFACE OF THE EARTH.—It is a matter of universal experience all over the earth that a heavy body tends to fall to the ground. Let us inquire into this in the first place by taking such a general view of the phenomenon as would be presented to an imaginary spectator who was sufficiently removed from the earth to be able to take a general view.

Fig. 1 represents a section of the earth by a plane which is drawn through its centre O. Then, the earth being sufficiently near a sphere for our purpose, we may regard the section PQRS as a circle, where the points P, Q, R, S are the intersections of the lines OA, OB, OC, OD, with the surface of the earth. If a stone be dropped from a point A above the surface of the earth, it will fall to the ground at P. The spectator would also notice that, if a stone were dropped from B or C or D, it would fall upon the ground at the points Q, R, S respectively. From A the stone would appear to fall downwards, from C it appears to move upwards, from B the spectator would see the stone moving to the left, while from D it appears to move to the right. One feature of these motions could not fail to be noticed; they all tend to the centre of the earth. The spectator might therefore sum up his experience in the following statement:—

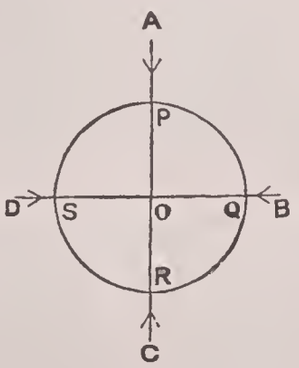


FIG. 1.

A body dropped from a point above the surface of the earth always falls in a straight line which is directed towards the centre of the earth.

§ 1. *Attraction.*—The familiar instance of the action of a magnet upon a piece of iron will suffice to illustrate what is meant by the word *attraction*. In virtue of certain properties possessed by the iron and the magnet, they are drawn together. The magnet draws the iron, and the iron draws the magnet. This particular kind of attraction is of a very special character. Thus, for example, the magnet appears to have no appreciable influence on a piece of wood or a sheet of paper, and has indeed no considerable influence on any known substance except iron.

By the attraction of gravitation, every body attracts every other body, *whatever be the materials of which each is composed*. In this we see a wide difference between the attractions of gravitation and that form of attraction which is known as magnetic attraction. Nor is the contrast between the *intensities* of these two different attractions less striking. The keeper of a magnet is drawn to the magnet by two different forces of attraction. The first of these is the gravitative attraction, which, so far as we know at present, would be equally exerted, whether the magnetism were present or not. The second is the magnetic attraction. The latter is enormously greater than the former; in fact, under ordinary circumstances as to intensity and dimensions, the intensity of the attraction of gravitation will not be nearly so much as a millionth part of the magnetic attraction.

The intensity of the attraction of gravitation is indeed so small, that, with one conspicuous exception, we can only become aware of its existence by refined and elaborate inquiries. That any two objects—for example, two books lying on the table—do actually attract each other, there can be no doubt whatever; but the intensity of this is so small that the attractive force cannot overcome the friction of the table, and consequently we do not find that the books are drawn together. It has, however, been found that the intensity of the attraction of gravitation between two masses is directly proportional to the product of those masses. Hence though the force is so small as to be almost inappreciable between two bodies of moderate dimensions, yet when the masses of the two bodies, or of even one of them, are enormously great, the intensity of the force will be sufficiently large to be readily discernible. In this way it is that the existence of the attraction of gravitation has been made known to us, and is, in fact, identified with our daily experience,—indeed, with our actual existence. The mass of the earth is so enormous that the attraction of gravitation which exists between it and an object near the surface is readily appreciable. It is this attraction of gravitation between the earth and any object which constitutes that force which is referred to when we speak of the *weight* of the body. It is the attraction of gravitation which causes bodies to fall to the surface of the earth; and it is easy to show that the facts already presented with respect to the direction in which a falling body moves are readily explained by the supposition that the motions are due to an attractive influence exerted by the earth, or, to speak more correctly, to a mutual attraction subsisting between the earth and the body.

Let O be the centre of the earth, supposed to be a sphere, and let A be the position of a body above its surface. Then, when the body is released, the attraction must evidently cause the body to move along the line OA. The line OA, in fact, is directed along a diameter of the sphere, and there is really no reason why the stone should move to one side of the line more than to another. We thus see that attraction would always tend to draw objects in a direction pointing towards the centre of the earth. The observed facts are therefore explained by the supposition that the earth possesses a power of attraction.

§ 2. *Movement of a Falling Body.*—Our knowledge of the force of gravitation being ultimately founded on observation and experiment, it will be convenient at this point to describe the experiments by which a knowledge of the laws of motion of a falling body may be ascertained. We shall first describe these experiments, and then we shall discuss the laws to which we are conducted by their aid.

A beginner is apt to be surprised when he is told that a heavy body and a light body will fall to the ground in the same time if let drop from the same height. Yet nothing can be easier than to prove this important fact experimentally. Take a piece of cork in one hand and a bullet in the other, and drop these two objects at the same moment from the same height. They will reach the ground together. Nor will the results be different if we try a stone and a piece of wood. If, however, one of the objects were a feather and the other were a stone, then no doubt the latter would reach the ground long before the former. But this arises from a cause quite different from gravity. It is the resistance of the air which retards the motion of the feather. Even the stone is retarded to a certain extent by the resistance of the air; but the feather, on account of its greater surface in proportion to its mass, is much more retarded. If we could get rid of the influence of the air, the stone and the feather would be found to fall to the ground in the same time. This can actually be verified by performing the experiment (or a similar one) in a space from which the greater portion of the air has been withdrawn by the aid of an air-pump. But the same thing can also be shown in a much more simple manner. Lay a small flat feather upon the top of a penny piece held horizontally. Then let the penny fall; it will be followed with equal rapidity by the feather, which will be found to remain in contact with the penny throughout the entire descent. In this case the penny piece displaces the air, and thus to a great extent shields the feather from the resistance to which it would be exposed without such pro-

tection; it is thus found that the two objects fall to the ground from the same height at the same time.

The various experiments to which we have referred suffice to establish the very important result that *the time occupied by a body in falling to the surface of the earth, if dropped from a point above it, is independent of the mass of the body as well as of the materials of which the body is composed.*

There are, no doubt, certain apparent exceptions to the generality of this statement. The law, as we have stated it, does surely not apply to the case of a balloon or a live bird. In each of these cases the air is made, directly or indirectly, to supply a force which overcomes the force of gravity and neutralizes its effects; but *if there were no air*, then the balloon and the bird would fall to the ground in precisely the same time as a 56 lb weight will do when dropped from the same height. It will not be necessary for us to introduce any further reference to the resistance of the air, and we shall discuss the phenomena presented by falling bodies as they would occur in a space from which the air has been removed.

We have by these considerations cleared the way for a very important quantitative determination. Taking a given interval of time,—for example, one second,—we see that the height through which a heavy body will fall in one second depends neither upon the mass of the body nor on the materials of which it is composed. This is therefore a constant at any given place on the earth's surface for every description of body, and it is of fundamental importance to determine that quantity accurately. By an indirect method, founded on pendulum observations, it is possible to determine this quantity with far greater accuracy than would be attainable by actually making the experiment. The value as thus found is slightly different at different parts of the earth though constant at each one. At any part of the United Kingdom it may be taken as 16·1 feet.

When the distance which the falling body moves over in the first second has been ascertained, it is possible to find the distance which will be accomplished in two seconds, or indeed in any number. The difficulty of the question arises from the circumstance that, as the velocity of the falling body is gradually increasing, the distance moved over in the second second is greater than it was in the first, and generally that the distance in any second is greater than the distance accomplished in any previous second. Imagine the "lift" in a hotel to be a room 16·1 feet high; then when the lift is at rest, a stone will take one second to fall from the top of the room to the floor. But now suppose the experiment to be repeated, when the lift is either ascending or descending. It will be found that no matter what be the velocity of the lift, provided it remains uniform for a second, and no matter whether the lift be ascending or descending, the stone will still take exactly one second to fall from the ceiling to the floor.

To illustrate the important conclusions which can be drawn from this experiment, let us make some suppositions with reference to the velocity of the lift. Suppose that the lift is descending with a velocity of 5 feet per second. Then since it is found that the stone will reach the floor in one second, it is manifest that during that second the stone must actually have fallen through a distance equal to the height of the room augmented by the 5 feet through which the floor of the room has descended. The total distance traversed by the stone is therefore $16{\cdot}1+5=21{\cdot}1$ feet. It is, however, to be observed that at starting the stone must necessarily have had the same velocity as the lift, *i. e.*, 5 feet per second. The observed facts can therefore be explained by supposing that the stone retained its initial velocity of 5 feet per second, and that gravity acted upon the stone so as to draw it 16·1 feet nearer the earth than it would have been had gravity not acted. On the other hand, suppose that at the time when the experiment was made the lift was ascending with an uniform velocity of 5 feet per second. Then the actual distance travelled by the stone in falling will be less than the height of the ceiling by the distance through which the floor has been raised, *i. e.*, $16{\cdot}1-5=11{\cdot}1$ feet. Observation nevertheless shows that the time occupied in falling from the ceiling to the floor is still one second. The observed facts can be explained by remembering that at the moment of starting, the stone must actually have had the same velocity as the lift, *i. e.*, an upward velocity of 5 feet per second. If therefore gravity had not acted, the stone would in one second have ascended through a vertical distance of 5 feet. The observations are therefore explained by supposing that gravity in this case also draws the body 16·1 feet nearer the earth in one second than the body would have been had gravity not acted.

By suitable contrivances it is possible to ascertain that a body dropped from rest will in a time of two seconds move over a space of 64·4 feet. We have already seen that during the first second the body will fall 16·1 feet. It follows that in the second second the space described by a body falling freely from rest is $64{\cdot}4-16{\cdot}1=48{\cdot}3$. It is thus obvious that the space described in the second second is three times as great as the space described in the first second. To what is this difference to be ascribed? At the commencement of the first second the body was at rest; at the conclusion of the first second the body had attained a certain velocity, and with this velocity the body commenced its motion during the second second. The total distance of 48·3 feet accomplished during the second second is partly due to the velocity possessed by the body at the *commencement*, and partly to the action of gravity *during* that second. By the principle just explained, we are able to discriminate the amounts due to each cause. It appears, from the experiments already referred to, that during the second second as during the first the effect of gravity is simply to make the body 16·1 feet nearer the earth than it could otherwise have been. But the body moves altogether 48·3 feet in the second second, and as the action of gravity during that second will only account for 16·1 feet, it follows that the residue, amounting to $48{\cdot}3-16{\cdot}1=32{\cdot}2$ feet, must be attributed to the velocity accumulated during the first second.

We are therefore led to the very important result that a body falling freely from rest in the United Kingdom will have acquired a velocity of 32·2 feet per second when one second has elapsed. It need not be a matter for surprise that, though at the close of the first second the velocity acquired is 32·2, the distance moved over during that second is only 16·1. It will be remembered that the body starts from rest, and that while in the act of falling its velocity is gradually increasing. The body, therefore, moves much further in the last half of the second than it did in the first half, and consequently the total distance travelled must be less than the distance which would have been accomplished had the body been moving during the whole second with the velocity acquired at its termination.

It might not be easy to arrange a direct experiment to show how far the body will fall during the third second; we can, however, deduce the result by reasoning from what we have already learned. Let us suppose that the lift already referred to is descending with an uniform velocity of 32·2 feet per second. A body let drop from the ceiling during the motion will, as before, reach the floor in one second. The body will therefore have acquired, *relatively to the moving lift*, a velocity of 32·2 feet per second. But the lift is itself in motion with a velocity of 32·2 feet per second. The *actual velocity* of the body must be measured by its velocity relatively to the lift, added to the velocity of the lift itself. It therefore appears that the body which, when it commenced to fall, had a velocity of 32·2 feet per second, acquires an equal amount during its fall, so that at its close the body actually had a velocity of $32{\cdot}2+32{\cdot}2=64{\cdot}4$ feet per second. A body falling freely from rest acquires a velocity of 32·2 feet in the first second; it follows that at the close of the first second the body is in the same condition as if it were let fall from the ceiling of the lift, under the circumstances just described. The motion during the third second is therefore commenced with the velocity of 64·4 feet, and in consequence of this initial velocity alone a distance of 64·4 feet will be accomplished in the third second. To this must be added 16·1 feet, being the additional distance due to the action of gravity, and therefore we have for the distance through which a body falling freely from rest will move in the third second, $64{\cdot}4+16{\cdot}1=80{\cdot}5$. Similar reasoning will show that the velocity acquired at the close of the third second is $64{\cdot}4+32{\cdot}2=96{\cdot}6$. With this velocity the fourth second is commenced, and therefore the distance accomplished during the fourth second is $96{\cdot}6+16{\cdot}1=112{\cdot}7$.

The results at which we have arrived may be summarily stated in the following propositions:—

A body falling freely from rest acquires a velocity which is equal to the product of 32·2 and the number of seconds during which the motion has lasted.

A body falling freely from rest moves over spaces proportional to the consecutive odd numbers (1, 3, 5, 7, etc.) *in each of the consecutive seconds during which the motion lasts.*

A body falling freely from rest will, in a given number of seconds, move over a distance which is found by multiplying the square of the number of seconds by 16·1.

§ 3. *Values of g.*—The velocity acquired by a body in one second is usually denoted by the symbol g. The following are values of g at different parts of the earth (adapted from Everett *On C.G.S. Units*, p. 12):—

	Latitude.	Value of g in Feet per Second.	Length in Feet of Pendulum beating seconds.
Equator	0° 0′	32·091	3·2514
Latitude 45°	45 0	32·173	3·2597
Munich	48 9	32·181	3·2607
Paris	48 50	32·183	3·2609
Greenwich	51 29	32·191	3·2616
Göttingen	51 32	32·191	3·2616
Berlin	52 30	32·194	3·2619
Dublin	53 21	32·196	3·2621
Manchester	53 29	32·196	3·2622
Belfast	54 36	32·199	3·2625
Edinburgh	55 57	32·203	3·2629
Aberdeen	57 9	32·206	3·2632
Pole	90 0	32·255	3·2682

The value of g in feet at a station of which the latitude is λ, and which is h feet above the level of the sea, is in feet

$$g = 32{\cdot}173 - 0{\cdot}082 \cos 2\lambda - 0{\cdot}000003h.$$

The length of the pendulum in feet which vibrates in one second is

$$l = 3{\cdot}2597 - 0{\cdot}0083 \cos 2\lambda - 0{\cdot}000000h.$$

g is really the excess of gravitation over the centrifugal force arising from the earth's rotation. The value of *gravitation alone* is given by the following expression:

$$32{\cdot}225 - 0{\cdot}026 \cos 2\lambda.$$

§ 4. *Algebraical Formulæ.*—The employment of the symbols and operations of algebra will enable us to express very concisely the results at which we have arrived.

Let v denote the velocity acquired in t seconds by a body which has been dropped from a state of rest. Let s denote the number of feet over which the body has moved. The laws we have arrived at may be thus expressed:—

$$v = gt; \qquad s = {\cdot}5gt^2.$$

From these equations we can eliminate t and obtain

$$v^2 = 2gs.$$

This expresses the velocity acquired in terms of the distance through which the force has acted.

We have hitherto considered the movement of a falling body which was simply *dropped*. It remains to determine the effect on the movement of the body which would be produced by a certain initial velocity. Let us for simplicity take the case of a body thrown vertically downwards, and calculate the distance through which the body will move in a certain time, as well as the velocity which it will acquire. In the act of throwing, the hand moves with a certain velocity, and the body when released starts off with that velocity. It will thus be observed that the act of throwing is merely to impart initial velocity to the body. Let v' be the initial velocity with which the body leaves the hand. Then the velocity of the body at the moment of starting is precisely the same as it would have been had it been dropped from rest $v' + g$ seconds previously. The velocity acquired at the end of t seconds is therefore the same as would have been acquired by a body which fell from rest for a period of $(v' + g + t)$ seconds; whence we have

$$\begin{aligned} v &= g(v' + g + t) \\ &= v' + gt. \end{aligned}$$

The distance must obviously be equal to the difference between the distance through which the body would drop from rest in $(v' + g + t)$ seconds and the distance through which a body would drop from rest in $v' + g$ seconds; whence

$$\begin{aligned} s &= {\cdot}5g(v' + g + t)^2 - {\cdot}5g(v' + g)^2 \\ &= {\cdot}5g(v'^2 + g^2 + 2v't + g + t^2) - {\cdot}5g(v'^2 + g^2) \\ &= v't + {\cdot}5gt^2. \end{aligned}$$

The case of a body projected vertically upwards seems at first to present somewhat greater difficulties, but this is not really the case. Such problems can always be readily solved by the help of the following general principle:—

A body moving vertically for t seconds will, at the end of that time, be $\cdot 5gt^2$ *feet nearer the earth than it would have been had gravity not acted.*

If the body be projected vertically upwards with an initial velocity v', then, if the influence of gravity were suspended, the body would in t seconds ascend to a height $v't$ in accordance with the first law of motion. The effect of gravity will be to reduce the height actually obtained by the amount $\cdot 5gt^2$. Whence we have

$$s = v't - {\cdot}5gt^2.$$

This expression may be written in the form

$$s = v'^2 + 2g - {\cdot}5g(t - v' + g)^2.$$

It is therefore obvious that the greatest altitude h is attained when

$$t = v' + g;$$

in which case

$$h = v'^2 + 2g,$$

or

$$v'^2 = 2gh.$$

As an illustration we may take the case of a body thrown vertically upwards with an initial velocity of 40 feet per second, and inquire where that body will be at the end of two seconds. Had gravity not acted, the body would, in two seconds, have ascended to a height $2 \times 40 = 80$ feet. The action of gravity will reduce this by $\cdot 5g2^2 = 2g$ feet, and hence the actual height of the body will be $80 - 2g$ feet, $= 15{\cdot}6$ if g be taken at 32·2.

§ 5. *Motion of a Projectile.*—We have hitherto referred only to the motion of a falling body in a vertical line; it will now be necessary to examine some cases in which the motion of the body is not so restricted. From a point on the mast of a steamer $g + 2$ feet above the deck a ball is dropped, which falls upon the deck at a certain point. When the steamer is at rest the time taken by the ball to fall will of course be one second, and its path will be vertical; but when the steamer is moving with uniform velocity it is found that the ball still falls precisely on the same spot of the deck as when the steamer was at rest, and that the time occupied in the descent is still one second. It is obvious that in this case the ball does not move in a straight line at all, but in a curved path due to the motion of the vessel compounded with the actual falling motion. We therefore see that the effect of the motion of the vessel on the ball was to project that ball with a certain initial horizontal velocity, but that notwithstanding that initial velocity the ball still reaches the deck in one second. We are therefore led to the general conclusion that

A body projected horizontally will, at the end of t *seconds, have fallen through a space of* 16·1 t^2 *feet.*

An experiment illustrating this result may be made in an exceedingly simple manner. Take a marble in each hand, and throw one of the marbles horizontally at the same time as you drop the other from the same height; you will find that the two marbles reach the ground together. Suppose for simplicity that the height at the moment when the marbles are released is 4 feet, then the time taken by one of the marbles in falling is half a second. But as both marbles reach the ground together, the experiment has really proved to us that a body at the height of 4 feet from the ground will if projected *horizontally* reach the ground in half a second. This is equally true whatever be the magnitude of the velocity, *i. e.*, whether it be 5, 10, or any other number of feet per second.

We have now studied the effect of gravity upon a body which has been projected either in a vertical line or in a horizontal line. We have found that in each case the effect of gravity is to bring the body $\cdot 5gt^2$ feet nearer the surface of the earth in t seconds than it would have been had gravity not acted. We are therefore tempted to inquire whether the same statement would not be true for a body projected *in any direction*. In every way in which this suggestion can be tested it has been

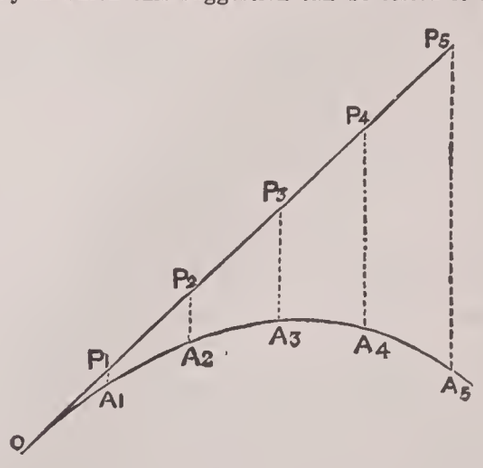


Fig. 2.

found to be verified, and there cannot therefore be the slightest doubt that it is true.

To illustrate this principle we may apply it to the case of a

body projected in any direction, and deduce the form of the path in which the body moves. Let O (fig. 2) be the point from which the body is projected, and let OP be the direction in which the body would move after projection if it were not for gravitation. In consequence of the first law of motion, we should find that if it had not been for the action of gravity the ball would reach P_1 in one second, P_2 in two seconds, etc., where $OP_1 = P_1P_2 = P_2P_3$ . . . Gravitation will, however, make the body swerve from the direction OP_1P_2, etc., so that at the end of one second the body is really found at the point A_1, at the end of two seconds at A_2, at the end of three seconds at A_3, etc. The curve drawn through the points A_1, A_2, A_3, etc., which is actually described by the body, can be readily constructed. Take, for example, $t = 3$. If gravity had not been acting, the body would in three seconds have reached the point P_3. We can find where the body actually is by taking a point A_3, which is vertically beneath P_3 at the distance $16{\cdot}1 \times 3^2$ feet. Similarly we can find where the body is after any other specified number of seconds, and thus we obtain the points A_1, A_2, etc.

The equation of the curve is thus found. Take the line OP as the axis of x, and let x denote the number of seconds during which the motion has lasted; then, if y denote the vertical distance through which the body has been deflected by gravity, we must have

$$y = v'x - {\cdot}5gx^2.$$

This curve, being of the second degree, represents a conic section; and as the highest terms form a perfect square, the conic section must be a parabola.

II. The Centre of Gravity.

§ 6. *Centre of Gravity of a Plate.*—In studying the effect of gravity upon a body which is at rest, it will be convenient to commence with a simple illustrative experiment which can be easily tried. Out of a piece of cardboard or tin plate a figure of *any shape*, ABCDE (fig. 3), is to be cut. A few holes, A, B, C, D, E, are to be punched quite at random in this plate. In the wall is a nail, and the plate can be suspended by passing the nail through any of the holes A, B, and C. From the nail is suspended, in front of the plate, a cord AH, which is kept in the vertical direction by the plummet attached to it at H. As the plate is not supported in any other way, it hangs quite freely from the nail; and if it be displaced and then released, it will, after a few oscillations, settle down again in the position which it occupied at the first. In order to mark this position, it is desirable to draw a line on the plate in the direction AP, indicated by the plummet line which is hanging in front. If the plate be blackened, this can be neatly done by chalking the plummet line and then giving it a flip against the plate.

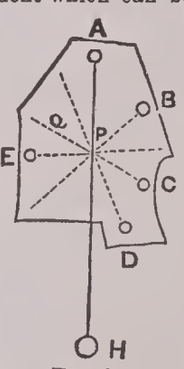


Fig. 3.

When the line has been drawn the plate may be removed from the nail, and again suspended by one of the other holes in its margin, for example B. The plate again assumes a definite position, and again the line and plummet is to be hung on, and a second line drawn as before. The two lines drawn on the plate intersect at a point P. When the plate is hung from a third hole, C, and a third plummet line is drawn, a very remarkable result is perceived. It is found that the line drawn on the third occasion passes *through the intersection of the two former lines*,—that is to say, all the three lines pass through the point P. Repeating the operation, with other holes, D, E, etc., it is found that all the lines drawn in the way we have described possess the remarkable property of passing through one definite point of the plate. It is therefore manifest that the point P possesses a very special property, for it is always situated vertically beneath the point of suspension when the plate is hanging at rest.

If a hole be actually punched at the position of the point P, and if the plate be suspended by passing this hole over the nail, we then find that *the plate will remain at rest in any position whatever*. This peculiarity of the point P will be more readily perceived if we make a hole in the plate at a point Q near to P. When the plate is suspended from Q it will only be at rest in one position, *i. e.*, when P is vertically beneath Q.

It must surely be regarded as a matter worthy of careful notice that any plate of any figure, regular or irregular, should contain one specific point which enjoys the unique properties which the experiments show to be possessed by the point P. This point has received a name; it is called the *centre of gravity*.

§ 7. *Centre of Gravity of a Rigid Body.*—In the illustration we have just given, we have spoken merely of a thin plate, because the experiments were more easily conducted in a body of this nature than in one of entirely irregular form. It must not, however, be supposed that a thin plate of uniform thickness is the only kind of body which possesses a point having the properties we have described. No matter what be the shape or materials of which a rigid body is composed, it possesses a centre of gravity. Let ADBC (fig. 4) be a body of any kind, and let it be suspended by a cord from a point A. Then when the body is at rest it assumes a certain position. We may suppose that a vertical hole AB is drilled through the body in the direction of the cord by which the body is suspended. If we now suspend the body by another point on its surface, C, the body will come to rest in the position which is represented in fig. 5. It will be found that these two straight holes intersect in the interior of the body at G. In fact, if we thrust a knitting-needle through one of the holes, and then attempt to thrust a second knitting-needle through the other hole, we shall find that the way is stopped in the interior of the body by the first knitting-needle. If the body be now suspended from any other point on its surface, and if a similar hole be made through the point and in the direction of the string by which the body is suspended, it will be found that this hole also passes through the intersection of the two former holes. From each and every point of suspension the same result is obtained, and thus we are led to the conclusion that in a rigid body of any shape or materials whatever there is one point which possesses the remarkable property thus stated:—

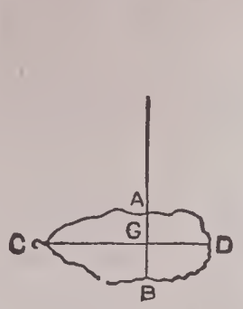


Fig. 4.

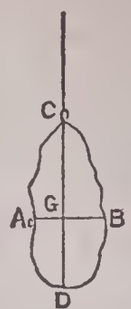


Fig. 5.

When a body suspended by a cord from a fixed point is at rest, there is one special point which is always vertically beneath the point of suspension, whatever may be the point of the body to which the cord is attached. This point is called the centre of gravity.

In the case of a homogeneous body of regular shape, the centre of gravity is determined from the most simple considerations of symmetry. In the case of a sphere it is obvious that the centre of gravity must lie at the centre, for there is no other point symmetrically related to the figure. In the case of a parallelopiped the centre of gravity is also situated at the centre of volume. This is found by joining the opposite corners of the figure, and thus making a diagonal; joining another pair of opposite corners we have a second diagonal; and the intersection of these two lines gives the centre of gravity of the mass.

§ 8. *Gravitation of a Rigid Body reduced to One Force.*—A body of any description may be considered to be composed of an innumerable multitude of small particles of matter. Each of these particles is acted upon by the attraction of the earth. Each particle is therefore urged towards the earth by a certain force which tends towards the earth's centre. The centre of the earth being nearly 4000 miles distant, the directions of these forces may, for all practical purposes, be regarded as parallel. Even if two particles were a mile distant, the inclination of the directions of the two forces is under a minute. We may therefore treat the forces as parallel without making any appreciable error. Two parallel forces may be compounded into a single force which is parallel to the two components. The forces acting on the two particles of the body may therefore be replaced by a single force. This force may be similarly compounded with the force acting on a third particle of the body, this resultant with the force on a fourth particle, and so on until all the particles have been included. We thus come to the important conclusion that the effect of gravity upon a body of any shape is to produce *one force* which acts vertically downwards. It remains to be shown that *the direction of this force passes through the centre of gravity of the body*. Suspend a body of any shape by a cord, then when the body is at rest the centre of gravity must lie vertically beneath the point of suspension. If the direction of that one force which constitutes the effect of gravity does not pass through the centre of gravity, then its line of action cannot coincide with the direction of the cord of suspension, but it is impossible that two forces should equilibrate unless their lines of action are coincident, whence we are led to the important conclusion that the effect of the attraction of the earth upon a rigid body is to produce a single force which passes through the centre of gravity of the body and acts vertically downwards.

III. Universal Gravitation.

§ 9. *Law of Gravitation between Two Masses.*—Investigations of the motions of the planets have conducted us to the conclusion that each planet is attracted towards the sun by a force which varies according to the inverse square of the distance. We likewise see that each of the satellites appears to be attracted towards the corresponding primary planet by a force which obeys the same law. We are therefore tempted to generalize these results into the proposition that *any two masses in*

the universe attract each other with a force which varies according to the inverse square of the distance. Observations of the most widely different character have combined to show us that this law, which was discovered by Sir Isaac Newton, is true. It is called *the law of Gravitation.*

We suppose that the distance between the two bodies is so exceedingly great compared with their dimensions that we may practically consider each of the bodies as a particle.

Let m, m' be the masses of the two bodies, and let r be the distance. The force with which m attracts m' is equal in magnitude though opposite in direction to the force with which m' attracts m. The reader may perhaps feel some difficulty at first in admitting the truth of this statement. We speak so often of the effects which the attraction of the sun produces on the planets that it may seem strange to hear that each planet reacts on the sun with a force precisely equal and opposite to the force with which the sun acts upon the planets. We can, however, by the aid of a simple illustration, show that such is really the case. Suppose the sun and the earth to be placed *at rest* in space, and abandoned to the influence of their mutual gravitation. It is evident that the two bodies would begin moving towards each other, and would after a certain time come into collision. If, however, the earth and the sun had been separated by a rigid rod, it would then be impossible for the two bodies to move closer to each other, so we must consider whether any other motion could be produced by their mutual attraction. As the two bodies were initially at rest, it is clear that there will be no tendency of the rod to move out of the line in which it was originally placed, and consequently if the rod begin to move at all it must move in that line, and carry with it the earth at one end, and the sun at the other. As, however, the earth and the sun would remain separated at a constant distance, the statical energy due to their separation would remain constant, and therefore if they began to move we should have the kinetic energy of their motion created out of nothing, which is now well known to be impossible. It therefore follows that, under the circumstances we have assumed, the rod would remain for ever at rest. But what are the forces which act upon the rod? At one end of the rod the earth presses upon it with a force which is equal to the attraction of the sun upon the earth. At the other end the sun presses upon the rod with a force which is equal to the attraction of the earth upon the sun. But since the rod remains at rest, these two forces must be equal and opposite, and hence the force with which the sun attracts the earth must be equal and opposite to the force with which the earth attracts the sun.

If we express the gravitation of two masses in the form

$$f(m,m') \div r^2,$$

then m and m' must enter symmetrically into the expression, for if the two masses were interchanged the gravitation must not be altered.

We should here also advert to a circumstance connected with gravitation which is of the very highest importance. Suppose we take two definite masses (for simplicity, two pounds) separated at a definite distance (for simplicity, one foot), then the gravitation of these two masses to each other is a certain *definite* force (which we shall subsequently calculate). What we want here to lay special stress upon is that, so far as we know at present, this force appears to be the same whatever be the *material* of which the two masses are composed. Thus two pounds of iron at a distance of one foot attract each other with the same force as a pound of iron would attract a pound of lead at the same distance. The significance, or perhaps it should be said the vast importance, of this statement is apt to be lost sight of from a somewhat peculiar cause. It must never be forgotten that, when it is asserted that two masses are equal to each other, what is really meant is that, if equal forces were to act upon each of the masses for the same time, the masses would receive the same velocity. As this test of the equality of masses is not practically convenient, the weighing scales have come into use for the purpose; and though it appears to be true that when two masses have equal "weights," as tested by the scales, then the masses are themselves equal, yet this is so far from being an obvious or necessary truth that it really is the most remarkable phenomenon connected with gravitation. The expression for the gravitation of two attracting masses must therefore depend solely upon their masses, upon their distance, and upon some specific constant which is characteristic of the intensity of gravitation.

Experiment shows that the gravitation of a body towards the earth is directly proportional to its mass, and hence we see that the expression

$$f(m, m') \div r^2$$

must be proportional to m, and as $f(m, m')$ must be unaltered by the interchange of m and m', it appears finally that the gravitation of the two masses is

$$\epsilon m m' \div r^2,$$

where ϵ is a numerical constant which is equal to the gravitation of two units of mass placed at the unit of distance. To form a definite conception of the intensity of this force, we take some specific instances. It can be shown that two masses A and B, each containing 415,000 tons of matter, and situated at a distance of one statute mile apart, will attract each other with a force of one pound. If the masses of A and B remain the same, and if the distance between them be increased to two miles, then the intensity of the force with which the two masses gravitate together is reduced to one quarter of a pound. If either of the masses were doubled, the distance being unaltered, then the force would be doubled. If both the masses were doubled, then the force would be quadrupled.

§ 10. *Motion of a Planet round the Sun.*—The effect of gravitation when the bodies are in actual motion must next receive our attention. It may so happen that in consequence of the attraction of gravitation one of the bodies will actually describe a circle around the other, so that, notwithstanding the effect of the attraction, the distance between the two bodies remains constant. We shall first explain, by elementary considerations, how it is possible for a planet to continue to revolve in a circular or nearly circular orbit about the sun in its centre; and then we shall proceed to the more exact consideration of the form of the orbit, and the laws according to which that orbit is described.

Let S represent the sun (fig. 6), and let T be the initial position of the planet. If the planet be simply released, it will immediately begin to fall along the line TS into the sun. If, on the other hand, the planet were initially projected along the line TZ perpendicular to TS, the attraction of the sun at S will deflect the planet from the line TZ which it would otherwise have followed, and compel the planet to move in a curved line. The particular form of curve which the planet will describe depends upon the initial velocity. With a small initial velocity the deflecting power of the sun will have a more speedy effect than is possible when the initial velocity is considerable. The rapidly curving path TX will therefore correspond to a small initial velocity, while the flatter curve TY may be the orbit when the initial velocity is considerable. As the movement proceeds, the velocity of the planet will generally alter. If the planet were moving along the curve TY, it is at every instant after leaving T going farther away from the sun. It is manifest that the planet is thus going against the sun's attraction, and therefore its velocity must be diminishing. On the other hand, when the planet is moving along the curve TX, it is constantly getting nearer the sun, and the effect of the sun's attraction is to increase the velocity. It is therefore plain that for a path somewhere between TX and TY the velocity of the planet must be unaltered by the sun's attraction. With centre S and radius ST describe a circle, and take a point P on that circle exceedingly near to T. With a certain initial velocity it is possible to project the planet so that it shall describe the arc TP. The attraction of the sun always acts along the radius, and hence in describing the arc TP the planet has at every instant been moving perpendicularly to the sun's attraction. It is manifest that under such circumstances the sun's attraction cannot have altered the velocity, for it would be impossible to give a reason for the velocity having been accelerated which could not be rebutted by an equally valid reason for the velocity having been retarded. We thus see that the planet reaches P with an unchanged velocity, and at that point the direction of the motion is perpendicular to the radius. It is therefore clear that after passing P the planet will again describe a small portion of the circle, which will again be followed by another, and so on, *i. e.*, the planet will continue to move in a circular orbit. We have therefore shown that, if a planet were originally projected with a certain specific velocity in a direction at right angles to the radius connecting the planet and the sun, then the planet would continue for ever to describe a circle around the sun.

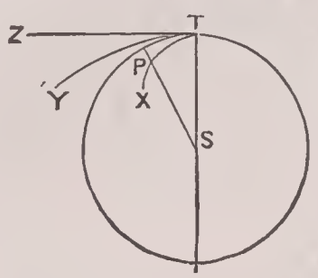


FIG. 6.

§ 11. *On the Elliptic Motion of the Planets.*—The laws of the motions of the planets were discovered by Kepler by means of calculations founded upon observations. They may be thus stated:—

1. *Each planet moves in an ellipse in one focus of which the sun is situated.*

2. *The radius vector drawn from the sun to the planet sweeps over equal areas in equal times.*

3. *The squares of the periodic times of the motions of the planets round the sun are in the same ratio as the cubes of their mean distances.*

These three laws form the foundations of that branch of astronomy which is called Physical Astronomy, and they are generally known as *Kepler's Laws.*

The sun and the planets are all very nearly spherical, and for the present, whenever we speak of the motions of the sun

or the planets, we are to understand the motions of the centres of the corresponding spheres. Indeed, the diameters of these spheres are so small in comparison with the distances at which they are separated from each other, that we may *generally* regard them as mere physical points. Thus, though the diameter of the sun is ten times greater than the diameter of the greatest planet, Jupiter, yet the sun's diameter is only the forty-second part of its distance from the nearest planet, Mercury, and it is less than the three thousandth part of its distance from the outermost planet, Neptune.

The orbits of the planets are so little eccentric that at a first glance the majority of them appear to be circular. Among the larger planets the orbits of Mercury and of Mars have the greatest eccentricity, being about $\frac{1}{5}$ and $\frac{1}{11}$ respectively. Next to these comes the orbit of Saturn, which has an eccentricity of $\frac{1}{18}$. Next in order come Jupiter, Uranus, the Earth, Neptune, and Venus, with eccentricities of $\frac{1}{21}$, $\frac{1}{21}$, $\frac{1}{60}$, $\frac{1}{115}$, $\frac{1}{146}$ respectively. The orbits of some of the minor planets are, however, much more eccentric.

§ 12. *The Hodograph.*—In discussing the actual motion of a planet around the sun, it is very convenient to introduce the

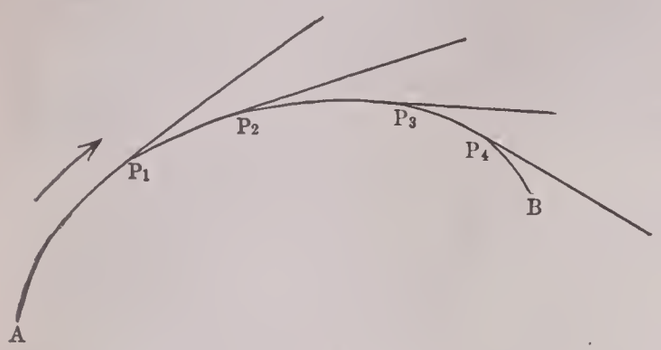


Fig. 7.

elegant conception of the hodograph. The use of this curve is originally due to Bradley, but for its practical development we are principally indebted to Sir W. R. Hamilton. Let AB (fig. 7) be a portion of the path of a particle P acted upon by any forces. From any point O draw radii vectores OR_1, OR_2, OR_3, OR_4 (fig. 8), parallel to the tangents to the curve AB drawn at the points, P_1, P_2, P_3, P_4, and equal to the velocities at those points. Then the curve R_1, R_2, R_3, R_4 is the hodograph of the orbit of P. To each position P of the particle in the path there is a corresponding point R in the hodograph; and simultaneously with the motion of P in its orbit we have the motion of R in the hodograph.

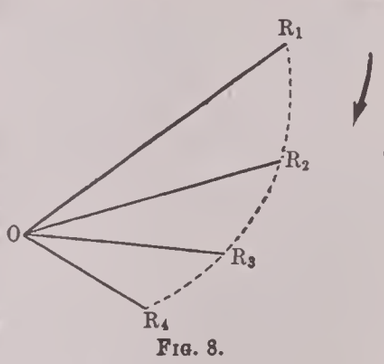


Fig. 8.

The utility of the hodograph depends upon the theorem that *the force which acts upon the particle is at any time equal and parallel to the velocity of the corresponding point in the hodograph.* This theorem is thus proved. Let P_2 and P_3, and therefore R_2 and R_3, be very close together. The velocity im-

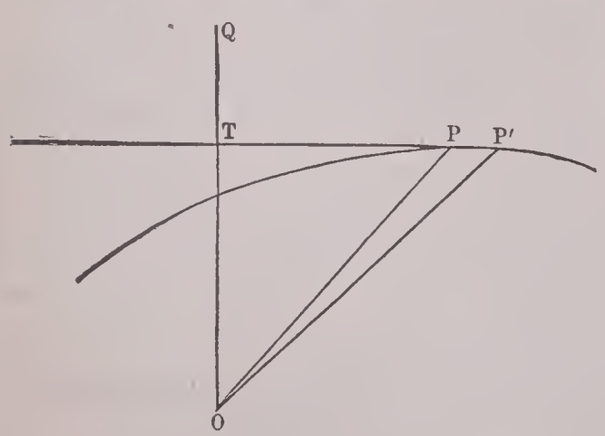


Fig. 9.

parted to the particle in passing from P_2 to P_3 in the small time δt must, when compounded with the velocity OR_2, produce the velocity OR_3. This increment of velocity must therefore be equal and parallel to R_2R_3. If therefore v denote the velocity of R, we have $v\delta t$ for the velocity acquired in the time δt. The force acting on P must therefore, by the second law of motion, be equal to v and parallel to the line R_2R_3, which ultimately coincides with the tangent. The theorem is therefore proved.

Kepler's second law states that in the movement of a planet around the sun the radius vector from the sun to the planet describes equal areas in equal times. It can be shown that when this is the case the force which acts upon the planet must necessarily be directed towards the sun. Let the planet be supposed to move from P to P′ (fig. 9) in the time t with the velocity v. Then, since equal areas are described in equal times, we must have the area OPP′ equal to $h\delta t$, where h is a constant which represents the area described in the unit of time. Let fall OT perpendicular upon the tangent at P, then $v \cdot OT = 2h$. We therefore infer that the velocity of a planet is inversely proportional to the perpendicular let fall from the centre of the sun upon the tangent to the orbit. Produce OT to Q, so that $OT \times OQ$ is constant; the radius vector OQ will therefore be proportional to the velocity; and as OQ is perpendicular to the tangent at P, it follows that the locus of Q must be simply the hodograph turned round through 90°. Draw two consecutive tangents to the orbit, and let Q_1 and Q_2 be the corresponding points (fig. 10). Then since $OT_1 \times OQ_1 = OT_2 \times OQ_2$, the quadrilateral $T_1Q_1Q_2T_2$ is inscribable in a circle, and therefore the angles OQ_1Q_2 and OT_2T_1 are equal; whence

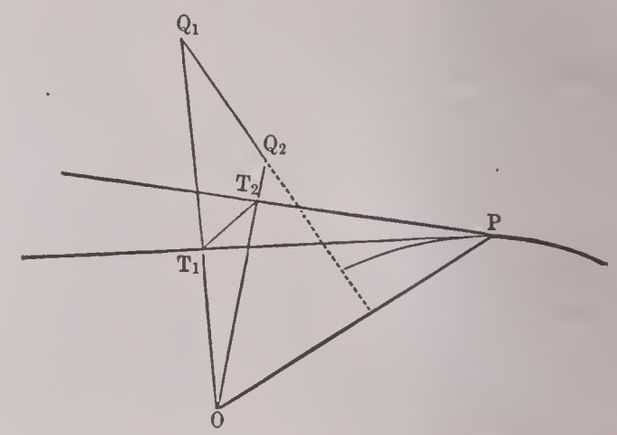


Fig. 10.

it is easily seen that Q_1Q_2 is perpendicular to OP. It follows from the principle of the hodograph that the force on P must be directed along OP.

Let F (fig. 11) be the focus of the ellipse in which, according to Kepler's first law, the planet is moving, then, from a well-known property of the ellipse, the foot of the perpendicular FT let fall from F on the tangent drawn to the ellipse at the point P lies on the circle of which the diameter is the axis major of the ellipse. The line FT cuts the circle again at Q,

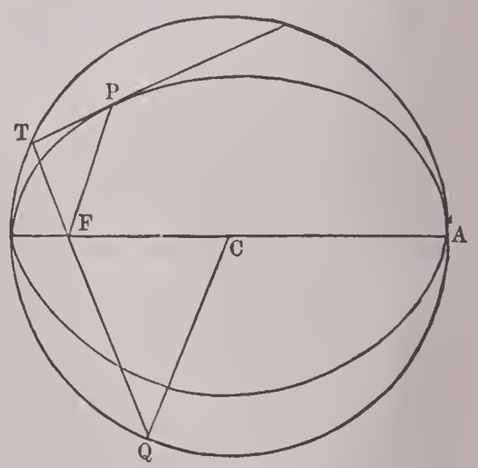


Fig. 11.

and as $FT \times FQ$ is constant, the radius vector FQ must be constantly proportional to the velocity, and therefore the hodograph will be the circle TAQ turned round through 90°. We have already shown that the tangent to the hodograph is parallel to the force. The line CQ must therefore be parallel to FP. If θ be the angle PFC, then, in consequence of the law of equal description of areas in equal times, $FP^2 d\theta \div dt$ must be constant, and therefore $d\theta \div dt$ must vary inversely as FP^2; but the velocity of Q will be proportional to $d\theta \div dt$; hence the velocity of Q, and therefore the force, will be inversely proportional to FP^2. In this way it is shown that the planets are

attracted by the sun with a force which varies inversely as the square of the distance.

§ 13. *The Problem of Three Bodies.*—We have pointed out that the motion of a planet is determined by the mutual attraction which exists between the planet and the sun. It follows, however, as a necessary consequence from the law of universal gravitation, that each planet is attracted not only by the sun but by every other planet, and indeed, so far as we know, by every other body in the universe. The effect of the attraction of the sun preponderates so enormously over the other attractions that the obedience of the planets to Kepler's laws, which would be perfect were the sources of disturbance absent, is still so nearly perfect that the departure therefrom can only be perceived either by very accurate or by very long-continued observations. The refinements of modern observations have, however, brought to light a very large number of *perturbations*, as they are called, in the motions of the planets and their satellites, which are due to the interference of other bodies. The explanation of these different perturbations by the law of universal gravitation has proved in the great majority of cases triumphantly successful.

In any problem where perturbations are involved, we have at least three bodies, viz., the principal body S, a body P which circulates around S, and a disturbing body P′. If we had only the two bodies S and P to consider, then P would describe around S a conic section, of which S was the focus, and the radius vector SP would sweep over equal areas in equal times. By the introduction of the third body P′, which attracts both the former bodies S and P, the motion is deranged, the orbit which P describes is no longer a conic section, and its radius vector has ceased to describe equal areas in equal times. The *general* case of this problem, as we have here described it, is one of excessive complexity. It is, however, a fortunate circumstance that, up to the present time, astronomers have had but little occasion to attack the problem in its *general* form.[1] In the solar system we have a great number of different problems of perturbations to discuss, but there is one feature common to all these problems. This feature is that *the perturbing force is very small in comparison with the primary force, by which the motion of the disturbed body is controlled.* In consequence of this peculiarity, the problems of perturbations in the solar system become greatly simplified. The circumstances of the orbits of the planets and their satellites are also happily such as to furnish additional facilities in the solution of the problems of perturbations. The eccentricities of the orbits are small, and in nearly every case the inclinations are small also. The problems of perturbations in the solar system are consequently adapted for the methods of successive approximation; but we should perhaps warn the reader that, even with the assistance so fortunately rendered by the circumstances of the case, the problems are still among the most difficult to which analysis has ever been applied.

Let S, P, P′ (fig. 12) denote the three bodies of which the masses are M, m, m'. Let the distances SP, SP′, PP′ be de-

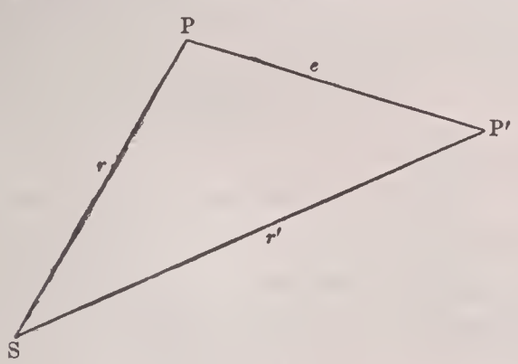


Fig. 12.

noted by r, r', ρ respectively; then if ϵ denotes, as before, the gravitation between two units of mass separated by the unit of distance, we have

on S the forces $\epsilon\frac{Mm}{r^2}$ and $\epsilon\frac{Mm'}{r'^2}$ along SP and SP′ respectively;

on P the forces $\epsilon\frac{Mm}{r^2}$ and $\epsilon\frac{mm'}{\rho^2}$ along PS and PP′ respectively;

on P′ the forces $\epsilon\frac{Mm'}{r'^2}$ and $\epsilon\frac{mm'}{\rho^2}$ along P′S and P′P respectively.

In the problem of the perturbation of a planet which is moving around the sun, the *absolute* motion of the planet in space is not what we are concerned with; what we do require is the *relative motion of the planet with respect to the sun.*

[1] There can be little doubt that in the case of multiple stars the problem of three or more bodies would often have to be faced in all its ruggedness, but the observations which would be required are certainly wanting, and probably unattainable.

Suppose that we apply *to each unit of mass* of the three bodies, forces equal to ϵmr^{-2} parallel to PS and $\epsilon m'r'^{-2}$ parallel to P′S, then it is clear that, from the second law of motion, each unit of mass of the system will receive in a small time, so far as these forces are concerned, equal and parallel velocities, and therefore the *relative motions* of the three bodies will not be altered by the introduction of these forces.

But these forces will, so far as the body S is concerned, amount to $\epsilon Mm \div r'^2$ and $\epsilon Mm' \div r'^2$ in the directions PS and P′S respectively, and will therefore neutralize the attractions of P and P′ upon S. It follows that, so far as the relative motions only are concerned, we may consider the body S as fixed, while the body P is acted upon by the forces

$$\epsilon m(M+m) \div r^2 \text{ on PS}$$
$$\epsilon mm' \div \rho^2 \text{ on PP'}$$
$$\epsilon mm' \div r'^2 \text{ parallel to P'S,}$$

with of course similar expressions for the forces on P′.

The problem of perturbation is therefore reduced to the determination of the motion of P in obedience to these forces, while S is regarded as fixed.

It is plain that, in order to find the motion of P, we should know the motion of P′, which is itself disturbed by P; but as the effect of the perturbation is small, we may, without appreciable error, use the place of P′, derived on the supposition that the motion of P′ is undisturbed, for the purpose of calculating disturbances caused by P′ in the motion of P. We shall therefore suppose that the orbit of P′ is an ellipse which is described around the focus S in consequence of an attractive force $\epsilon m'(M+m') \div r'^2$ directed towards S.

In computing the disturbed motion of P we transform the three given forces into three equivalent forces, which will be more convenient for our purpose. We take first a force T directed along the radius vector; secondly, a force V perpendicular to the radius vector, and lying in the plane of the orbit; and, thirdly, a force W, which is normal to the plane of the orbit. T is to be regarded as positive when it endeavors to increase the distance between P and S; V is to be regarded as positive when it tends to move P to the same side of the line PS as that in which the direction of its motion tends to carry it; and W is to be regarded as positive when it tends to raise P to the *north* of the plane of its orbit.

From P′ (fig. 13) let fall a perpendicular P′Q upon the plane of the undisturbed orbit of P, and let fall from Q a perpen-

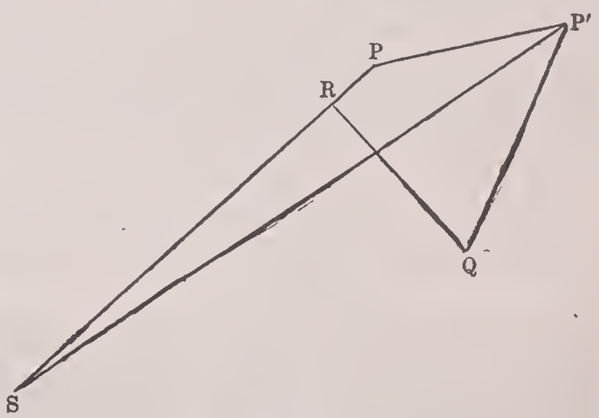


Fig. 13.

dicular QR upon the line SP. The force along PP′ can be resolved into a component parallel to QP′ and another parallel to QP; and the latter can again be decomposed into components parallel to RQ and RP. Hence we have, as the equivalents to the force on PP′, the following three forces which form parts of T, V, W respectively:

$$+\frac{\epsilon mm'}{\rho^3}\text{PR}; \qquad -\frac{\epsilon mm'}{\rho^3}\text{QR}; \qquad +\frac{\epsilon mm'}{\rho^3}\text{QP'}.$$

In a similar manner we find for the components of the force parallel to SP, the following three forces which form parts of T, V, W respectively:—

$$-\frac{\epsilon mm'}{r'^3}\text{SR}; \qquad +\frac{\epsilon mm'}{r'^3}\text{QR}; \qquad -\frac{\epsilon mm'}{r'^3}\text{QP'}.$$

Hence we deduce the following expressions:—

$$\text{T} = -\frac{\epsilon m(M+m)}{r^3} - \frac{\epsilon mm'}{\rho^3}\text{PR} - \frac{\epsilon mm'}{r'^3}\text{SR}.$$

$$\text{V} = -\frac{\epsilon mm'}{\rho^3}\text{QR} + \frac{\epsilon mm'}{r'^3}\text{QR}.$$

$$\text{W} = +\frac{\epsilon mm'}{\rho^3}\text{QP'} - \frac{\epsilon mm'}{r'^3}\text{QP'}.$$

Let the line SO, from which the longitudes are reckoned, be drawn in the plane of the undisturbed orbit of P. Let the

longitudes of P and P′ be l, l' respectively, and let the angle P′SQ or the latitude of P′ be denoted by b', then we have

$$QP' = r' \sin b'; \quad SQ = r' \cos b'.$$
$$RQ = SQ \sin (l' - l) = r' \cos b' \sin (l' - l).$$
$$SR = SQ \cos (l' - l) = r' \cos b' \cos (l' - l).$$
$$PR = r - r' \cos b' \cos (l' - l).$$

With these substitutions, we have for the values of T, V, W, the following expressions:—

$$T = -\frac{\epsilon m(M+m)}{r^2} + \epsilon mm'\left(\frac{1}{\rho^3} - \frac{1}{r'^3}\right) r' \cos b' \cos (l' - l) - \frac{\epsilon mm'}{\rho^3} r.$$

$$V = -\epsilon mm'\left(\frac{1}{\rho^3} - \frac{1}{r'^3}\right) r' \cos b' \sin (l - l').$$

$$W = +\epsilon mm'\left(\frac{1}{\rho^3} - \frac{1}{r'^3}\right) r' \sin b'.$$

It will be noticed that the first term of the expression for T consists of the force which corresponds to the purely elliptic motion. The two remaining terms in T, as well as the whole of V and W, depend upon the disturbing force, as is evident from the circumstance that they contain m' as a factor, and would vanish if m' were equal to zero. As b' is small, we may neglect its squares and higher powers, so that

$$\cos b' = 1 \text{ and } \sin b' = b'.$$

When these substitutions are made, we see that the expressions for T and V are both independent of b'; and consequently we may, so far as these forces are concerned, consider the motions of the disturbing and the disturbed body to take place in the same plane.

The expression for W contains, however, the first power of the latitude of the disturbing body. This is of course connected with the circumstance that it is only in consequence of the disturbing force W that the disturbed body is induced to leave the plane of its undisturbed motion at all.

§ 14. *Calculation of Disturbed Motion.*—Observation has shown that, notwithstanding the perturbations, the orbit of each planet differs but little from a circle, of which the sun is the centre. It is further shown by observation that, though the rate at which a planet moves in its orbit is not quite constant, it is still very nearly so. We may make a similar statement with reference to the motion of the moon around the earth. The orbit of the moon is nearly a circle, of which the earth is the centre, and the velocity of the moon in its orbit is nearly constant. These features of the motions of the planets and the moon enable us to replace the more exact formulæ by approximate expressions which are much more convenient, while still sufficiently correct.

Let ρ, θ be the polar co-ordinates of a celestial body which moves nearly uniformly in a nearly circular orbit. The form of the orbit may be expressed by an equation of the type

$$f(\rho, \theta) = 0.$$

It will, however, be more convenient to employ two equations, by means of which the co-ordinates are each expressed directly in terms of the time. We thus write two equations of the form

$$\rho = f_1(t), \quad \theta = f_2(t);$$

and by elimination of t from these equations the ordinary equation in polar co-ordinates is ascertained. With reference to the forms of the functions f_1 and f_2, we shall make an assumption.

Let χ_1, χ_2, etc., be arbitrary angles; ω_1, ω_2, etc., arbitrary angular velocities; a_1, a_2, etc., *small* arbitrary linear magnitudes; and η_1, η_2, etc., *small* numerical factors. a is an arbitrary linear magnitude, and ω is an arbitrary angular velocity. We shall *assume* that

$$\rho = a + a_1 \cos (\omega_1 t + \chi_1) + a_2 \cos (\omega_2 t + \chi_2) +, \text{ etc.}$$
$$\theta = \omega t + \eta_1 \sin (\omega_1 t + \chi_1) + \eta_2 \sin (\omega_2 t + \chi_2) +, \text{ etc.}$$

To justify our employment of these equations it would really be sufficient for us to state that, as a matter of fact, the motions of all the heavenly bodies which are at present under consideration are capable of being expressed in the forms we have written. It may, however, facilitate the reader in admitting the legitimacy of this assumption, if we point out how exceedingly plausible are the *a priori* arguments which can be adduced in its favor.

The orbits of the celestial bodies are approximately circular, and consequently ρ must remain approximately constant. The value of ρ is, in fact, incessantly fluctuating between certain narrow limits which it does not transcend. Thus ρ is what is called a *periodic function of the time.* It is necessary that the mode in which the time t enters into the expression for ρ must fulfil the condition of confining ρ within narrow limits, *notwithstanding the indefinitely great increase of which* t *is susceptible.* It is obvious that this condition is fulfilled in the form we have assumed for ρ. Under all circumstances

$$\rho = > a \mp a_1 \mp a_2 \mp, \text{ etc.};$$
$$\rho = < a \pm a_1 \pm a_2 \pm, \text{ etc.};$$

and as a_1, a_2, etc., are small quantities it appears that ρ is necessarily restricted to narrow limits.

By similar reasoning we can justify the equation for θ, for we can show that the angular velocity of the celestial body to which it refers must be approximately uniform.

By differentiation,

$$\frac{d\theta}{dt} = \omega + \eta_1\omega_1 \cos (\omega_1 t + \chi_1) + \eta_2\omega_2 \cos (\omega_2 t + \chi_2) +, \text{ etc.}$$

Under all circumstances we must have

$$\frac{d\theta}{dt} = > \omega \mp \eta_1\omega_1 \mp \eta_2\omega_2 \mp, \text{ etc.};$$
$$\frac{d\theta}{dt} = < \omega \pm \eta_1\omega_1 \pm \eta_2\omega_2 \pm, \text{ etc.};$$

and as η_1, η_2, etc., are all small quantities, it is obvious that $\frac{d\theta}{dt}$ is confined within narrow limits, notwithstanding the indefinite augmentation of the time.

In addition to the reasons already adduced in justification of the expressions of ρ and θ, it is to be remarked that the number of disposable constants a_1, a_2, etc., χ_1, χ_2, etc., η_1, η_2, etc., ω_1, ω_2, etc., a, ω is practically indefinite, and that consequently the equations can be compelled to exhibit faithfully the peculiarities of *any* approximately circular orbit described by a particle moving with approximate uniformity.

§ 15. *Determination of the Forces.*—The orbit which is described by a planet or other celestial body being given by the equations

$$\rho = a + \Sigma a_1 \cos (\omega_1 t + \chi_1),$$
$$\theta = \omega t + \Sigma \eta_1 \sin (\omega_1 t + \chi_1),$$

it is a determinate problem to ascertain the forces by which the motion of the planet is controlled. In making this calculation we shall assume that the squares and higher powers, and also the products of the small quantities a_1, a_2, etc., η_1, η_2, etc., may be discarded. T is to be computed from the well-known formula

$$T = m\left(\frac{d^2\rho}{dt^2} - \rho\frac{d\theta^2}{dt^2}\right);$$

where we have

$$\frac{d\rho}{dt} = -\Sigma a_1\omega_1 \sin (\omega_1 t + \chi_1);$$

$$\frac{d^2\rho}{dt^2} = -\Sigma a_1\omega_1^2 \cos (\omega_1 t + \chi_1);$$

$$\frac{d\theta}{dt} = \omega + \Sigma\eta_1\omega_1 \cos (\omega_1 t + \chi_1);$$

$$\frac{d\theta^2}{dt^2} = \omega^2 + 2\Sigma\eta_1\omega\omega_1 \cos (\omega_1 t + \chi_1);$$

$$\rho\frac{d\theta^2}{dt^2} = a\omega^2 + \Sigma(2\eta_1 a\omega\omega_1 + a_1\omega^2) \cos (\omega_1 t + \chi_1);$$

whence by substitution

$$T = -ma\omega^2 - \Sigma m(a_1\omega_1^2 + 2\eta_1 a\omega\omega_1 + a_1\omega^2) \cos (\omega_1 t + \chi_1).$$

To compute V, the force perpendicular to the radius vector, we proceed as follows:—

$$\rho^2 = a^2 + \Sigma 2aa_1 \cos (\omega_1 t + \chi_1);$$
$$\frac{d\theta}{dt} = \omega + \Sigma\eta_1\omega_1 \cos (\omega_1 t + \chi_1);$$

whence we find

$$\rho^2\frac{d\theta}{dt} = a^2\omega + \Sigma(2aa_1\omega + \eta_1 a^2\omega_1) \cos (\omega_1 t + \chi_1).$$

Differentiating we have

$$\frac{d}{dt}\left(\rho^2\frac{d\theta}{dt}\right) = -\Sigma(2aa_1\omega\omega_1 + \eta_1 a^2\omega_1^2) \sin (\omega_1 t + \chi_1).$$

Substituting this in the ordinary formula

$$V = \frac{m}{\rho}\frac{d}{dt}\left(\rho^2\frac{d\theta}{dt}\right),$$

we have finally

$$V = -\Sigma m(2a_1\omega\omega_1 + \eta_1 a\omega_1^2) \sin (\omega_1 t + \chi_1).$$

Let us assume, for the sake of brevity,

$$\lambda_1 = \omega_1 t + \chi_1; \quad \lambda_2 = \omega_2 t + \chi_2; \text{ etc.}$$
$$aF_1 = a_1(\omega^2 + \omega_1^2) + 2\eta_1 a\omega\omega_1; \qquad aG_1 = 2a_1\omega\omega_1 + \eta_1 a\omega_1^2;$$
$$aF_2 = a_2(\omega^2 + \omega_2^2) + 2\eta_2 a\omega\omega_2; \qquad aG_2 = 2a_2\omega\omega_2 + \eta_2 a\omega_2^2;$$
$$\text{etc.} \qquad\qquad \text{etc.}$$

then the result to which we have been conducted may be thus stated:—

If a body be moving in a nearly circular orbit under the influence of a radial force equal to

$$-ma\omega^2 - ma\Sigma F_1 \cos \lambda_1$$

and a force perpendicular to the radius vector equal to

$$-ma\Sigma G_1 \sin \lambda_1,$$

then the path which the body describes is defined by the equations

$$r = a + \Sigma a_1 \cos \lambda_1;$$
$$\theta = \omega t + \Sigma \eta_1 \sin \lambda_1.$$

§ 16. *Deductions from these Expressions.*—We proceed to point out a few of the more remarkable deductions from this theorem.

If as a first approximation we neglect entirely the small quantities a_1, a_2, etc., η_1, η_2, etc., we have

$$r = a; \quad \theta = \omega t; \quad T = -ma\omega^2; \quad V = 0.$$

In this case the orbit described by the body is a circle of which the radius is a. The angle made by the radius vector to the particle with a fixed axis is proportional to the time. It follows that the velocity with which the particle moves in its orbit is uniform. Since the angle swept out by the particle in one unit of time is equal to ω, it follows that the angular velocity of the particle is equal to ω; since the radius is a, the actual velocity with which the particle is moving in its orbit is ωa. In the case now under consideration the force V perpendicular to the radius vector is constantly equal to zero. Hence the total force which acts upon the particle is always directed along the radius vector, and is equal to $-ma\omega^2$. The *sign* — merely expresses that the force which acts upon the particle must be constantly directed *towards* the centre.

Let p denote the periodic time of the motion of the particle in its orbit. Then we must find the angular velocity by dividing the angle 2π described in the time p by the time p, whence

$$\frac{2\pi}{p} = \omega.$$

By substituting this value for ω in the expression for T, we deduce

$$T = -ma\frac{4\pi^2}{p^2}.$$

This proves that the force must vary directly as the radius of the orbit of the particle and inversely as the square of the periodic time in which the orbit is described.

Let us now consider the case in which a_1 and η_1 are retained, while the remaining quantities a_2, a_3, etc., η_2, η_3, etc., are all equal to zero. The formulæ then are

$$r = a + a_1 \cos \lambda_1; \qquad T = -ma\omega^2 - maF_1 \cos \lambda_1;$$
$$\theta = \omega t + \eta_1 \sin \lambda_1; \qquad V = -maG_1 \sin \lambda_1;$$

where $aF_1 = a_1(\omega^2 + \omega_1^2) + 2\eta_1 a\omega\omega_1$; $aG_1 = 2a_1\omega\omega_1 + a\eta_1\omega_1^2$.

It is clear in the first place that the orbit is not a circle, for as λ_1 depends upon t, it will follow that $\cos \lambda_1$ may vary between the limits $+1$ and -1, so that the radius vector r may also vary between the extreme values $a + a_1$ and $a - a_1$. As a_1 is extremely small, it appears that the orbit is still nearly circular with a radius a, but that the particle may sometimes be found at a distance a_1 on the inside or outside of the circle.

We shall similarly find that the angular velocity with which the radius vector sweeps round is not quite uniform. The average angular velocity is no doubt ω, but the actual position of the radius vector differs by the quantity $\eta_1 \sin \lambda_1$ from what it would have been had its motion been uniform. As $\eta_1 \sin \lambda_1$ must vary between the limits $+\eta_1$ and $-\eta_1$, it follows that the radius vector can never be at an angle greater than η_1 from its mean place, *i. e.*, the place which it would have occupied had it continued to move uniformly.

The orbit is completely defined by the two equations—

$$\theta = \omega t + a_1 \sin(\omega_1 t + \chi_1);$$
$$r = a + a\eta_1 \cos(\omega_1 t + \chi_1).$$

If from these two equations the time t could be eliminated, the result would be the equation in polar co-ordinates of the path which the particle described. Owing, however, to the fact that the quantity t occurs separately, and also under the form of a sine and cosine, this elimination would be transcendental.

If, however, we take advantage of the smallness of f_1 and g_1, we can eliminate t with sufficient accuracy for all practical purposes.

As θ is nearly equal to ωt, we may assume for t as the first approximation the value $\theta \div \omega$. If we consider the squares or higher powers of a_1 and η_1 negligible, this value of t may be substituted for t under the sine and cosine, and we have

$$r = a + \eta_1 \cos\left(\frac{\omega_1}{\omega}\theta + \chi_1\right).$$

This equation in general denotes a curve undulating about the circumference of the circle of which the radius is a.

We must now briefly consider the case where the motion of the particle is not confined to a plane. Suppose a third axis OC be drawn through the point O perpendicular to the plane which contains the undisturbed orbit. Let z be the co-ordinate of the particle parallel to the line OC which is called the axis of z, while x, y denote as usual the co-ordinates referred to two other rectangular axes. We shall suppose that the motion of the particle is such that the co-ordinate z can be expressed by the equation

$$z = h_1 \sin \beta_1 + h_2 \sin \beta_2 +, \text{ etc.},$$

where h_1, h_2, etc., are lines of constant length; β_1, β_2, etc., are angles of the form $p_1 t + \xi_1$, $p_2 t + \xi_2$, etc.; p_1, p_2, etc., ξ_1, ξ_2, etc., are constants; and t denotes the time.

Let W denote the force which acts upon the particle P in a direction parallel to the axis of z. Then we have

$$W = m\frac{d^2z}{dt^2}.$$

Differentiating the equation

$$z = h_1 \sin \beta_1 + h_2 \sin \beta_2 +, \text{ etc.},$$

we have $$\frac{dz}{dt} = h_1 \cos \beta_1 \frac{d\beta_1}{dt} + h_2 \cos \beta_2 \frac{d\beta_2}{dt} +, \text{ etc.};$$

but $$\frac{d\beta_1}{dt} = p_1; \qquad \frac{d\beta_2}{dt} = p_2, \text{ etc.};$$

whence $$\frac{dz}{dt} = p_1 h_1 \cos \beta_1 + p_2 h_2 \cos \beta_2 +, \text{ etc.}$$

Differentiating again

$$\frac{d^2z}{dt^2} = -p_1^2 h_1 \sin p_1 - p_2^2 h^2 \sin \beta_2 -, \text{ etc.};$$

whence, finally,

$$W = -mp_1^2 h_1 \sin \beta_1 - mp_2^2 h_2 \sin \beta_2 -, \text{ etc.}$$

§ 17. *The Motion of the Moon.*—One of the most important problems to which we may apply the expressions to which we have been conducted is to an examination of the disturbances which the moon experiences in its motion round the earth. The moon would describe a purely elliptic motion around the earth in one of the foci were it not that the presence of the sun disturbs the motion and produces certain irregularities. Notwithstanding the vast mass of the sun, these disturbing causes still only slightly derange the moon's motion from what it would be were these disturbing causes absent. The reason of this is that the sun is about 400 times as far from the earth as the moon, and consequently the difference of the effects of the sun upon the earth and the moon is comparatively small.

In applying the formulæ to the case of the moon we denote by
S, P, P′ the earth, the moon, and the sun respectively;
M, m, m' signify the masses of the earth, moon, and sun;
r, r' are the distances of the moon and the sun from the earth;
ρ is the distance from the moon to the sun;
l, l' are the longitudes of the moon and the sun measured in the moon's orbit.
T, V, W are the forces acting upon the moon, whereof T is along the radius vector, V is perpendicular to the radius vector, and W is perpendicular to the plane of the moon's orbit.

Since $r + r'$ is very nearly equal to $1 + 400$, we may regard this fraction as so small that its squares and higher powers are negligible. Hence, since $\cos b' = 1$,

$$\rho = r'\left(1 - 2\frac{r}{r'}\cos(l - l') + \frac{r^2}{r'^2}\right)^{\frac{1}{2}}$$
$$= r'\left(1 - \frac{r}{r'}\cos(l - l')\right);$$

whence $$\rho^{-3} = r'^{-3}\left(1 + 3\frac{r}{r'}\cos(l - l')\right),$$

or $$\frac{1}{\rho^3} - \frac{1}{r'^3} = 3\frac{r}{r'^4}\cos(l - l').$$

With these substitutions we have, after a few simple transformations,

$$T = -\frac{\epsilon m(M + m)}{r^2} + \frac{1}{2}\frac{\epsilon mm'r}{r'^3}\left(1 + 3\cos 2(l - l')\right);$$

$$V = -\frac{3}{2}\frac{\epsilon mm'r}{r'^3}\sin 2(l - l');$$

$$W = 3\frac{\epsilon mm'r}{r'^3}\cos(l - l')\sin b'.$$

§ 18. *The Variation.*—The inequality in the motion of the moon which is known as the *variation* is independent both of the eccentricity of the orbit of the moon and of that of the earth. As we shall at present only discuss irregularities in longitude and radius vector, and as we shall neglect small quantities of an order higher than the second, we may assume that the plane of the orbit of the sun coincides with the plane of the orbit of the moon.

The radius vector and the longitude may be expressed by the formulæ

$$r = a + af_1 \cos \lambda_1;$$
$$l = \omega t + g_1 \sin \lambda_1.$$

We shall assume that

$$2(l' - l) = \lambda_1;$$

and since

$$r^{-3} = a^{-3}(1 - 2f_1 \cos \lambda_1),$$

we have

$$T = -\frac{\epsilon m(M+m)}{a^2} + \frac{1}{2}\frac{\epsilon m m' a}{a'^3} + \left(2f_1\frac{\epsilon m(m+M)}{a^2} + \frac{3}{2}\frac{\epsilon m m' a}{a'^3}\right)\cos\lambda_1;$$

but from § 15, n being the mean motion of the moon,

$$T = -mn^2a - maF_1\cos\lambda_1;$$

whence, by identifying the two expressions we have from the portions independent of the time,

$$n^2a = \frac{\epsilon(M+m)}{a^2} - \frac{1}{2}\frac{\epsilon m' a}{a'^3}.$$

This is a very important formula, inasmuch as it gives the relation between the mean motion n and the mean distance a in the disturbed orbit.

Suppose that there were no disturbing influence, and that a satellite moved uniformly around the earth in a circular orbit of radius a_0 with a mean motion n_0, then we have

$$\epsilon(M+m) = n_0^2a_0^3.$$

Assuming also that the earth moves uniformly round the sun in a circular orbit of radius a' with a mean motion n', then

$$\epsilon(M+m') = n'^2a'^3,$$

or, since M is negligible in comparison with m',

$$\epsilon m' = n'^2a'^3.$$

With these substitutions, and making $w = n'^2 + n^2$, we have finally

$$n^2a^3 = n_0^2a_0^3\left(1 - \frac{1}{2}w\right).$$

If we identify the coefficients of $\cos\lambda_1$ in the two expressions for T, we have

$$-maF_1 = 2f_1\frac{\epsilon m(M+m)}{a^2} + \frac{3}{2}\frac{\epsilon m m' a}{a'^3};$$

whence, by substitution and by neglecting small quantities,

$$f_1(n^2 + n_1^2) + 2g_1nn_1 = -2f_1n^2 - \frac{3}{2}wn^2.$$

We have also for V the two expressions

$$-\frac{3}{2}\frac{\epsilon m m' r}{r'^3}\sin\lambda_1,$$

and

$$-maG_1\sin\lambda_1;$$

whence by identifying the coefficients

$$2f_1nn_1 + g_1n_1^2 = \frac{3}{2}wn^2,$$

where n_1 denotes the rate at which λ_1 alters.

Solving the two equations, we deduce the following expressions:—

$$f_1 = -\frac{3w}{2}\frac{n^2n_1 + 2n^3}{n_1^3 - n^2n_1}; \quad g_1 = \frac{3w}{2}\frac{n^2(n_1^2 + 2nn_1 + 3n^2)}{n_1^2(n_1^2 - n^2)}.$$

We can now calculate the value of f_1 and g_1 numerically. For

$$\frac{n_1}{n} = 2\frac{n - n'}{n} = 2\frac{365{\cdot}256 - 27{\cdot}322}{365{\cdot}256} = 1{\cdot}8504,$$

and also

$$w = \frac{1}{178{\cdot}72};$$

from these we deduce

$$f_1 = -0{\cdot}007204$$
$$g_1 = +0{\cdot}01024 = 35'{\cdot}20.^1$$

The results at which we have arrived may be thus summarily stated, using, however, a more accurate value of g_1 than that which is formed by this method:—

If we suppose the orbit of the moon to coincide with the plane of the ecliptic, and if we neglect the ellipticity of the orbit of the earth around the sun and that of the moon around the earth; if n' denotes the mean motion of the earth around the sun, and n the mean motion of the moon around the earth; and, finally, if n and a be connected by the equation

$$n^2a^3 = 0{\cdot}9972\,\epsilon(M+m);$$—

then we have for the motion of the moon the equations

$$r = a\left(1 - 0{\cdot}007204\cos(2nt - 2n't)\right),$$

$$l = nt + 39'\,30''\sin(2nt - 2n't).$$

We thus see that the motion of the moon, on the hypothesis which we have assumed, is different from a uniform circular motion. The distance from the moon to the earth is sometimes 1-139th part greater or less than its mean value. And the longitude of the moon is sometimes 39′ 30″ in advance of or behind what it would be on the supposition that the moon was moving uniformly.

When the distance is the greatest, we have $\cos(2nt - 2n't) = -1$; whence

$$2nt - 2n't = \pi \text{ or } 3\pi;$$

and it follows that the distance of the moon from the earth is greatest at quadratures. When the distance is least, then

$$\cos(2nt - 2n't) = +1,$$

whence

$$2nt - 2n't = 0 \text{ or } 2\pi;$$

consequently the moon is nearest to the earth at syzygy. It thus appears that the orbit of the moon as modified by the disturbing influence of the variation resembles an oval of which the earth is the centre, and of which the minor axis is constantly in the line of syzygies.

The mean longitude of the moon and the true longitude coincide when

$$\sin(2nt - 2n't) = 0.$$

This condition is fulfilled both at syzygy and quadrature; consequently the mean place of the moon and its true place coincide when the moon is either in syzygy or in quadrature. The true place of the moon is at its greatest distance in advance of the mean place when

$$\sin(2nt - 2n't) = 1.$$

This condition is fulfilled at the middle points of the first and third quadrants, while at the middle points of the second and fourth quadrants

$$\sin(2nt - 2n't) = -1;$$

and therefore the moon is behind its mean place in the second and fourth quadrants.

After new moon, the distance between the moon and the earth gradually increases, and the apparent velocity of the moon also increases until, when the moon is three or four days old, it has advanced 39′ beyond its mean place; the velocity then begins to diminish, though the distance goes on increasing, until at first quarter the distance has attained a maximum. After first quarter the distance diminishes, and the moon falls behind its mean place, the maximum distance of 39′ behind the mean place being reached about 11 days after new moon. At full moon the distance has become a minimum, and the mean place and true place coincide. At 18 days the true place has again gained 39′ on the mean place, but the distance increases, and at third quarter the distance is again a maximum, and the true and the mean place coincide. After passing third quarter the distance diminishes, and the true place falls behind the mean place, the difference attaining a maximum on the 26th day, after which the true place gains on the mean place, with which it coincides at new moon, when also the distance is again a minimum.

Since the amount of this irregularity in longitude is so considerable, being in fact larger than the diameter of the moon itself, it is very appreciable even in comparatively coarse observations. It was discovered by observation by Tycho Brahe, by whom it was named the *variation*.

It would lead us too far to endeavor to trace out any of the other irregularities by which the motion of the moon is deranged. We have taken the variation merely as an illustration of one of the numerous corrections which the law of gravitation has explained. The accordance which subsists between the values of these corrections as computed by theory and as determined by observation affords the most conclusive evidence of the truth of the law of universal gravitation. (R. S. B.)

GRAVITY, Specific. See Hydrodynamics.

GRAY, the chief town of an arrondissement in the department of Haute-Saône, is situated on the declivity of a hill on the left bank of the Saône, 37 miles S. W. of Vesoul by rail. Its streets are narrow and steep, but it possesses broad and beautiful quays, and the Allée des Capucins is a fine promenade. The principal buildings are the old castle of the duke of Burgundy, the church in the style of the Renaissance, the communal college (with a library of 15,000 volumes and a natural history museum), the theatre, and the barracks. The town possesses very large flour-mills, and among the other industries are ship-building, dyeing, tanning, haircloth-weaving, plaster-casting, and the manufacture of machinery, oils, and starch. There is also considerable trade in iron, corn, provisions, vegetables wine, and wood. The population in 1901 was 5611. Gray was founded in the 7th century. Its former defensive works were destroyed by Louis XIV. in 1688. During the Franco-Prussian war General von Werder concentrated his army corps in the town, and held it for a month, making it the *point d'appui* of movements towards Dijon and Langres, as well as towards Besançon.

[1] When the approximation is carried sufficiently far it is found that the coefficient of the variation is 39′ 30″.

GRÁY, David (1838–1861), Scottish poet, was the son of a hand-loom weaver, and was born at Merkland, a small village on the banks of the Luggie, about 8 miles from Glasgow, January 29, 1838. His parents, observing his fondness for study and his exceptional cleverness, resolved to educate him for the church, and through their self-denial and his own exertions as a pupil teacher and private tutor, he was able, after receiving the rudiments of education at the parish school of Kirkintilloch, to complete a course of four sessions at the university of Glasgow. It soon, however, became evident that the vision of poetry and world fame had begun to lure him away from the path which his parents' desires had marked out for him. His most intimate companion at this time was Robert Buchanan, the now well-known poet; and in May, 1860, the two agreed to proceed to London, with the indefinite purpose of finding some kind of employment in connection with literature. Shortly after his arrival in London Gray introduced himself to Mr. Monckton Milnes, now Lord Houghton,[1] with whom he had previously corresponded, who, though unsuccessful in his application for a place for Gray's poem, "The Luggie," in the *Cornhill Magazine*, gave him some light literary work. He also showed him great attention when a cold which had seized him assumed the serious form of consumption, and procured him the means of staying for a time in the south of England; but as the disease made rapid progress, an irrisistible longing seized Gray to return to Merkland, where he arrived in January, 1861, and died on the 3d December following, having the day before had the gratification of seeing a printed specimen copy of his poem *The Luggie*. He was buried in the Auld Aisle Churchyard, Kirkintilloch, where in 1865 a monument was erected by "friends far and near" to his memory.

The *Luggie*, the principal poem of Gray, is a kind of reverie in which the scenes and events of his childhood and his early aspirations are mingled with the music of the stream which he celebrates. The series of sonnets *In the Shadows*, composed during the latter part of his illness, possess, without the smallest taint of morbidness, a touching and solemn beauty in keeping with the circumstances in which they were written. Most of his poems necessarily bear traces of immaturity, and lines may frequently be found in them which are mere echoes from Thomson, Wordsworth, or Tennyson, but they possess, nevertheless, the distinct individuality of true genius. They nearly all have a direct or indirect reference to phases of outward nature, and they give evidence of an underlying wealth of imagination and sentiment, of a true and vigorous power of conception, and of a gift of clear and strong, yet subtle and tender, musical utterance, which apparently only required to have been mellowed by time and experience in order to have fashioned a poetry which would have given him an enduring name in English literature.

The Luggie and other Poems, with an introduction by R. Monckton Milnes, and a brief memoir by James Hedderwick, was published in 1862, and a new and enlarged edition of Gray's *Poetical Works*, edited by the late Sheriff Glassford Bell, appeared in 1874. See also the "Essay on David Gray," published originally in *Cornhill Magazine*, and reprinted in *David Gray and other Essays*, by Robert Buchanan, 1868, and the poem on David Gray, reprinted there from *Idyls and Legends of Inverburn*.

GRAY, John Edward (1800–1875), a distinguished English naturalist, born at Walsall, Staffordshire, in 1800, was the eldest of the three sons of Mr. S. F. Gray, of that town, druggist and writer on botany, author of the *Supplement to the Pharmacopœia*, etc., and grandson of Mr. S. Gray, who translated for Lee the *Philosophia Botanica* of Linnæus, and assisted in the composition of the *Introduction to Botany*. Gray studied at St. Bartholomew's and other hospitals for the medical profession, but was attracted to the more enlivening pursuit of botany, on which he wrote and lectured. At an early age he assisted his father by collecting notes on botany and comparative anatomy and zoology in Sir Joseph Banks's library at the British Museum, aided by Dr. W. E. Leach, assistant-keeper. The systematic synopsis of the *Natural Arrangement of British Plants*, 2 vols., 1821, was prepared by him, his father writing the preface and introduction only. This work, which introduced the natural system of plants on Jussieu's plan to the student of English botany, gave offence to the Linnean Society, who rejected Gray's application for a fellowship in 1822. Chafed at this unmerited rebuff, he turned to the study of zoology, writing on zoophytes, shells, *Mollusca*, and *Papilionidæ*, still aided by Dr. Leach at the British Museum. In December, 1824, Gray obtained the post of assistant in that institution; and from that date to December, 1839, when Mr. J. G. Children retired from the keepership, he had so zealously applied himself to the study, classification, and improvement of the national collection of zoology that he was selected as the fittest person to be entrusted with its charge. Immediately on his appointment as keeper, Gray took in hand the revision of the systematic arrangement of the collections; scientific catalogues followed in rapid succession; the department was raised in importance; its poverty as well as its wealth became known, and whilst increased grants, donations, and exchanges made good many deficiencies, great numbers of students, foreign as well as English, availed themselves of its resources to enlarge the knowledge of zoology in all its branches. Gray found the representatives of the animal kingdom confusedly huddled together in old Montagu House; and the science of zoology was just then emerging from infancy, with little public support to foster it. But, in spite of numerous obstacles, he worked up the department, within a few years of his appointment as keeper, to such a state of excellence as to make it the rival of the cabinets of Leyden, Paris, and Berlin; and later on it was raised under his management to the dignity of the largest and most complete zoological collection in the world. The extensive acquaintance which he had obtained with practical zoology, his love of the subject, close application, and original views, his skill and accuracy of observation, his readiness to impart the information he had acquired to any one who sought it, and above all his marvellous industry, place Gray in the foremost rank of naturalists. It has been said that he tried to accomplish too much, that he wrote hurriedly and paid little attention to anatomy; but it must be remembered that he labored for the past generation, not among the one-subject men of the present age. He did his work nobly, though somewhat roughly; and it will ever be appreciated by generous men of science. His eagerness for controversy, and the outspoken plainness with which he asserted his views, sometimes brought him into unpleasant relations with those he had to do with. Of this the catalogue dispute with Panizzi, and the gorilla dispute with Du Chaillu, Owen, and others, are well-known instances. Although seized with paralysis in 1870, Gray continued to discharge the functions of keeper of zoology, and to contribute papers to the *Annals of Natural History*, his favorite journal, and to the transactions of a few of the learned societies. At Christmas, 1874, having completed half a century of official work, he resigned office; and on the 7th of March, 1875, this indefatigable naturalist expired.

Gray was elected a fellow of the Royal Society in 1832; in 1852 the honorary degree of doctor of philosophy of the university of Munich was conferred upon him, in recognition of his formation of the largest zoological collection in Europe; and in 1860 the king of Würtemberg, desiring to mark the estimation in which he held Gray, who had declined an offer of knighthood, bestowed upon him the gold medal of merit. He was a president of the Entomological Society, vice-president of the Zoological and Microscopical Societies, fellow of the Geographical and Palæontological Society, in the formation of which he took part; he was president of the Botanical Society, and also a fellow of the Linnean and Geological Societies; he founded the Greenwich Society of Useful Knowledge; and he was an honorary or corresponding member of numerous foreign societies and academies. He was deputy-chairman of the section of the animal and vegetable substances of the Exhibition of 1851, and a juror of the educational section of the Exhibition of 1862. He took an active part in questions of public importance of his day, such as slave emancipation, prison discipline, abolition of imprisonment for debt, sanitary and municipal organizations, the decimal system, public education, extension of the opening of public institutions, etc.

Works.—Dr. Gray commenced to publish in 1820, and continued till the year of his death. He began with an *Historical Sketch of the Improvements in Comparative Anatomy and Zoology in 1819*, and ended with a paper "On the Madagascar River-Hog (*Potamochœrus*), and on the skulls of the three species of the genus," *Ann. N. H.*, xv., 1875. The titles of the books, memoirs, and miscellaneous papers written by him, accompanied by a few notes, fill a privately printed list of 56 octavo pages. The more important of the books, besides those already mentioned, are:—*Synopsis of the species of the class Mammalia*, 1827 (Griffith's *Cuvier*, vol. v.); *Illustrations of Indian Zoology*, 2 vols., 1830–35; *A Synopsis of the species of the class Reptilia*, 1830 (*Cuvier*, ix.); *Zoological Miscellany*, 1831–45; *Synopsis Reptil-*

[1] [Richard (1809–85), for twenty-eight years in Parliament for Pontefract, a Liberal reformer, baron in 1863, wrote of his travels and much stately verse, biographer of Keats, patron of literary merit, friend of the United States in the Civil War.—Am. Ed.]

ium, 1831; *A Descriptive Catalogue of Recent and Fossil Shells*, 1832; Turton's *Manual of the Land and Freshwater Shells of the British Islands* (new ed.), 1840; *List of the Specimens of Mammalia in the British Museum*, 1843; *Catalogue of Tortoises*, etc., 1844; *Systematic Catalogue of British Land and Freshwater Shells*, 1844; *Catalogue of Specimens of Lizards*, 1845; *Gleanings from the Menagerie and Aviary at Knowsley Hall* (superintended at the request of the late earl of Derby), 1846–50; *List of the genera of recent Mollusca*, 1847; *List of Osteological Specimens*, 1847, *of British Sponges, Radiated Animals* (*Centroniæ*), *of British Radiata*, separate, 1848; *Catalogue of Mollusca*, 1849–50; *Catalogue of Reptiles* (*Snakes*), 1849; *Catalogue of Fish* (*Chondropterygia*), 1850; *Catalogue of Mammalia* (*Cetacea, Seals, Hoofed Quadrupeds*), 1850–52; *Catalogue of Amphibia*, 1850; *Catalogue of Bivalve Mollusca*, 1850–53; *List of Fish* (*Cartilaginous*), *of British Fish*, separate, 1851; *List of British Mollusca and Shells*, 1851; *Catalogue of Echinidæ or Sea-Eggs*, 1851; *Catalogue of Phaneropneumona* (with L. Pfeiffer), 1852; *Catalogue of Fish collected and described by L. T. Gronov*, 1854; *Catalogue of Shield Reptiles*, 1855–72; *Catalogue of the recent Echinida*, 1855; *Catalogue of Pulmonata* (with L. Pfeiffer), 1855; *Guide to the collection of Mollusca*, 1856; *Catalogue of Apodal Fish, by Dr. J. J. Kaup*, translated and edited by Gray, 1856; *Catalogue of Auriculidæ*, 1857; *Systematic arrangement of figures of Conchifera and Brachiopoda*, 1857; *List of Mollusca*, 1858; *Handbook of British Waterweeds, or Algæ* (with W. Carruthers), 1864; Salisbury's *Genera of Plants*, edited by Gray, 1866; *Catalogue of Seals and Whales*, 1866–71; *Synopsis of Species of Starfish*, 1866; *Synopsis of species of Whales and Dolphins*, 1868; *Catalogue of Carnivorous, Pachydermatous, and Edentate Mammalia*, 1869; *Catalogue of Monkeys, Lemurs, and Fruit-eating Bats*, 1870; *Tortoises, Terrapins, and Turtles*, 1872 (re-edited); *Hand-list of Seals, Morses, Sea-Lions, and Sea-Bears*, 1874.

GRAY, THOMAS (1716–1771), the author of the celebrated *Elegy written in a Country Churchyard*, was born in Cornhill, London, December 26, 1716. His father, Philip Gray, an exchange broker and scrivener, was a wealthy and nominally respectable citizen; but he treated his family with brutal severity and neglect, and the poet was altogether indebted for the advantages of a learned education to the affectionate care and industry of his mother, whose maiden name was Antrobus, and who, in conjunction with a maiden sister, kept a millinery shop. A brother of Mrs. Gray was assistant to the master of Eton, and was also a fellow of Pembroke College, Cambridge. Under his protection the poet was educated at Eton, and thence went to Peterhouse, Cambridge, attending college from 1734 to September, 1738. At Eton he had as contemporaries Richard West, son of the lord chancellor of Ireland, and Horace Walpole, son of the triumphant Whig minister, Sir Robert Walpole. West died early in his 26th year, but his genius and virtues and his sorrows will for ever live in the correspondence of his friend. In the spring of 1739 Gray was invited by Horace Walpole to accompany him as travelling companion in a tour through France and Italy. They made the usual tour, and Gray wrote remarks on all he saw in Florence, Rome, Naples, etc. His observations on arts and antiquities, and his sketches of foreign manners, evince his admirable taste, learning, and discrimination. Since Milton, no such accomplished English traveller had visited those classic shores. In their journey through Dauphiné, Gray's attention was strongly arrested by the wild and picturesque site of the Grande Chartreuse, surrounded by its dense forest of beech and fir, its enormous precipices, cliffs, and cascades. He visited it a second time on his return, and in the album of the mountain convent he wrote his famous Alcaic Ode. At Reggio the travellers quarrelled and parted. Walpole took the whole blame on himself. He was fond of pleasure and amusements, "intoxicated by vanity, indulgence, and the insolence of his situation as a prime minister's son,"—his own confession,—while Gray was studious, of a serious disposition, and independent spirit. The immediate cause of the rupture is said to have been Walpole's clandestinely opening, reading, and resealing a letter addressed to Gray, in which he expected to find a confirmation of his suspicions that Gray had been writing unfavorably of him to some friends in England. A partial reconciliation was effected about three years afterwards by the intervention of a lady, and Walpole redeemed his youthful error by a life-long sincere admiration and respect for his friend. From Reggio Gray proceeded to Venice, and thence travelled homewards, attended by a *laquais de voyage*. He arrived in England in September, 1741, having been absent about two years and a half. His father died in November, and it was found that the poet's fortune would not enable him to prosecute the study of the law. He therefore retired to Cambridge, and fixed his residence at the university. There he continued for the remainder of his life, with the exception of about two years spent in London, when the treasures of the British Museum were thrown open. At Cambridge he had the range of noble libraries. His happiness consisted in study, and he perused with critical attention the Greek and Roman poets, philosophers, historians, and orators. Plato and the *Anthologia* he read and annotated with great care, as if for publication. He compiled tables of Greek chronology, added notes to Linnæus and other naturalists, wrote geographical disquisitions on Strabo, and, besides being familiar with French and Italian literature, was a zealous archæological student, and profoundly versed in architecture, botany, painting, and music. In all departments of human learning, excepting mathematics, he was a master. But it follows that one so studious, so critical, and so fastidious could not be a voluminous writer. A few poems include all the original compositions of Gray—the quintessence, as it were, of thirty years of ceaseless study and contemplation, irradiated by bright and fitful gleams of inspiration. In 1742 Gray composed his *Ode to Spring*, his *Ode on a Distant Prospect of Eton College*, and his *Ode to Adversity*,—productions which most readers of poetry can repeat from memory. He commenced a didactic poem, *On the Alliance of Education and Government*, but wrote only about a hundred lines. Every reader must regret that this philosophical poem is but a fragment. It is in the style and measure of Dryden, of whom Gray was an ardent admirer and close student. His *Elegy written in a Country Churchyard* was completed and published in 1751. In the form of a sixpenny *brochure* it circulated rapidly, four editions being exhausted the first year, and within the same period it also appeared in three magazines—the *Magazine of Magazines* for February, the *London Magazine* for March, and the *Grand Magazine of Magazines* for April. This popularity surprised the poet. He said sarcastically that it was owing entirely to the subject, and that the public would have received it as well if it had been written in prose. The solemn and affecting nature of the poem, applicable to all ranks and classes, no doubt aided its sale; it required high poetic sensibility and a cultivated taste to appreciate the rapid transitions, the figurative language, and lyrical magnificence of the odes; but the elegy went home to all hearts; while its musical harmony, originality, and pathetic train of sentiment and feeling render it one of the most perfect of English poems. No vicissitudes of taste or fashion have affected its popularity. When the original manuscript of the poem was offered for sale in 1854, it brought the almost incredible sum of £131. The two great odes of Gray, the *Progress of Poetry* and *The Bard*, were published in 1757, and were but coldly received. His name, however, stood high, and, on the death of Cibber the same year, he was offered the laureateship, which he wisely declined. He was ambitious, however, of obtaining the more congenial and dignified appointment of professor of modern history in the university of Cambridge, which fell vacant in 1762, and, by the advice of his friends, he made application to Lord Bute, but was unsuccessful. Lord Bute had designed it for the tutor of his son-in-law, Sir James Lowther. No one had heard of the tutor, but the Bute influence was all-prevailing. In 1765 Gray took a journey into Scotland, penetrating as far north as Dunkeld and the Pass of Killiecrankie; and his account of his tour, in letters to his friends, is replete with interest and with touches of his peculiar humor and graphic description. One other poem proceeded from his pen. In 1768 the professorship of modern history was again vacant, and the duke of Grafton bestowed it upon Gray. A sum of £400 per annum was thus added to his income; but his health was precarious—he had lost it, he said, just when he began to be easy in his circumstances. The nomination of the duke of Grafton to the office of chancellor of the university enabled Gray to acknowledge the favor conferred on himself. He thought it better that gratitude should sing than expectation, and he honored his grace's installation with an ode. Such occasional productions are seldom happy, but Gray preserved his poetic dignity and select beauty of expression. He made the founders of Cambridge, as Mr. Hallam has remarked, "pass before our eyes like shadows over a magic-glass." When the ceremony of the installation was over, the poet-professor went on a tour to the lakes of Cumberland and Westmoreland, and few of the

beauties of the lake-country, since so famous, escaped his observation. This was to be his last excursion. While at dinner one day in the college-hall he was seized with an attack of gout in his stomach, which resisted all the powers of medicine, and proved fatal in less than a week. He died on the 30th of July, 1771, and was buried, according to his own desire, beside the remains of his mother at Stoke Pogis, near Slough in Buckinghamshire, in a beautiful sequestered village churchyard that is supposed to have furnished the scene of his elegy.[1]

The literary habits and personal peculiarities of Gray are familiar to us from the numerous representations and allusions of his friends. It is easy to fancy the recluse poet sitting in his college-chambers in the old quadrangle of Pembroke Hall. His windows are ornamented with mignonette and choice flowers in china vases, but outside may be discerned some iron-work intended to be serviceable as a fire-escape, for he has a horror of fire. His furniture is neat and select; his books, rather for use than show, are disposed around him. He has a harpsichord in the room. In a corner of one of the apartments is a trunk containing his deceased mother's dresses, carefully folded up and preserved. His fastidiousness, bordering upon effeminacy, is visible in his gait and manner,—in his handsome features and small well-dressed person, especially when he walks abroad and sinks the author and hard student in "the gentleman who sometimes writes for his amusement." He writes always with a crow quill, speaks slowly and sententiously, and shuns the crew of dissonant college revellers who call him "a prig," and seek to annoy him. Long mornings of study, and nights feverish from ill-health, are spent in those chambers; he is often listless and in low spirits; yet his natural temper is not desponding, and he delights in employment. He has always something to learn or to communicate, some sally of humor or quiet stroke of satire for his friends and correspondents, some note on natural history to enter in his journal, some passage of Plato to unfold and illustrate, some golden thought of classic inspiration to inlay on his page, some bold image to tone down, some verse to retouch and harmonize. His life is on the whole innocent and happy, and a feeling of thankfulness to the Great Giver is breathed over all.

Various editions of the collected works of Gray have been published. The first, including memoirs of his life and his correspondence, edited by his friend, the Rev. W. Mason, appeared in 1775. It has been often reprinted, and forms the groundwork of the editions by Mathias (1814) and Mitford (1816). Mr. Mitford, in 1843, published Gray's correspondence with the Rev. Norton Nicholls, and in 1854 his correspondence with Mason, from which Mason had made only a partial selection in his memoirs of Gray. A second edition of the correspondence with additional notes was published in 1855.[2]

(R. CA.)

GRAYLING (*Thymallus*) are fishes belonging to the family of *Salmonidæ*, which resemble the vendace and gwyniad (*Coregonus*) in having scales of considerable size, and a narrow mouth with very small teeth. They are distinguished by their large, wing-like, dorsal fin. Only a few species are known, which inhabit clear streams of the north of Europe, Asia, and North America. The best known are the "Poisson bleu" of the Canadian voyageurs, and the European species, *Thymallus vulgaris* (the *Asch* or *Aesche* of Germany, *Ombre* of France, and *Temola* of Upper Italy). This latter species is esteemed on account of its agreeable colors (especially of the dorsal fin), its well-flavored flesh, and the sport it affords to anglers. It is very fastidious in the choice of the rivers it inhabits. In England it is found in the Test, the Avon, the Dove, the Lug, the Wye, the Irvon, the Teme, the Clun, the Hodder, the Trent, the Dee, the Wiske, the Wharfe, the Ure, the Ribble, and the Derwent; but it is not found either in Scotland or in Ireland. It is more generally distributed in Scandinavia and Russia, and the mountain streams of central Europe southwards to the Alpine waters of Upper Italy. Specimens attaining to a weight of four pounds are very scarce. See ICHTHYOLOGY.

GRAZALEMA (the Roman *Lacidulermium*), a town of Spain, in the province of Cadiz, is situated on the great road from Cadiz to Ronda, 60 miles E.N.E. of Cadiz. It stands in a very strong position on a rocky hill, and to capture it was reckoned one of the chief feats of the *esforzado* Rodrigo Ponce de Leon. It possesses three hermitages, a parish church, and a convent. The manufactures are chiefly woollen, linen, leather, and soap, and there is considerable trade in sheep and swine from the neighboring sierra of the same name. Inscriptions and other Roman antiquities still exist in the town. The population is about 6000.

GRAZZINI, ANTONFRANCESCO (1503–1583), an Italian author, was born at Florence, March 22, 1503, of good family both by his father's and mother's side. Of his youth and education all record appears to be lost, but he probably began early to practise as an apothecary. In 1540 he was one of the founders of the Academy of the Humid (degli Umidi), and about forty-two years afterwards he took a prominent part in the formal establishment of the more famous Accademia della Crusca. In both societies he was known as *Il Lasca* or *Leuciscus*, and this pseudonym is still frequently substituted for his proper name. His temper was what the French happily call a difficult one, and his life was consequently enlivened or disturbed by various literary quarrels. His Humid brethren went so far as to expel him for a time from the society,—the chief ground of offence being apparently his ruthless criticism of the "Arameans," a party of the academicians who maintained that the Florentine or Tuscan tongue was derived from the Hebrew, the Chaldee, or some other branch of the Semitic. He was readmitted in 1566, when his friend Salviati was "consul" of the academy. His death took place on February 18, 1583. Il Lasca ranks as one of the great masters of Tuscan prose. His style is copious and flexible: abundantly idiomatic, but without any affectation of being so, it carries with it the force and freshness of popular speech, while it lacks not at the same time a flavor of academic culture. His principal works are *Le Cene*, a collection of stories in the manner of Boccaccio, and a number of prose comedies, *La Gelosia*, *La Spiritata*, *I Parentadi*, *La Arenga*, *La Sibilla*, *La Pinzochera*, *L'Arzigogolo*. The stories, though of no special merit as far as the plots are concerned, are told with verve and interest. A number of miscellaneous poems, a few letters, and *Four Orations to the Cross* complete the list of Grazzini's extant works.

He also edited the works of Berni, and collected *Tutti i Trionfi, Larri, Mascherate, e Canti Carnascialaschi, andati per Firenze dal tempo del Magnifico Lorenzo de' Medici fino all' anno 1559*. In 1868 Adamo Rossi published in his *Ricerche per le biblioteche di Perugia* three "novelle" by Grazzini, from a MS. of the 16th century in the "Comunale" of Perugia; and in 1870 a small collection of those poems which have been left unpublished by previous editors appeared at Poggibonsi, *Alcune poesie inedite*. See Pietro Fanfani's "Vita del Lasca," prefixed to his edition of the *Opere di A. Grazzini*, Florence, 1857.

GREAT BRITAIN AND IRELAND, THE UNITED KINGDOM OF, has been since January 1, 1801, the official title of the political unity composed of England, Scotland, and Ireland. Great Britain was employed as a formal designation from the time of the union of the kingdoms of England and Scotland in 1707. Although the name (which apparently had its origin in Britannia Major, the name given to the island to distinguish it from Britannia Minor or Brittany) had, in earlier times, been often used both by English and by foreign writers, especially for rhetorical and poetical purposes, it was not till after the accession of James I. that it became a recognized part of the royal style. Its adoption was due to the king himself who was anxious to give expression to the fact that he was sovereign of the undivided island, and not only of Eng-

[1] A claim has been put up for the churchyard of Granchester, about two miles from Cambridge, the great bell of St. Mary's serving for the "curfew." But Stoke Pogis is more likely to have been the spot, if any individual locality were indicated. The poet often visited the village, his aunt and mother residing there, and his aunt was interred in the churchyard of the place. Gray's epitaph on his mother is characterized, not only by the tenderness with which he always regarded her memory, but by his style and cast of thought. It runs thus:—"Beside her friend and sister here sleep the remains of Dorothy Gray, widow, the careful, tender mother of many children, one of whom alone had the misfortune to survive her. She died March 11, 1753, aged 72." She had lived to read the *Elegy*, which was perhaps an ample recompense for her maternal cares and affection. Mrs. Gray's will commences in a similar touching strain:—"In the name of God, amen. This is the last will and desire of Dorothy Gray to her son Thomas Gray." They were all in all to each other. The father's cruelty and neglect, their straitened circumstances, the sacrifices made by the mother to maintain her son at the university, her pride in the talents and conduct of that son, and the increasing gratitude and affection of the latter, nursed in his scholastic and cloistered solitude—these form an affecting but noble record in the history of genius.

[2] A volume of the original autograph letters of Gray addressed to Dr. Thomas Wharton, fellow of Pembroke Hall, Cambridge, and latterly of London and Old Park, near Darlington, was added in 1877 to the Egerton library of manuscripts in the British Museum.

land or Scotland. As early as 1559 the Scottish Congregation had formally proposed through Maitland the union of the two crowns, and the adoption of the name of Great Britain for the common country (Teulet, i., "Mém. Caillé à M. de la Mothe," Dec. 20). But in England the innovation at first met with great opposition. Various objections, sentimental and practical, were urged against it in parliament; and the judges, when appealed to by the king, declared that the adoption of the title would invalidate all legal processes. At length, on the 20th October, 1604, the king, weary of the discussion, cut the knot by assuming the title by royal proclamation, and in due course the inscription "J. D. G. Mag. Brit. F. et H. Rex" appeared on his coins. The proclamation declared that Great Britain was "the true and ancient name which God and time have imposed upon this Ile, extant and received in histories, in all mappes and cartes wherein this ile is described, and in ordinary letters to ourselfe from divers foreign princes, warranted also by authentical charters, exemplifications under seals, and other records of great antiquitie." In November, 1604, we find the king instructing the Lords Commissioners of the Gunpowder Plot to try and discover if the prisoner was the author of a most "cruel pasquil" against him for assuming the name of Britain. For further details see *Calendar of State Papers, Domestic Series*, and Speeding, *Letters and Life of Lord Bacon*, vol. iii.

GREAVES, John (1602–1652), a mathematician and antiquary, was the eldest son of John Greaves, rector of Colemore, near Alresford in Hampshire, and was born in 1602. He was educated at Balliol College, Oxford, and in 1630 was chosen professor of geometry in Gresham College, London. After travelling in Europe, he in 1637 visited the East, where he collected a considerable number of Arabic, Persic, and Greek manuscripts, and made a more accurate survey of the pyramids of Egypt than any traveller who had preceded him. On his return to Europe he visited a second time several parts of Italy, and during his stay at Rome instituted inquiries into the ancient weights and measures. Soon after his arrival in England, he was appointed to the Savilian professorship of astronomy at Oxford, but he was deprived of his Gresham professorship for having neglected its duties. In 1648 he lost both his fellowship and his Savilian chair on account of his adherence to the royalist party. But his private fortune more than sufficed for all his wants till his death in 1652.

Besides his papers in the *Philosophical Transactions*, the principal works of Greaves are *Pyramidographia, or a Description of the Pyramids in Egypt*, 1646; *A Discourse on the Roman Foot and Denarius*, 1649; and *Elementa Linguæ Persicæ*, 1649. His miscellaneous works were published in 1737 by Dr. Birch, with a biographical notice of the author. See also Smith's *Vita quorundam erudit, virorum*, and Ward's *Gresham Professors*.

GREBE (French *Grèbe*), the generally accepted name for all the birds of the Family *Podicipedidæ*,[1] belonging to the group *Pygopodes* of Illiger, members of which inhabit almost all parts of the world. Some systematic writers have distributed them into several so-called genera, but, with one exception, these seem to be insufficiently defined, and here it will be enough to allow but two—Latham's *Podiceps* and the *Centropelma* of Messrs. Sclater and Salvin. Grebes are at once distinguishable from all other Water-birds by their very short body, and the peculiar structure of their feet, which are not only placed far behind, but have the tarsi flattened and elongated toes furnished with broad lobes of skin.

In Europe we have five well-marked species of *Podiceps*, the commonest and smallest of which is the very well-known Dabchick of our ponds, *P. fluviatis*, or *minor*, the Little Grebe of ornithologists, found throughout the British Islands, and with a wide range in the Old World. Next in size are two species known as the Eared and Horned Grebes, the former of which, *P. nigricollis*, is a visitor from the south, only occasionally showing itself in Britain, while the latter, *P. auritus*, has a more northern range, breeding plentifully in Iceland, and is a not uncommon winter-visitant. Then there is the larger Red-necked Grebe, *P. griseigena*, also a northern bird, and a native of the subarctic parts of both Europe and America, while lastly the Great Crested Grebe, *P. cristatus*, or Gaunt—known as the Loon on the meres and broads of East Anglia, and some other parts of England, is also widely spread over both Worlds, and though apparently not found within the tropics, is known in the extreme south as a native of Australia and New Zealand. North America is credited with seven species of Grebes, of which three (*P. cristatus*, *P. griseigena*, and *P. auritus*) are admitted to be specifically inseparable from those already named, and two (*P. occidentalis* and *P. californicus*) appear to be but local forms; the remaining two (*P. Dominicus* and *P. ludovicianus*) may, however, be accounted good species, and the last differs so much from other Grebes that many systematists make it the type of a distinct genus, *Podilymbus*. South America seems to possess four or five more species, one of which, the *P. micropterus* of Mr. Gould (*Proc. Zool. Society*, 1858, p. 220), has been deservedly separated from the genus *Podiceps* by Messrs. Sclater and Salvin (*Exot. Ornithology*, p. 189, pl xcv.), owing to the form of its bill, and the aborted condition of its wings, which seem to render it absolutely flightless. Lake Titicaca in Bolivia is, so far as is known

Great Crested Grebe.

at present, its only habitat. Grebes in general, though averse from taking wing, have much greater power of flight than would seem possible on examination of their alar organs, and are capable of prolonged aerial journeys. Their plumage is short and close. Above it is commonly of some shade of brown, but beneath it is invariably white, and so glossy as to be in much request for muffs and the trimming of ladies' dresses. Some species are remarkable for the crests or tippets, generally of a golden-chestnut color, they assume in the breeding season. *P. auritus* is particularly remarkable in this respect, and when in its full nuptial attire presents an extraordinary aspect, the head (being surrounded, as it were, by a *nimbus* or aureole, such as that with which painters adorn saintly characters), reflecting the rays of light, glitters with a glory that passes description. All the species seem to have similar habits of nidification. Water-weeds are pulled from the bottom of the pool, and piled on a convenient foundation, often a seminatant growth of bog-bean (*Menyanthes*), till they form a large mass, in the centre of which a shallow cup is formed, and the eggs, with a chalky white shell almost equally pointed at each end, are laid—the parent covering them, whenever she has time to do so, before leaving the nest. Young Grebes are beautiful objects, clothed with black, white, and brown hair, disposed in streaks, and their bill often brilliantly tinted with orange or yellow. When taken from the nest and placed on dry ground, it is curious to observe the way in which they progress—using the wings almost as fore-feet,

[1] Often, but erroneously, written *Podicipidæ*. The word *Podiceps* being a contracted form of *Podicipes* (*cf.* Gloger, *Journal für Ornithologie*, 1854, p. 430, note), a combination of *podex*, *podicis*, and *pes*, *pedis*, its further compounds must be in accordance with its derivation.

and suggesting the notion that they must be quadrupeds instead of birds. In water, however, they equal if not surpass their parents in the power of diving, which is a special accomplishment of all Grebes. (A. N.)

GRECO, El. Domenico Theotocopuli, commonly called El Greco, was a native of Greece, where he was born about the year 1545. He appears to have studied art at Venice, where it is alleged that Titian was his master. The date of his removal to Spain is unknown; but in 1577 we find him at Toledo, engaged on one of his most admired paintings, that on the parting of the raiment of Jesus. Until now he had been content to follow closely in the footsteps of the Venetian school, and he is generally admitted in his earlier works frequently to have approached the style of some of its best representatives; but in 1579, having been summoned, along with other artists of repute, by Philip II. to contribute to the decoration of the Escorial, he began to aim at greater originality of style with very unfortunate results. The first work in his new manner, having for its subject the martyrdom of St. Maurice, was executed in 1579; in this, as in all his subsequent productions, a dull ashen monotony of color combines with stiff and unnatural drawing to produce an effect which is at no time very pleasant, and is sometimes absolutely repulsive. El Greco, however, continued to be held in considerable repute in the peninsula; sonnets in his honor are to be found in the writings both of Gongora and Pallavicino; and he became the founder of a school in which many of the disciples excelled their master. He practised sculpture and architecture as well as painting, and is said by Pacheco to have written with great learning and ability upon all these arts; none of his books, however, have come down to our time. He died at Toledo in 1625.

GREECE.—Part I.—Geography and Statistics. Greece is a European kingdom, occupying the southern portion of the most easterly of the three peninsulas which Europe projects into the Mediterranean. By its own inhabitants it is called Hellas, as it was also in antiquity, and the name Greece, by which in one form or other it is known in most European languages, was given to it by the Romans, and was not used by any Greek writer, so far as we know, before Aristotle. Why the Romans called it so is an obscure point, but the most probable and usually accepted explanation is that they gained their first knowledge of the country from a tribe in the north-west of Greece who were called Græci (Γραικοί), and that they accordingly gave the name of that tribe to the whole country. The name Greece or Hellas has been applied at different times to territory of widely different extent. At first Hellas denoted nothing but the spot in Thessaly where the tribe of Hellenes dwelt, and in later times, after Philip of Macedon obtained a seat at the Amphictyonic council, it meant the whole peninsula south of the Balkan mountains (Hæmus) including Macedonia and Thrace; but at the period of its greatest distinction it excluded these two regions, and was restricted to the part of the peninsula to the south of the Cambunian range and the islands of the surrounding seas. Its ancient limits, however, cannot be rigidly defined, for (1) its northern frontier seems never to have been precisely settled, some writers excluding Thessaly which was generally taken in, and others including part of Epirus which was generally left out; and (2) the name Hellas expressed not so much a geographical as an ethnological unity. It was the country of the Hellenes. Wherever Greeks settled there was Hellas, and a Greek colony in Sicily or Africa was thought to participate as essentially in all that constituted Hellas as either Attica or Lacedæmon. Still the name was usually applied to the land which formed the geographical centre of the race, of which the greatest length was 250 miles and the greatest breadth 180, and which had an area, exclusive of Epirus (4690 square miles) but including Eubœa (1410 square miles), of 21,121 square miles. This territory comprised (1) Northern Greece, all north of the Maliac (Zeitoum) and Ambracian (Arta) Gulfs; (2) Central Greece, extending from these gulfs to the isthmus of Corinth; (3) the peninsula of the Peloponnesus (Morea) to the south of the isthmus; (4) the following islands,—Eubœa (Negropont) in the east, the Ionian Islands in the Ionian Sea on the west, Crete and Cyprus in the south, and the Cyclades and Sporades across the mouth of the Ægean from the southeast headlands of Attica and Eubœa. Continental Greece—*i. e.*, all the country now specified, exclusive of the islands—consists of a series of natural cantons, hedged from one another and from the outer world by mountain ranges from 5000 to 8000 feet high, and so was almost by a physical necessity occupied in the times of its ancient political independence by seventeen separate states, none of which was larger than an ordinary English county. The whole eight states of the Peloponnesus covered less area than York and Lancaster together; and Attica, the most celebrated state of antiquity, was less than Cornwall. These states, which are noticed separately under the special headings, were—Thessaly in North Greece; Acarnania, Ætolia, Locris, Doris, Phocis, Megaris, Bœotia, and Attica in Central Greece; and Corinthia, Sicyonia, Achaia, Elis, Messenia, Laconia, Argolis, and Arcadia in the Peloponnesus.

Plates I. and II.

Extent of ancient Greece. Plate I.

Modern Greece is of smaller extent, and its limits are strictly determined by the arrangement between Great Britain, France, Russia, and Turkey, concluded at Constantinople on the 21st [9th] July, 1832, which finally settled the question of frontier between Greece and Turkey. It left to Turkey the fertile Greek-speaking province of Thessaly and part of Acarnania, and fixed the northern boundary of Greece at a line running from the Gulf of Arta (Sinus Ambracius) to the Gulf of Volo (S. Pagasæus), keeping along the crest of the Othrys mountain range. The pass of Khlomo was to belong entirely to Greece, and the fort of Punta (Actium) at the southern head of the Gulf of Arta was to continue to belong to Turkey, though Greek vessels were required to have free entry into the gulf. The Ionian islands, consisting of Corfu (Corcyra), Paxo (Paxos), Santa Maura (Leucas), Cephalonia, Thiake (Ithaca), and Zante (Zacynthus) on the west coast of Greece, and Cerigo (Cythera) on the south, which had remained under British protectorate for 50 years, were voluntarily ceded by Britain to Greece in 1864, after the accession of King George. Modern Greece is not more than two-thirds the size of Scotland; it is 200 miles long from north to south, and 180 broad from east to west, and has an entire area of 19,353 square miles, of which 8288 square miles are in the Morea, 7558 in the northern part of continental Greece, 2500 in the islands of the Ægean, and 1007 in the Ionian Islands.

Extent of modern Greece. Plate II.

General physical features.

Its most obvious geographical peculiarity is its remarkable richness in mountains, bays, and islands, which give it unexampled natural defences, unusual maritime facilities, and quite a peculiar variety of climate, vegetation, and scenery. In this respect it but gathers into a smaller page and expresses in distincter type the structural peculiarities of the continent to which it belongs. In the complexity of its make and the variety of its natural features Greece excels every country of Europe, as Europe excels every continent of the world. No part of Greece is 40 miles from the sea or 10 from the hills. Though not much more than half the size of Portugal, it has a coast-line greater than that of Spain and Portugal together, and that coast-line is broken everywhere into all manner of gulfs, and bays, and inlets, affording a rich supply of good natural harbors. The country is divided by its mountain chains into a number of independent parts, the capture of one of which by an enemy is but a single step towards possession of the whole. The small basins of arable land between these hills maintained comparatively isolated populations, on account of the difficulty of inland intercommunication, and naturally developed that individuality of character, that local patriotism, and that political independence, which marked the ancient Greek communities. And the great variety of pursuit, interest, and stimulus which the geographical features of the country created could not fail to conduce to the uncommon mental vigor, quickness, and versatility which the people exhibited. The Greeks therefore owed their greatness largely to the country it was their fortune to dwell in.

Mountains.

The ruling feature in the mountain system of ancient Greece—and, to a certain extent, in modern Greece also—is the great chain of Pindus, which takes its rise in the Balkans (Hæmus), and runs like a backbone through the entire length of the northern half of the peninsula, throwing out various branches to the east and the west on its way. At about 40° N. lat. the Cambunians leave it and go east, forming the boundary between Mace-

donia (Roumelia) and Thessaly, and as they approach the coast they turn in a southerly direction at the lofty and famous Mount Olympus, the highest mountain in ancient Greece, and are continued at intervals, on the other side of the vale of Tempe, by Ossa (Kissovo), Pelion (Zagora), and the hills of Eubœa. At 39° the Othrys chain (Helloro), whose chief elevation is the conical Mount Veluchi (Tymphrestus), is sent out also to the east, and forms the northern bulwark of the present kingdom. A little further south the Œta range (Katavothra) goes in the same direction, and reaches the Gulf of Zeitoun (Maliac Gulf) at the celebrated pass of Thermopylæ. The Cambunian chain intersects Pindus at Mount Lacmon (Zygo), and thence westward the chain passes under the name of Tænarus and the Ceraunian Hills (Montes Acrocraunii) till it enters the sea at the Acroceraunian promontory (Cape Linguetta). From the point of junction with the Othrys, the Pindus chain is continued southwards in a series of separate peaks —Parnassus (Liakura), Helicon, Cithæron, Parnes, and Hymettus, on to the promontory of Sunium (Cape Colonna) in the southeast of Attica. Parnes divides Attica from Bœotia. The mountains of the Morea have no connection with the mountain system of Northern Greece; they do not run in chains, but rather cluster in knots. The most important of these are Ziria (Cyllene), Khelmos, Olonos, and the range of Pentedaktylon (Taygetus), which stretches from the centre of Arcadia through the length of Laconia to Cape Matapan (Tænarum), and is the most imposing of all the mountains of Greece. The hegemony of Sparta in the Peloponnesus is attributed by some to its possessing both sides of this chain. Its highest point is Mount St. Elias, called, like several other Greek mountains, after the prophet Elijah. None of the mountains of Greece is within the line of perpetual snow, though the tops of several are white for some months in the year. What is peculiar to Greece is not the presence of any one hill of pre-eminent height, but the great number it possesses of considerable and nearly equal elevation. Modern Greece has no summit so high as Olympus (9754 feet), but within its narrow area it has twenty-six hills above 3000 feet, of which eight are above 7000 feet, viz., Parnassus (8068), Taygetus (7904), Tymphrestus (7610), Œta (7071), the three summits of Cyllene in Arcadia (7788), and Corax in Ætolia. The noted fortified hills of Greece were Acrocorinthus (1686 feet) which guards the isthmus, Ithome (2631 feet) at Messene, Larissa (900 feet) at Argos, and the Acropolis (150) at Athens.

Rivers. Greece has few rivers, and these small, rapid, and, as a rule, turbid, as they could not help being in a country where they rise in high mountains and have no space to grow in before they reach the sea. They are either perennial rivers or torrents, the white beds of the latter being dry in summer, and only filled with water after the autumn rains. The chief rivers (none of which are navigable) are the Hellada (Sperchius) in Phthiotis, the Aspro Potamo (Achelous) in Ætolia, and the Roufia (Alpheus) and Vasiliko (Eurotas) in the Morea. Of the famous rivers of Athens, the one, the Ilissus, is only a chain of pools all summer, and the other, the Cephissus, though never absolutely dry, does not reach the sea, but is drawn off in numerous artificial channels to irrigate the neighboring olive groves. The waters of both are clear and delicious to the taste. A frequent peculiarity of the Greek rivers is their sudden disappearance in subterranean chasms and reappearance on the surface again, such as gave rise to the fabled course of the Alpheus under the sea, and its emergence again in the fountain of Arethusa in Syracuse. Some of these chasms—"Katavothras"—are merely sieves with herbage and gravel in the bottom, but others are large caverns through which the course of the river may be easily followed. Floods are frequent, especially in autumn, and natural fountains abound and gush out even from the tops of the hills. Aganippe rises high up among the peaks of Helicon, and Peirene flows from the summit of Acrocorinthus. It is surprising that there are no waterfalls in Greece, the only one worth mentioning being the famous Styx in Arcadia, which has a fall of 500 feet. During part of the year it is lost in the snow, and it is at all times almost inaccessible. Lakes are numerous, but few are of any size, and many merely marshes in summer. The largest are Trichonis in Ætolia, Copais in Bœotia, and Stymphalus in Arcadia.

The valleys are generally narrow, and the plains small in extent, deep basins walled in among the hills or more free at the mouths of the rivers. **Plains.** The principal plains are those of Thessaly (which is not in modern Greece), Bœotia, Messenia, Argos, and Marathon. The bottom of these plains consists of an alluvial soil, the most fertile in Greece. In some of the mountainous regions, especially in the Morea, are extensive table-lands. The plain of Mantinea is 2000 feet high, and the upland district of Sciritis, between Sparta and Tegea, is in some parts 3000 feet.

Coast. Strabo said that the guiding thing in the geography of Greece was the sea, which presses in upon it at all parts with a thousand arms. From the Gulf of Arta on the one side to the Gulf of Volo on the other the coast is indented with a succession of natural bays and gulfs. The most important are the Gulfs of Ægina (Saronicus) and Lepanto (Corinthiacus), which come in between the Morea and the northern mainland of Greece—the first from the Ægean, the second from the Ionian Sea—and are only prevented from joining their waters by the high land of the narrow isthmus of Corinth (3½ miles wide). The outer portion of the Gulf of Lepanto is called the Gulf of Patras, and the inner part the bay of Corinth, and a narrow bay on the north side of the same gulf, called the Bay of Salona, penetrates northwards into Phocis so far that it is within 24 geographical miles of the Gulf of Zeitoun on the north-east coast of Greece. The width of the entrance to the gulf of Lepanto is subject to singular changes, which are ascribed to the formation of alluvial deposits by certain marine currents, and their removal again by others. At the time of the Peloponnesian war this channel was 1200 yards broad; in the time of Strabo it was only 850; and in our own day it has again increased to 2200. On the coast of the Morea there are several large gulfs, that of Arcadia (Cyparissus) on the west, Kalamatia (Messeniacus) and Kolokythia (Laconicus) on the south, and Nauplia (Argolicus) on the east. Then between Eubœa and the mainland lie the channel of Talanti (Euboicum Mare) and the channel of Egripo, which are connected by the strait of Egripo (Euripus). This strait, which is spanned by a bridge, is 120 feet wide, and is remarkable for the unexplained eccentricity of its tide, which has puzzled ancients and moderns alike. The current runs at the rate of 8 miles an hour, but continues only for a short time in one direction, changing its course, it is said, ten or twelve times in a day.

Volcanic action. There are no volcanoes on the mainland of Greece, but everywhere traces of volcanic action and frequently visitations of earthquakes, for it lies near a centre of volcanic agency, the island of Santorin, which has been within recent years in a state of eruption. There is an extinct crater at Mount Laphystium in Bœotia. The mountain of Methane, on the coast of Argolis, was produced by a volcanic eruption in 282 B. C. An earthquake laid Thebes in ruins in 1853, another destroyed every house in Corinth in 1858, and a third filled up the Castalian spring in 1870. There are hot springs at Thermopylæ and other places, which are used for sanitary purposes. Various parts of the coast exhibit indications of upheaval within historical times. On the coast of Elis four rocky inlets are now joined to the land, which were separate from it in the days of ancient Greece. There are traces of earlier sea-beaches at Corinth, and on the coast of the Morea, and at the mouth of the Hellada. The land has gained so much that the pass of Thermopylæ, which was extremely narrow in the time of Leonidas and his three hundred, is now wide enough for the motions of a whole army.

Geology. The whole chain of the Pindus and some of the mountains of the Morea are composed of Primitive rocks—granite, serpentine, porphyry, mica, and other schists—but greater part of the country consists of Secondary formations, especially of a compact gray limestone, which hardens often into the purest marble. All Parnassus and Helicon consist of this rock. In the vicinity of Athens the limestone rests on mica schist, which prevails also in other parts of Attica, and in Eubœa, Laconia, and the Cyclades. Clay slate is found in some districts, and coal, equal to two-thirds of an equal weight of Newcastle coal, is found at Kumi in Eubœa, and of an inferior quality at Marcoponeo in Bœotia. Greece is not rich in minerals. Gold exists, but not in sufficient quantity to cover the expense of working. Copper is abundant, and silver, lead, iron, emery, antimony, cobalt, manganese, sulphur, and salt

are found. Gypsum and porphyry are quarried. Marble is abundant, the chief kinds being the white marble of Pentelicus, of which the Parthenon was made, the blue marble of Hymettus, the green and red marble of the Morea, and the green and white of Caryste. In Mount Taygetus are beds of verd-antique jasper.

Scenery. The scenery of Greece excites the warmest admiration of all travellers, mainly from three causes:—(1) its unusually rich variety; (2) its exquisite sensibility to every modification of the light of the sky; and (3) the graceful and almost severely classical outline of its hills.

Vegetation. The vegetation of Greece may be described as belonging to four distinct zones. (1) Up to 1500 feet above the sea is a region growing corn, vines, olives, oranges, melons, pomegranates, and other fruits; (2) from 1500 feet to 3500 feet is the region of the oak; (3) from 3500 feet to 5000 feet is the region of the beech and pine, interspersed still with a few corn-fields; (4) above 5000 feet is a sub-alpine region yielding only a few wild plants. Most travellers are struck with the comparative scarcity of wood in Greece. But though most of the ancient forests have disappeared, more of the surface still remains woodland than travellers realize. Close on 15 per cent. of it was under forest in 1860, which is only 1 per cent. less than in Spain, and is 12 per cent more than in Britain. The most common tree is the pine, but the oak, plane, walnut, chestnut, and olive are also abundant. The beech is said to be a modern invader from the north, where it covers the whole of the Pindus range, and in some places, as on Mount Pelion, which were covered with other kinds of trees in historical times, the beech seems now to have driven them entirely out. The palm thrives in Messenia, and finds a home even in Attica. Myrtles flourish in the west, and oleanders brighten the river beds.

Animals. The wild animals still to be found occasionally in Greece are the boar, wolf, bear, lynx, wild cat, jackal, and fox. The wild goat, which has disappeared from the rest of Europe, finds a last asylum in some of the islands of the Greek archipelago. Game is abundant,—red deer, fallow deer, roe, hares, rabbits. It is said that hares and rabbits never occupy the same island, except in the case of Andros, where the hares are found in the north and the rabbits in the south. The birds are the eagle, vulture, hawk, owl, hoopoe, egret, pelican, pheasant, bustard, partridge, woodcock, nightingale, etc. Quails come in April. The domestic animals are the horse, ox, ass, mule, sheep, goat, pig, dog, and poultry. Poisonous snakes are only found in some few places, but mosquitos and gnats are everywhere sources of annoyance.

Climate. The climate of Greece, which ancient writers praised for its equableness, presents to modern observers two peculiarities which do not possess that character. One is a greater intensity of heat in summer and of cold in winter than obtains in Spain, Italy, and other countries which lie within the same latitudes, and are even less open to the tempering influences of the sea. This peculiarity is due to the exposure of the country to the cold winds from the snow hills in close proximity to it on the north, and to the exhausting sirocco from the sands of Africa on the south. The other peculiarity is the remarkable local contrasts and rapid transitions which the climate manifests, and which are a natural effect of the diversity of the geographical configuration. The remark of Gell is often quoted, that in travelling through the Morea in March he found summer in Messenia, spring in Laconia, and winter in Arcadia, without moving beyond a radius of 50 miles. There is great diversity in the rainfall in different parts of Greece. As a rule, rain is more prevalent in the west than in the east, which accounts for the fertile look of the hills of Elis and the barren aspect of those of Argolis. Attica is the driest part of Greece, and Bœotia has still the same heavy moist atmosphere it had of old; and, what is remarkable, the old contrast between the people of those two provinces, which was proverbial when both were Greek by blood, still holds good when they are both certainly Albanian, the Atticans of the present day being still quick and lively, and the Bœotians dull and phlegmatic. According to statistics kept by Julius Schmidt, director of the observatory of Athens, and published in his *Beiträge zur physikalischen Geographie von Griechenland* (1864–70), there were in 1859 only twenty-five days on which enough rain fell at Athens to be measured by the rain gauge. The mean annual temperature of Greece is 64° Fahr. The coldest months of the year are January and February. Snow seldom falls in Athens. The corn is a considerable height in March, and is cut in May. Vines and olives bud in March, and almonds are then in blossom. Winters are, however, severe on the table-lands, and in some of the plains of the interior, which are shaded from sun and sea by high hills. Dr. Clarke was informed that the peasants at the foot of Cithæron, in Bœotia, were confined to their houses sometimes for several weeks by snow. Kruse says the north wind blows ten months of the year, but Schmidt's statistics show this to be an error; there are really northerly and southerly winds every month, though now the one is more prevalent and now the other. The bird winds (so called because they bring the birds of passage) are a periodical variety of the south-west, and blow thirty days from the end of April. The Etesian winds are periodical winds from the north-east, which blow regularly about the time of the dog days, and temper the heat of that season in the whole region of the Archipelago. Columella says they begin on the 1st August and continue to the 30th; and Kruse, on the other hand, says they begin in July and blow for fifty-five days (*Hellas*, i. 265); but neither of these statements is borne out by Schmidt's figures. In 1862 the only winds which blew at Athens during July and August were north-east and south-west, and out of the sixty-two days the north-east blew for thirty four, and the south-west for twenty-eight,—the north-east blowing twenty-two days in July and twelve in August, and the south-west nine in July and nineteen in August. Malaria prevails largely from the neglect of drainage and the consequent creation of marshes in many parts, and the malaria causes fever, which is very fatal among children, and leaves debilitating effects in the adults, and altogether imposes a very serious check on the growth of the population of the country.

Inhabitants. The modern Greeks are of very composite origin, yet are an extremely compact and homogeneous people. Out of the million and a half which constitute the present population of the country, only 67,941 speak any other language than Greek, and only 16,084 profess any other religion than the Orthodox; and all draw well together, glorying with one another in the same memories of a common deliverance, and sharing in the same ambition of a great future. There are in the narrow bounds of Greece three distinct races, speaking different languages, wearing different costumes, observing different customs, and holding little social intercourse with one another. These races are the Greek, the Albanian, and the Wallachian. All three are probably much mixed in blood, and, in fact, the descent of each of them has been a very vexed problem in ethnology. But, on the whole, the suggestion of Freeman seems the most likely account of the matter,—that, taking them all in all, these three races are the direct representatives of the three races which occupied Greek territory at the time of its conquest by the Romans. Since that time their blood has certainly been mingled with other elements, but still substantially the base of the modern Greek is the ancient Greek, the base of the modern Albanian is the ancient Illyrian, and the base of the modern Wallachian is the ancient Thracian.

Of these races the least numerous in Greece is the Wallachian or Roumanian. They are found chiefly in the mountainous regions in the northern parts of Greece, on the slopes of Othrys, in the neighborhood of Zeitoum, on the hills of Acarnania and Ætolia, and even so far south as the banks of the Bœotian Cephissus. They pursue a nomadic shepherd life, wear black shaggy *capotes* made to imitate sheep-skin, and speak Roumanian,—a modified Latin,—the language of their race, and also Greek, the language of the country. They belong to the Greek Church, and sometimes marry Greek girls, but almost never give their own daughters in marriage to Greeks. In 1851 Finlay says there were 50,000 Wallachians in the modern kingdom of Greece; but they are rapidly becoming completely Hellenized, and in 1870 there were only 1217 Wallachians in Greece who did not speak Greek. Most of the brigands that used to infest Greece were Wallachians.

The Albanians, Skipetars (*i. e.*, Highlanders), or Arnaouts, occupy at present more than a fourth of modern Greece,—all Attica and Megaris (except the capitals), most part of Bœotia and part of Locris, the southern half of Eubœa, part of Ægina and Andros, the whole of the islands of Salamis, Poros, Hydra, and Spezzia, and considerable districts in Argolis, Sicyonia, Arcadia, Laconia, Messenia, and Elis. They speak a language of their own, which certainly belongs to the Aryan family, but philologists are at a loss whether to count it an independent member of the family, or merely a corruption of one of the better known branches. In districts where they exist in small bodies they are losing their own tongue and adopting Greek; but in places like Attica and Hydra, where they exist in larger numbers, they still keep it up, and if the men understand Greek the women do not. In 1851 Finlay states there were 200,000 Albanians in Greece, and in 1870 there were only 37,598 left who did not speak Greek. The Albanians who dwell in Greece all belong to the Greek Church. They are mostly

agriculturists, and seem to care little for political or professional life. They wear a peculiar dress, which was adopted by them mostly from the Slavs, and was regarded as the national costume of Greece after the Revolution,—a red fez, a silk jacket embroidered with gold, a white fustanella or petticoat, and gaiters.

The rest of the population, comprising the great bulk of it, are Greeks.—a people speaking the Greek language, practising the Greek rite, and claiming descent from the ancient Greek race. This claim, which seems to rest naturally on the obvious evidence of language and feature, was warmly contested on historical grounds by Fallmerayer, who held that during the Slavonic occupation of the country the ancient Greeks were completely extirpated, and that the present inhabitants are merely Slavonians Byzantinized. But his arguments have been conclusively confuted by Hopf, Finlay, and others, and it may be said to be now universally admitted that, while the blood of the population contains a considerable Slav admixture, its base is still that of the ancient race of Hellas.

It is curious that the two sections of the population of Greece whom Fallmerayer credited with the purest Greek descent—the Mainotes and the Tshakones, who inhabit the two mountain ranges of Laconia—are thought by Hopf to be the only two remnants of the Slavs that still exist. The Tshakones, whose name is commonly supposed, contrary to all etymological analogy, to be a corruption of Laconcs, speak a peculiar dialect of Greek, and still live very much by themselves. They now occupy only seven villages, and number 1500 families. The Mainotes, celebrated by Byron, live in Maina, on the western mountain chain of Laconia. They also speak a particular dialect, and are remarkable for their personal beauty and independent spirit. Their houses are fortified keeps, and they were never subdued by the Turks. They practise the vendetta, but are simple and truthful above their neighbors.

Other nationalities are represented in Greece, but so slightly as hardly to be worth mentioning. They numbered only 29,126 in all in 1870. The Jews, who were never favored by the Greeks, are found only in the Ionian Islands, where they obtained a footing during the British protectorate, and numbered, in 1870, 2528. Important remains of the old Venetian colonists still exist in the Ionian and some of the other islands.

In physique, the Greeks are generally tall and well made, if perhaps rather meagre, with oval face, long and arched nose, fine teeth, and eyes full of animation. Obesity is unknown, and their form is supple, graceful in its movements, and remains erect and elastic till past the age of 70. The best physical types are to be found in the islands and in some parts of the Morea, and there, many travellers remark, you may meet every day in the streets or highways women and boys who might have formed the models of Phidias.

National character. The national character of the Greeks is a matter upon which authorities take very contrary views, some idealizing them foolishly, and others depreciating them most unjustly. They seem to have the faults and the excellences of their famous ancestors. They have their quickness of parts and their moderation of character. They are inquisitive, full of mental activity, fond of excitement, as keen for discussion as in the days of Plato, and as eager after novelty as in those of Paul. Their thirst for knowledge is indeed quite remarkable, as well as their aptness to learn. Boys will put themselves to any discomfort in order to get to school; students at the university never missed a day from their classes during the Revolution of 1863, but regularly attended the lectures with the arms of the national guard in their hands; and domestic servants are often found in spare hours learning their letters or doing their sums. They excel in tact, in astuteness, in —what Tuckerman calls the most distinctive thing about them—finesse, which degenerates often into cunning, that weapon of the weak which could not fail to be forged under their long Turkish oppression. They are courteous and very sunny in disposition, and entirely strangers to melancholy, so that both suicide and insanity are unknown among them. They are the most temperate of Christian nations, and the chastest. Though they make a good deal of strong wine, they drink little, and they eat as sparingly as they drink. The common people live on one meal a day, and the richer on two, and an English laborer will consume at one meal what would serve a Greek family of six for the day. A little maize and vegetables steeped in oil make the staple fare. Their rate of illegitimacy is lower than that of any other European country, which may perhaps be ascribed to the fact that Greece is the only country in Europe where the males outnumber the females, and that this circumstance combines with the frugal habits of living of the people to encourage early marriages. In other countries from 3 to 22 per cent. of the births are illegitimate, in Greece only 1.40 per cent. are so. Two striking characteristics of the Greeks are their patriotism, —their local attachment to their country, which stands out in the stronger relief because it is a quality in which their neighbors the Turks are entirely awanting,—and their love not only of liberty but specially of equality. They are in spirit the most democratic European nation. They have no nobility—as of old, to be a Greek is itself to be noble; and Mahaffy says that "every common mule-boy is a gentleman (κύριος) and fully your equal, sitting in the room at meals, and joining in the conversation at dinner;" and such is their jealousy of social superiorities that he was often told by Greeks that the only reason why they tolerated a foreign king was that they could not endure to be under one of themselves. It is the same temper as ostracized Aristides, and doubtless it springs largely from their vanity and egotism, which even the most favorable witnesses own to be among their prominent faults. They have a deep belief, which they take no pains to conceal, in their own superiority over other nations; and the point in which they conceive their superiority more especially to dwell is in their intellectual gifts. There are two other qualities in which the Greeks are strong, and which, though they are often abused, are yet main agents in human advancement, —ambition and the love of money. These have given a stimulus to their commerce, and made them thrifty and saving. The faults of which the Greeks are oftenest accused are cowardice and dishonesty, and both charges are equally unwarranted. Their bravery was proved on many a field during the War of Independence. Dishonesty is not a national vice, though it seems certainly to be characteristic of the classes of Greeks who more than the rest are thrown under the observation of foreigners, particularly the low mongrel Greeks of the Levant ports and the venal public officials of Greece, who have consequently helped to blacken the reputation of their countrymen in general.

Customs. The Greeks have few peculiar customs worth noting. Their national costume is now giving place almost universally to the less picturesque dress of the Franks. They still adhere to the unreformed calendar, and their dates are accordingly calculated according to old style. They marry early,—young women from thirteen years of age to fifteen, and young men from sixteen to twenty. The marriage is arranged by the parents of the parties, is in all cases a religious ceremony, and may be severed by legal divorce. One is allowed to marry three times, but a fourth marriage is forbidden. The bride brings a dowry—houses, furniture, or money—and many unmarried girls wear their whole dowry in pieces of money as a head-dress. The prohibited degrees are those of canon law.

Population. The population of Greece in 1896, when the last census was taken, was 2,433,806, or an average of 97 persons to the square mile. The islands are the most densely peopled portions of the kingdom, especially the Ionian Islands, which have a population of 231,174, or 229 to the square mile. In continental Greece the rate is only 59 per square mile, and in the Morea 89. Greece is more thickly peopled than any country of Europe, except Prussia and Sweden. The population has doubled since 1832. It was then (exclusive of the Ionian Islands) only 612,608, and it is now (also excluding the Ionian Islands) 1,448,601. The males outnumber the females in Greece by 82,385. The only reason we have seen assigned for this is that large numbers of the women go out of the country as domestic servants, and are not counted in the census, while sailors, who are also at work out of the country, are counted. But this seems an inadequate explanation, for in 1870 the number of sailors not present in the country was only 5180. The disproportion between men and women appears, too, to be increasing, for there were 50,468 more men than women in Greece in 1870, when the whole population was 220,000 less than it was in 1879. The average birth-rate for the four years 1870–73 was 1 in 34; the average death-rate for the same period was 1 in 45. The largest towns in Greece are—Athens, with a population in 1906 of 170,000; Patras, with 37,958; Corfu, with 17,918; Hermopolis or Syra,

17,894; Zante, with 14,650; Chalcis, 11,000; Sparta, with 10,700; and Argos, with 10,600.

Administration.

The kingdom of Greece is an hereditary constitutional monarchy, descending by primogeniture from male to male, female succession being only allowed in the event of the absolute failure of legitimate heirs male. The title of the sovereign at first (according to the convention of London, May, 1832) was king of Greece, but it was altered by the conference of London, August, 1863, to king of the Hellenes. The king attains his majority at eighteen years of age. Both he and the heir-apparent are required to belong to the Greek orthodox church, but a special exception is made for the present king, who is a Lutheran. The king receives an annual income of £52,179, of which £40,179 comes from the civil list, and £12,000 from personal donations of £4000 from each of the three protecting powers. He has a palace in Athens—built by Otho at a cost of £500,000—and a summer residence at Corfu. The legislative power is shared by the king with a single chamber called the boule—a house of representatives which is elected for four years by the people; its numbers cannot fall below 150, and amounted in 1872 to 188. The election is by universal (manhood) suffrage, protected by the ballot. The boule elects its own president, and its members are paid £9 a month during the session. The executive is vested in the king, who, however, is personally irresponsible, and rules by ministers chosen by himself and responsible to the legislature, in whose deliberations they also take part. They are seven in number, and their several departments of administration are—foreign affairs, home affairs, justice, finance, education and worship, army, and navy. A minister's salary is £428 a year. The king appoints all public officials,—civil, naval, and military,—sanctions and proclaims laws, calls and prorogues parliament, grants pardon or amnesty, coins money, and confers decorations. There are 18,860 public offices in the patronage of the ministry, and, as in America, a large number of them change hands with every change of administration. The effect of this in a country where politics is an open profession, and where there is a plethora of well-educated men who can find nothing to do, has been to poison political life to an unusual degree with the vice of place-hunting,—to create several active political parties in the state, which, instead of being the representatives of any policy or cause, tend too much to degenerate into mere rings of post-mongers, and conduce, by their constant strife, to an excessive frequency of ministerial crises which greatly checks the national progress of the country.

For purposes of local government Greece is divided into 13 nomarchies, under officers called nomarchs, whose duties correspond with those of the French prefects; the nomarchies are subdivided into 59 eparchies, under eparchs, corresponding to French sub-prefects; and the eparchies are further subdivided into 351 demarchies, under demarchs or mayors. The following is a list of the nomarchies, with their areas, populations, and capitals:—

	Sq. Miles.	Pop. in 1870.	Capitals.
A. In Northern Greece—			
1. Attica and Bœotia.....	2481	185,364	Athens.
2 Eubœa.....	1574	95,136	Chalcis.
3. Phthiotis and Phocis..	2053	128,440	Lamia.
4. Acarnania and Ætolia.	3025	138,444	Mesolonghi.
B. In Morea—			
5. Achaia and Elis.....	1908	181,632	Patras.
6. Arcadia.....	2028	148,905	Tripolitza.
7. Laconia.....	1678	121,116	Sparta.
8. Messenia.....	1226	155,760	Kalamata.
9. Argolis and Corinthia.	1448	136,081	Nauplia.
C. In the Islands—			
10. Cyclades.....	926	132,020	Syra.
11. Corfu.....	427	106,109	Corfu.
12. Cephalonia.....	302	80,543	Argostoli.
13. Zante.....	277	44,522	Zante.

The demarchs are elected by the people for four years; the nomarchs and eparchs are elected by the Government without fixed terms. The nomarchs are assisted in the administration of the province by a council elected by universal secret suffrage for four years, which manages the police, roads, and other local business, and imposes the assessments. The local accounts must be sent once a year to Athens to be audited by a court of Government officials. The demarchies vary in size, but, in 1861, out of 280 that then existed, only 57 were under 2000 in population, and only 7 above 10,000.

Judicial system.

Greece has an admirable legal system, which is the one good thing it has got from the Bavarians. It is based on the old Roman law, with modifications drawn from the Bavarian and French. Liberty of person and domicile is inviolate; no one can be apprehended, no house can be entered, and no letter can be opened without a judicial warrant. Criminal and political offences and delinquencies of the press are tried by jury. The commercial code is identical with that of France. The civil law is administered by a supreme court of cassation (the Areopagus); 4 courts of appeal; 17 courts of first instance, with jurisdiction up to 500 drachmas; 191 judges of the peace, with jurisdiction up to 30 drachmas, or, with an appeal, to 300 drachmas, and 4 commercial courts (at Syra, Nauplia, Patras, and Corfu), with jurisdiction up to 800 drachmas. To be a judge, it is necessary to have graduated as doctor of laws at Athens or some other European university; a judge cannot hold any other salaried appointment at the same time except that of professor in the university. Judges are appointed by the crown, and are as yet removable. Criminal courts are held in connection with those of the peace, of first instance, and of appeal; in the last the judicial authority is vested in a jury of twelve, with three accessory judges selected from those of the inferior courts, who apply the law in accordance with the jury's verdict. The crown is prosecutor in all criminal cases, and punishments are by fines, imprisonment, and, in the case of capital offences, death by guillotine. The prisons are extremely defective in construction and administration, except that of Corfu, improvements are often projected, but constantly put off from want of funds to carry them out. There is no Habeas Corpus Act, and an accused person may be detained indefinitely before being brought to trial. Judicial commissions and extraordinary courts of judicature cannot be established under any pretext. The courts of law are open to the public, except when the interests of good morals or public order demand the contrary. Naval and military offences are tried by naval and military courts, and offences of ministers of the crown by special courts, in accordance with the constitution of 1864.

Crime is proportionately less common in Greece than elsewhere, for the people are more temperate, and, on the whole, more contented. The peculiar Greek crime is—or, as we may happily now say, was—brigandage, the form of robbery which is natural to a mountainous and thinly-peopled country without roads. According to the latest consular reports, the country is at present completely free from brigands. But it will never be secure against their reappearance until it obtains good roads, which will operate against the brigands both by tending to increase the rural population and by affording better facilities for the capture of criminals.

Army.

The strength of the Greek army on a peace footing was, at the census in 1870, 12,400, including upwards of 2000 gendarmes; but since the Servian war with the Turks in 1876 the Government has resolved to raise it to 24,376, exclusive of 2508 mounted gendarmes. This, with the national guard and the reserves and volunteers, would make their total strength on a war footing over 150,000. The national guard is composed of all citizens capable of serving and under the age of 50; it is designed for purposes of defence only. The reserves consist of those who have served out their time in the regular army. The army is recruited by lot from all capable of serving, with the alternative, which is largely used, of providing a substitute; and the period of service is three years in the line, three years in the first reserve, and six in the second.

Navy.

The navy consists of two small ironclads and a few wooden gunboats and vessels for coast-guard purposes, which are manned by 2500 men, raised, as a rule, by conscription from the inhabitants of the coast, though volunteering is encouraged. The Greek flag is a white cross on blue ground—the Bavarian colors and the Greek cross.

Religion.

The religion of the people and of the state is that of the Orthodox Greek Church. In fact the Greek rite is not only the national religion, but perhaps the deepest and most creative factor in the nationality of Greece itself. Men of Greek blood who do not belong to the Greek Church do not identify themselves with the Greek

people. The Moslems of Crete were the sternest oppressors the Greeks knew, and the Latins of Syros sided at the revolution with the Turks, yet both were of the purest Greek descent. And what makes the Greek and Skipetar and Wallach of the modern kingdom all equally Greek in their sympathies to-day is their common profession of the Greek rite. But all other religions are tolerated in Greece. There is a Moslem mosque at Chalcis; there is a Jewish synagogue at Corfu; and, whatever a man's religion may be, it entails on him in Greece no civil disabilities of any kind. A Catholic or a Mahometan may rise to the highest offices of state; both Turks and Jews are at present members of municipal councils; and Jews and Catholics are buried in the same cemetery with the Orthodox at Athens. The Church of Greece, which became virtually independent at the time of the revolution, was organized upon the model of the Russian Church. Its supreme power is vested in a synod consisting of five members, who are appointed annually by the king, and the majority of whom must be prelates. The metropolitan (archbishop of Athens) is *ex officio* president; two royal commissioners attend and deliberate without voting, and the synod's resolutions require to be confirmed by them in the king's name. In all purely spiritual matters the synod has entire independence; but on questions having a civil side,—as marriage, divorce, excommunication of laymen, the appointment of feasts and fasts, and the religious censorship of the press and of religious pictures,—it can only act in concert with the Government. Excluding the Ionian Islands, which have five archbishops, there are eleven archbishops and thirteen bishops in Greece, who are chosen by the king out of a list of three candidates presented by the synod, and can only be deposed by common consent of king and synod, and in conformity with canon law. The clergy numbered 5102 in 1861. The immense majority of the population belongs to the Greek Church. In 1870 the number of other Christians in Greece was 12,585, most of whom were Roman Catholics; of Jews, 2582; and of all other religions, 917. There are two Roman Catholic archbishops and four bishops. The revenue from the property of the Greek Church in 1877 was £10,571. The prelates receive a salary from the state,—the bishops £145, and the archbishops £180. The inferior clergy receive none, but are entirely dependent on the fees they earn for various spiritual services and superstitious observances,—praying for the sick, exorcising the evil eye, consecrating a new house or fishing boat, or purifying one bought from a Turk. There are 1600 monks and 1500 nuns in Greece.

Education.

Popular education is widely diffused in Greece. It was the first care of the newly-liberated people, and has been jealously fostered ever since, till they have now an exceedingly complete national system of education, which is perhaps the most striking product of the new kingdom. The latest statistics we have on the subject are those of the year 1872, given in Watson's report of that year (*Reports of H. M. Secretaries of Embassy and Legation*, No. i. 1872). From these figures we learn that there were then 1141 primary or demotic schools, 136 grammar or Hellenic schools, 7 gymnasia, and finally, the crown of the whole, the university of Athens; besides 6 nautical schools, a polytechnic school, 4 theological seminaries of the Greek Church, and various private institutions maintained by Catholic or Protestant societies. At the primary schools, the usual elementary branches only are taught,—reading, writing, arithmetic, the catechism, grammar, history, geography, natural history, agriculture, and drawing. In the Hellenic schools instruction is given besides in the least difficult of the ancient Greek authors; and in the gymnasia, a more thorough acquaintance is made with ancient Greek and with Latin and French, mathematics, logic, anatomy, physics, and natural history. The teachers of the primary schools are educated at a training institution in Athens; those of the Hellenic schools must be licentiates of a university; and those of the gymnasia must have the degree of Ph. D. The primary schools are maintained at the expense of the communes, with a subsidy, in certain particular cases, from the state. The total amount spent by the communes for this object comes to about one-sixth part of their income, or over £40,000 in all, and the whole Government grant for primary education in 1872 was £4171. At these schools a small fee is charged, running from 1d. to 5d. a month, from all who are able to pay it. The grammar schools, the gymnasia, and the university are maintained entirely by the state, the expense in 1877 exceeding £35,000 for the two classes of secondary schools, and £18,000 for the university; at these schools and the university education is entirely gratuitous, and is furthermore encouraged by the existence of various exhibitions for meritorious pupils, won by competition. The university was erected at a cost of £10,000, raised by private subscription from Greeks all over the world, and is furnished with excellent laboratories and museums, a library of 150,000 volumes, medical hospitals, an astronomical observatory, and a botanical garden. It has 4 faculties—arts, medicine, law and theology—52 professors, 12 fellows, and after a curriculum of 4 years, confers the degrees of licentiate and doctor, which are indispensable for those who contemplate becoming lawyers, medical men, or teachers in the higher schools. It was opened in 1835 with 52 students; in 1854 it had 643; it now has 1400. In 1872 it had 1244,—of whom 26 were students of theology, 622 of law, 423 of medicine, 120 of arts, and 53 of pharmacy. The small number of theological students is partly accounted for by the existence of four other theological seminaries in Greece, supported by private funds,—one at Athens and three in the provinces,—and partly by the scandalous neglect of clerical education that obtains in Greece. In 1867 there were only 115 students at these four theological seminaries. A large proportion of the students at the university have always been foreign Greeks, for professional men are trained there not only for Greece itself but for the whole region of the Levant. Out of the 1244 students who attended in 1872, 249 were Greeks from foreign parts,—124 of these being students of medicine, 66 of law, and 6 of theology. No one is admitted as a student who has not completed his education at a gymnasium. The salary of a professor hardly amounts to £200 a year. There is no school inspection beyond that of the demarch.

Education is by law compulsory for children from seven to twelve years of age, but this law is not enforced, for it does not require to be; and the results of education in Greece are the more remarkable as being the fruits of what is practically purely voluntary attendance. Every eighteenth person in Greece is at school; in Russia only every seventy-seventh is so. In 1872 the total number of pupils was 81,197,—of whom 65,111 were males and only 16,086 females. Boys and girls are taught at separate schools; of the primary schools, 942 are for boys, with 1009 male teachers and 52,943 pupils, and only 199 for girls, with 221 female teachers and 11,035 pupils. The Hellenic schools and gymnasia are for boys only, and in 1872 had 6055 and 1942 pupils respectively. There are, however, various private schools for girls, with an aggregate attendance of 5000. These figures show that there is a serious defect in female education, for which neither the Government of Greece nor the people have due solicitude. It ought to be mentioned, however, that there is one phase of female education in which Greece is in advance of many other European countries, for the medical school of Athens is open to female students, who numbered 42 in 1879.

Industries.

We have no exact statistics as to the numbers engaged in each branch of industry severally, but Bikelas gives in the *Journal* of the Statistical Society of London for 1868 an estimate for the year 1861, according to which nearly half the population (49·37 per cent.) were agriculturists and shepherds, and more than a third of the remainder (or 18·66 per cent. of the whole population) in the liberal professions. 13·87 per cent. were engaged in industrial pursuits, 8·43 per cent. in trade, 5·40 per cent. were domestic servants, and only 4·27 per cent. were persons of independent means. Government officials and their families comprise a twelfth part of the population. There is great want of employers with considerable capital, and the amount of labor done and wages earned by the workmen is much diminished by the extraordinary number of ecclesiastical holidays they are required to observe. There are 195 fast days in Greece, and the number of working days in the year never exceeds 265. There are no paupers in Greece, no poor-law or poor-rate, and no religious associations for charitable purposes. Beggars are very rare, and absolute destitution may be said not to exist.

Agriculture.

Agriculture is still in its infancy. A larger proportion of its area is uncultivated than obtains in any country in Europe except Russia; but that is explained by the unusually large part of it which is occupied by mountains. We have no exact statistics since 1860, but then only one-seventh was under culti-

vation. Its entire area (exclusive of the Ionian Islands, not then part of it), was 45,699,248 stremmas,—a stremma being a little over a quarter of an acre. Of these only 17,824,000 were capable of cultivation, and only 6,076,000 actually under it, and half of this amount is always fallow from their system of working it. By universal testimony the country might grow food for three times its present population, yet it has to import cereals every year to an amount exceeding a third of its own produce, and over £1,000,000 in value. But agriculture contends with many difficulties in Greece, most of them, like the vicious land tax, the want of roads, and the imperfect agricultural methods, being happily remediable.

The soil is, as a rule, light and thin. In many places there is great lack of rain and running water, but the people are expert in irrigation. The chief products are corn, wine, fruit, and oil. Six different kinds of wheat are grown, producing, in a favorable season, as much as 10 or 13 returns, and after a dry spring from 3 to 5. Good crops are got of rye, barley, and maize; oats do not grow so well, and potatoes not at all. Pulse thrives everywhere, and rice is produced in the plains of Marathon and Argos, and in marshy land elsewhere. Cotton and tobacco have been introduced in our own day, and give good returns.

Greece is still in want of one of the first requisites to agricultural prosperity,—a resident proprietary. The modern kingdom began with almost no proprietors. Under the Turks two-thirds of the land belonged to the sultan, and became at the revolution simply national property, which the Government has been selling ever since to private owners on more or less reasonable terms. The peasants are showing a passion for land, and save up to buy their crofts, and in this way a large class of small freeholders is being created, with what effect upon agriculture we have no means as yet of determining. There were 16,122 proprietors in 1861. The relation between landlord and tenant is the metayer system of taking as rent or usufruct a share of the net produce, usually a third, but in the case of Government land 15 per cent. Great part of the agricultural laborers are not Greek subjects, but are Mahometan Albanians from Thessaly and Epirus, who come into Greece annually in harvest-time, in bands of 30 or 40 under a captain, who work at lower rates than Greeks and work longer, for they have no feasts to observe, and who contrive by frugal living to carry back three-fourths of their earnings to their families at home.

The methods of cultivation in use are still primitive. Modern implements are not employed to any great extent, though their manufacture is carried on at Syra and the Piræus, and though even the steam plough has been actually introduced in Elis. The Greek plough is still that of Homer, which the husbandman carries about his croft on his shoulder, and which hardly does more than scrape the surface of the ground. It is wrought by oxen, Greek horses—the old Thessalian breed—being small and unfit for farm work. There is no system of rotation of crops. Fields are cropped till they are exhausted, and then left fallow for a year or two. The farmers have no idea of manure or drainage. There are few enclosures, and even the laying out of the fields is slovenly,—a patch of this crop here, and a patch of that there. The houses of the peasantry are sheds of wood or huts of mud, without either chimney or window, but always with a picture of the Virgin inside.

With all the defects in the Greek system of cultivation, agricultural returns show gradual though slow progress. In 1846 the yield for the year of wheat, barley, and maize was estimated at 6,000,000 kilots, a kilot being nearly 7·3 gallons; in 1876, 12,000,000. In 1860 there were 2,287,645 stremmas—*i. e.*, 565,048 acres—under cereal crops, which yielded 9,512,993 kilots of grain,—*i. e.*, 1,165,807 quarters, or 2 quarters an acre.

Wines.

Vineyards are numerous, but the wine is poor, with little body, and is ruined for European use by the resin put in to preserve it. All provinces produce wine, but the best is that of Santorin, which is shipped largely to Russia. There is still a Malvoisie wine, though it is no longer that which was once so celebrated under the name of Malmsey; and the Kephissia wine of Attica and the red wine of Zante are in good repute. There has been a large increase in the number of vineyards, and a marked improvement in the manufacture of wine since the kingdom began, and Greek wines have been of some commercial importance since 1858. In 1820 there were only 25,000 stremmas under vines; there are now 700,000.

Currants.

A grape peculiar to Greece is that of Corinth, which, from the place where it grows, is called the currant. It constitutes the largest export of Greece, and goes almost exclusively to England to make the national plum-pudding. Its cultivation has been largely increased of late. In 1820 only 10,000,000 ℔ were raised, and in 1831, after the destruction of the vines by Ibrahim Pasha, only 5,000,000 ℔, but in 1851 there were 57,000,000 ℔, and in 1876 195,000,000 ℔, valued at £1,400,000. There are now 40,000 acres of ground under currants alone, and this probably cannot be much increased, for the Corinthian vine is fastidious, and grows only on the northern and western shores of the Morea, on some of the Ionian Islands, and at Mesolonghi, and nowhere else in Greece or in the world. The vines bear in their sixth year, but do not attain full perfection till their twelfth. The grapes are gathered in August, dried in the sun, and packed.

Other products.

The olive and the mulberry are very important products of cultivation. The oil of Attica has still its ancient reputation. It is calculated that in Greece in 1876 there were 12,000,000 olive trees, which yielded 19,000,000 okes of oil. In 1834 there were only 2,300,000 trees, yielding 1,000,000 okes. The mulberry grows best in the south of the Morea, and there the house of almost every peasant is given up in part to rearing the silk-worm, the eggs being nestled in the bosoms of the women. There were in 1833 only 300,000 mulberry trees in Greece; in 1876 there were 2,000,000

A natural production of Greece of great importance is valonia, the husk of the acorn of the *Quercus Ægilops*, an oak of which considerable forests exist in Arcadia, Attica, the island Zea, and other places. Valonia is valuable on account of the amount of tannin it contains, and is much exported to England and Italy for use in dyeing and tanning. Another species of oak, the *Quercus coccifera*, which grows largely on Mount Taygetus, breeds the insect called kermes, which, when dried, looks like a berry, and is used in dyeing the red fez of the country. Turpentine is obtained in large quantities from the pines of Cithæron and elsewhere.

Cotton and tobacco are the only products whose cultivation is free from taxation, the exemption being made with a view to the encouragement of their cultivation. Cotton is now grown to a considerable extent, its culture having received a great impetus during the American civil war. It is produced particularly on the marshy lands of Levadia, and Phthiotis in northern Greece. In 1862 the produce was 28,537 quintals; in 1864, 193,615 quintals. The annual yield of tobacco is 4,000,000 okes. Opium, madder, and flax are grown in the northern parts of Greece.

Greece is rich in fruits. The figs of Attica have not degenerated, and they are produced to a considerable extent in other parts also, especially Messenia. In 1834 there were but 50,000 fig trees; in 1861, 300,000. Apricots, oranges, lemons, pomegranates, and citrons grow well in the islands, and the fruit trade might be largely increased.

Though there is much excellent timber in the Greek forests, it is practically useless from want of roads, so that it is cheaper to import wood from abroad. In 1860 there were 7,000,000 stremmas of land under forest, and it is estimated that now only 5,500,000 are so.

The herds are chiefly bred on the mountain pastures, and are mainly sheep and goats. Most of the cattle are used in agricultural labor. In 1865 the total number of sheep in the country subject to taxation was 1,778,729; of goats, 2,289,123; of cattle, 226,737, of which 168,927 were work oxen; of horses, 69,787; of mules, 29,637; of asses, 64,051; of swine, 55,776; and of camels, 72. Cows' milk and butter are considered unwholesome in Greece (Kruse, *Hellas*, i. p. 368), and the butter and cheese in use are from ewes' and goats' milk. The honey of Greece is not equal to that of other countries; even that of Hymettus,—so famous in ancient days when honey was exceptionally prized, because men were ignorant of sugar, and which is still one of the best kinds in Greece,—could not compete with French in the English market. But over £35,000 worth of honey is produced in Greece every year, and goes chiefly to Turkey. There are extensive fisheries on some parts of the coasts.

Land tax.

The land tax is still the Turkish system of exacting a percentage—generally a tenth—of the gross produce of the land; and though, in the case of the vineyards, a money commutation, based on the planter's declaration, is coming into use, the tax is, as a rule, paid in kind. This system is rendered more objectionable by the tax being farmed out to private contractors. The cultivator cannot reap his crop, though it be ripe, till the day appointed by the tax collector, and he must cut it then, though it be green. When cut, he must carry the whole crop on pack animals (there being no roads for wagons), sometimes for miles, to the particular public threshing-floor which the collector fixes upon, and he must wait with it there till the collector can find time to see it threshed and take his tithe, which is often weeks, sometimes, it

is said, even as long as three months. Proposals for the abolition of this method of taxation have often been introduced into the chamber of deputies, but the matter has always been deferred till they should have a register of lands, which, however, they seem to take no steps to make.

Roads. When Capodistria assumed the government of Greece fifty years ago, he said there were two things he meant to give the nation,—roads and education. The system of education has been very satisfactorily built up since that time, but its roads are still to make. We have no recent statistics on the subject, but Rangabe says that in 1867 nineteen roads had been made since the kingdom was established, with a total length of 380 kilometres; and Watson, writing in 1872, complains that, from want of roads at that time, it cost more to carry grain from Marathon to Athens (25 miles) than to bring it from the Black Sea, while highly fertile tracts of country, not far from seaport towns, were left entirely uncultivated because of the expense of the transit of their produce. Every man in Greece is by law obliged to give at least three days' labor in the year, or its equivalent in money, for road-making; and a law was passed in 1876 to apply one-fifth of the proceeds from the sale of state lands to making roads.

Manufactures. Manufacturing industries are steadily advancing. According to a report issued in 1876 by Mansolas, director of the statistical bureau at Athens, there are in Greece 95 steam-mills and factories, with a total of 1967 horse-power; the most important of these have been established since 1869. They include 35 flour-mills, 12 for cotton-weaving, 2 for cotton-spinning, 4 for ginning, 6 for silk-weaving, 10 oil-mills, 9 for constructing machinery, 4 for making wines and spirits, 3 tanneries, 2 metal-foundries, 1 powder-mill, and 7 others of various kinds. Shipbuilding is carried on at the seaports. The Greeks excel in tailoring, confectionery, and embroidery. As an index to the industrial progress of the nation it may be noted that in the International Exhibition of 1851 there were only 35 Greek exhibitors; in 1862, 295; and in 1878, 1000. Greece has established a series of industrial exhibitions of its own,—the new Olympic games, as they are termed, which a wealthy Greek left £3000 a year to found,—which combine literary, scientific, and athletic competitions with those of industry, and which occur, like the old Olympic games, every four years. The cotton industry is making decided progress. The annual export of raw cotton is diminishing, and its importation is increasing; and, to encourage the trade, there is no duty on native cotton, unless exported, while the import duty on raw cotton was reduced in 1875. Leather is made chiefly at Syra.

Mines. The marble quarries of Pentelicus, Caryste, and Paros are important works. The coals of Eubœa are not much used, as their heat-giving capacity is small. The only mining operations in the country are those of the Laurium Company, which, by help of improved modern appliances, extracts treasure from the waste which the ancient workers of the mines threw away, and which has been roughly guessed to contain still 120,000 tons of lead. The scoriæ or refuse heaps of Laurium are dug up and carried on trucks, by a short line of rail belonging to the company, to the town of Ergasteria, near Cape Colonna, built by themselves to be their workshop and port; there these scoriæ are re-smelted, and yield annually nearly 10,000 tons of lead, and a large quantity of silver. There are 3000 operatives engaged in this work at Ergasteria. The value of the export in 1875 was £150,513.[1]

Commerce. But the most conspicuous success of Greece has been in her maritime commerce, for which the situation and configuration of the country afford unusual facilities. In 1821 Greece had only 440 vessels, with a total tonnage of 61,450 tons, whereas in 1875 she had 5440 vessels, 27 of them steamers, with a tonnage in all of 262,032 tons, and employing 26,760 men. In 1830 there was hardly a harbor in all Greece worth the name, the Piræus being then barely accessible to fishing boats; there are now 65 good ports. It had only one lighthouse in 1847; it has now 46, but more are still urgently needed.

The straits of Euripus have been cleared, deepened, and widened, and an iron bridge thrown across. There are five chambers of commerce. The chief ports are Hermopolis (Syra), Hydra, Spezzia, Corfu, Zante, Piræus, Patras, Mesolonghi, Nauplia, Santorin, Naxos, Corinth.

The commerce of Greece is usually divided into general and special,—general including all exports and imports whatever, and special taking in only imports meant for home consumption and exports of commodities produced in the country The special commerce amounts usually to 80 per cent. of the general. The general commerce of Greece in 1875 amounted to £8,374,198, of which £5,196,629 were imports and £3,177,569 exports. An idea of the remarkable progress of its commerce may be obtained by comparing these figures with the following:—In 1833 the total Greek commerce amounted to £671,499, and in 1840 to £1,036,374; in 1860 it was £3,147,000, and in 1870 £5,354,000. England occupies the first place among countries trading with Greece, its transactions being more than double those of any other country, and amounting in 1873 to 41 per cent., and in 1875 to 38 per cent., of the whole commerce of Greece. Taking the average of the six years ending 1874, Wyndham calculates that 60·75 per cent. of the exports of Greece go to England, and that 28·85 per cent. of its imports come from England. Turkey and Austria, its nearest neighbors, stand next. 25 per cent. of its imports are cereals and flour,—the cereals from Russia, Turkey, and Roumania, the flour from France; and 20 per cent. are tissues, mainly from England. Though timber is so abundant, it still is one of the largest imports, amounting to £187,778 in 1875. The other chief imports are cattle, salt meat, rice, coals, butter, iron, and paper. The principal item of export, amounting to half the whole, is currants; this in 1875 was £1,350,467, of which £1,083,482 went to England; then come oil, hides, lead, figs, valonia, wines and spirits, tobacco, cotton yarn, etc.

The Greek coasting trade is not open to foreigners. The steamers of the Hellenic Company possess a monopoly of the coastage of those waters, the object being to encourage the development of native steam navigation.

Railways. There is only one railway in Greece, if we except the private one already mentioned belonging to the Laurium Company. It is from Piræus to Athens, is 7½ miles long, belongs to Government, and carries passengers only. Another railway is projected from the Piræus to Lamia (Zeitoum) in the north (140 miles), with the view of connecting Greece with the general railway system of Europe. There were 1235 miles of telegraph in Greece in 1875, the property of Government and worked at a considerable loss.

Postal system. The postal system is a Government undertaking, and has been a source of profit only since 1861, when postage stamps were introduced. In 1875 there were 131 post-offices in Greece.

Banks. There are two banks,—the National, with its head office at Athens, and the Ionian, with its head office at Corfu. The National had in 1868 a paid-up capital of £540,000, with a reserve fund of £215,000.

Money. The currency of Greece is that of the Latin monetary league, which it joined in 1868, and which allows it to strike 26,000,000 silver francs and as much gold as it thinks proper. Under Otho, Greece had a coinage of its own, on the basis of a double standard and the decimal system, the unit being the drachma (equal to 8½d.), which was divided into 100 equal parts called leptas. Coins of various values were struck, but only £4000 in gold pieces, and only £36,000 in silver, an amount quite inadequate for the trade of the country, and quickly disappearing altogether, so that there is probably not a single coin of them now left in Greece. It became necessary therefore to declare the gold and silver coins of other countries a legal tender in Greece; and these, with the notes of the National and Ionian Banks, became, and still remain, the practical currency of the country, so that the simplest payment may require a puzzling arithmetical calculation, for people have to pay in sovereigns and thalers prices stated in drachmas and leptas. Though the unit of the Latin currency is the franc, the official accounts of Greece are still reckoned in old drachmas, in distinction from which the franc is termed the new drachma. There are 28 old and 25 new drachmas in the pound sterling.

Weights and measures. The system of weights and measures is the Turkish. Their measures of length are—the pique, which is equal to 27 inches; the royal pit, equal to 1 metre, or 3·2808 feet; the stadion, equal to 10·62 English miles. Their measures of superficial extent are—the stremma, equal to one-fourth of an English acre, and the hectare equal to 10 stremmas. Their standard of weight is the cantar or quintal, equal to 123 lb avoirdupois. It is divided into 44 okes, an oke being equal to 2·84 lb, and subdivided into 400 old and 1280 royal drams. A kilo, used for weighing corn, is half a cantar, or 22 okes. 816 kilos are equal to 100 quarters.

Finances. The financial condition of Greece is unsatisfactory. Its annual expenditure usually exceeds its income, and it is deeply in debt. The new kingdom was born in debt, and contracted to pay the expenses of the revolution that gave it being, and to that original burden it has from time to time added fresh liabilities, till it has now no longer any credit in the money markets of Europe, and is deeper in debt in proportion to its revenue than any European country except Spain. The total debt of Greece was £15,360,103, according to Mr. Malet's report in 1875, and, what with the accumulation of interest and the contraction of a fresh debt for army extension during the Servian insurrection of 1876, it must now be over £16,000,000. This debt consists of two kinds—foreign and internal. The foreign debt is of two parts. There are first the original two loans, amounting between them to £2,300,000, which were negotiated by the revolutionists in 1824 and 1825 with two English houses at 59 and 55 per cent., and whose coupons are now held mainly by Dutch speculators. On this Greece has never paid a farthing of interest. The Greek treasury, although it accepts the obligation, puts it off from year to

[1] [Serpho or Serphanto, the ancient island of Seriphos, produces considerable fine iron.—Am. Ed.]

year under the heading "Deferred Debt." With accumulating interest at 5 per cent., it had increased to £8,084,500 in 1874. The second part of the foreign debt is a loan of £2,400,000 guaranteed by the three protecting powers on the accession of Otho in 1832, and negotiated with Rothschild at 94. On this Greece paid interest for a few years, but its payment has so fallen into arrear that in 1874 this debt had grown to £3,870,000. There is also a small debt due to the Bavarian Government, amounting now to £250,000, and there are some still smaller debts to other foreign creditors. The internal debt of the country consists partly of indemnity due to sufferers in the War of Independence, partly of loans contracted with capitalists within the kingdom after its credit abroad was gone; it now amounts in all to £5,270,339.

The revenue for 1877, according to the estimate in the budget, was £1,401,687, and the expenditure £1,466,708. The actual receipts usually fall short of the budget estimate, for Greece permits her subjects to fall much into arrear with the payment of their taxes; and in 1867 it was calculated there was an aggregate of arrears of taxes amounting to £2,226,000. This revenue is received partly from direct taxes on land and property; partly from indirect taxes; partly from the public services, the post-office, telegraphs, and printing; partly from the rent of the public domains, mines, quarries, hot springs, salt fisheries, fruits, olive gardens, vineyards, and currant plantations; and partly from the sale of national lands and the ecclesiastical revenues. The largest sources of revenue are the land tax, which brought in 8,500,000 drachmas in 1877; the customs 13,400,000; and the stamps, 4,200,000. The cost of collecting the land tax is very extravagant. It takes £25 to collect £100, or ten times more than it does in France. The Greeks are not sorely taxed. Rangabe estimates that they pay 23·43 drachmas (about 17s.) each in the year as taxes.

Of the expenditure of Greece, nearly one-fourth part goes to pay interest on its debt, another fourth to maintain its army and navy, and a large sum (£136,386) to pay pensions to persons who suffered in the revolution, or who possessed interests in the Ionian Islands at the time of their cession. The education and worship of the country cost £75,427, and the foreign office and diplomatic service only £40,257. The administration of justice takes £107,716, and the department of the interior, including the post-office and many other outlays, £171,526. The salaries of members of the chambers of deputies come to £16,071.

Literature.—Bursian, *Geographie von Griechenland* (Leipsic, 1862); Tozer, *Lectures on the Geography of Greece* (London, 1873); Kruse, *Hellas* (Leipsic, 1825–27); Julius Schmidt, *Beiträge zur physikalischen Geographie von Griechenland* (Leipsic, 1864–70); Finlay, *History of Greece* (Oxford, 1877); Maurer, *Das Griechische Volk in öffentlicher und privat-rechtlicher Beziehung* (Heidelberg, 1835); About, *La Grèce Contemporaire* (Paris, 1854); Rangabe, *Greece, her Former and Present Position* (New York, 1867); Strickland, *Greece, its Condition and Resources* (London, 1863); Wyse, *Impressions of Greece* (London, 1871); Tuckerman, *The Greeks of To-day* (London, 1873); Moraitinis, *La Grèce Neuve qu'elle est* (Paris, 1877); Sergeant, *New Greece* (London, 1878); and the annual reports of the British secretaries of embassy and legation and of the British consuls. (J. R.)

PART II.—GREEK HISTORY.

SECTION I.—GREEK HISTORY TO THE DEATH OF ALEXANDER THE GREAT.

The early history of Greece is the first chapter in the political and intellectual life of Europe. In contrast with nations still in the tribal stage the Greeks have already the life of cities; in contrast with the despotic monarchies of the East they recognize the principle that no personal rule should be unlimited. From the first they appear as a people obedient to reason and to a native instinct of measure. In the political sphere this leads them to aim at a due balance of powers and tendencies in the state, at the definition of duties and the protection of rights. In the intellectual sphere it leads them to explore causes, to interpret thought in clear forms, to find graceful expression for the social feelings and sympathies. The historical interest of Greece does not begin therefore only at the point where details and dates become approximately certain, but with the first glimpses of that ordered life out of which the civilization of Europe arose. At a later stage the Greek commonwealths offer the most instructive study which the ancient world affords in the working of oligarchic and democratic institutions. Then, as the Roman power rises, culminates, and declines, Greek history assumes a new character and a new interest. From Alexander the Great dates the beginning of a modern Greek nation, one, not in blood, but in speech and manners. Two main threads link together the earlier and later history of civilized man. One passes through Rome, and is Latin; the other passes through the new Rome in the east, and is Greek.

In a sketch like the present it would be impossible to attempt a detailed narrative of facts, which, besides, fall to be considered under particular headings. The aim here will be rather to trace in outline the general course of the development, and to indicate, so far as a rapid survey permits, the leading causes and tendencies which were at work in its successive stages.

Six periods may be distinguished. I. The prehistoric period, down to the close of the great migrations. II. The early history of the leading states down to about 500 B. C. III. The Ionic revolt and the Persian wars, 502–479. IV. The period of Athenian supremacy, 478–431. V. The Peloponnesian War, 431–404, followed by the period of Spartan and then of Theban ascendency, 404–362. VI. The reigns of Philip and Alexander, 359–323 B. C.

I. *The Prehistoric Period, down to the close of the great Migrations.*

"Ancient Hellas," says Aristotle, "is the country about Dodona and the Achelous, . . . for the Selloi lived there, and the people then called the Graikoi, but now the Hellenes" (*Meteor.*, i. 14). The name *Graikoi* probably meant the "old" or "honorable" folk (Curtius, *Etym.*, 130). The Italians may have enlarged the application of this name, which they found on the eastern side of the Ionian Gulf. The moderns have followed the Romans in giving it to the whole people who, from very early times, have always called themselves *Hellenes*.

Primitive Indo-European civilization.

The evidence of language tells something as to the point of civilization which had been reached by the ancestors of the Indo-European nations before the Hellenes parted from the common stock in Central Asia. They had words for "father," "mother," "brother," "sister," "son," "daughter," and also for certain affinities by marriage, as "father-in-law," "brother-in-law," "daughter-in-law." They lived in houses; they wore clothes made of wool or skins; as arms they had the sword and the bow; they had flocks and herds, goats and dogs; they drove, if they did not ride, horses. They were a pastoral rather than an agricultural people. They knew how to work gold, silver, and copper; they could count up to a hundred; they reckoned time by the lunar month; they spoke of the sky as the *Heaven-father*. The first great migration from the common home was that which carried the ancestors of the Teutonic, Slavonic, and Lithuanian tribes into north-western Europe. The next was that which carried the ancestors of Greeks, Italians, and Celts into southern and south-western Europe.

Language indicates that there must have been a period during which the forefathers of Greeks and Italians, after the Celts had parted from them, lived together as one people. Again, the Greek language, unique in its characteristic development, tells that the Hellenes, after the Italians had left them, must have long remained an undivided people. But to us this primitive Hellenic unity is prehistoric. We first know the Hellenes as a race divided into two great branches, each with well-marked characteristics of its own,—*Dorians* and *Ionians;* while those who have been less affected by the special causes which produced these divergences from an earlier common type are regarded as forming a third branch, and are called collectively *Æolians*. Further, we hear of a people distinguished indeed from the Hellenes, yet apparently felt (as by Thucydidēs) to be not wholly alien from them,—a people represented as having been before them in Greece proper, on the coasts, and in the islands of the Ægean,—the *Pelasgians*.

Hellenes.

Pelasgians.

In some Homeric passages, and those among the oldest, the name *Pelasgoi* denotes a tribe of Achæan or Æolian Greeks living in Thessaly (*Iliad*, ii. 681; xvi. 233). In other poetical texts of later date, and repeatedly in Herodotus, *Pelasgoi* is a general designation for people of whom the Greeks knew little definitely, except that they had preceded the Hellenic dwellers in the land. In this second and vague use, "Pelasgian" is virtually equivalent to "prehistoric."

Earliest Hellenic migrations.

The highlands of Phrygia have the best claim to be regarded as the point of departure for the distinctively Hellenic migrations. In these fertile regions of north-western Asia Minor, the Hellenes, after the Italians had left them, may have lived, first as a part of the Phrygian nation, and afterwards as a

First epoch.

separate people. From these seats a great wave of migration seems to have carried over the Hellespont into Europe a population which diffused itself through Greece and the Peloponnesus, as well as over the coasts and islands of the archipelago. In after ages, when the kinship, though perhaps dimly suspected, was no longer recognized, the Hellenes called these earlier occupants of the land *Pelasgians*. It has been conjectured that in *Pelasgos* we have combined the roots of πέραν and εἶμι (ηα). The name would then mean "the further-goer," "the emigrant." It would thus be appropriate as the name given by the Hellenes, who had remained behind in Phrygia, to the kinsmen who had passed over into Europe before them.

Second epoch.

The second epoch of migration from the Phrygian highlands appears to have been one by which single Hellenic tribes, with special gifts and qualities, were carried forth to become the quickeners of historic life among inert masses of population, among those "Pelasgians" who had long been content to follow the calm routine of husbandmen or herdsmen. The ancestors of the Ionians went down to the coasts of Asia Minor, and became the founders of a race whose distinctive powers found scope in maritime enterprise and in commerce. The ancestors of the Dorians passed into the highlands of Northern Greece, and there developed the type of hardy mountaineer which united the robust vigor of hunter and warrior with a firm loyalty to ancestral traditions in religion and in civil government.

Phœnicians.

Of these two branches,—the Ionian and the Dorian,—the Ionian was that which most actively influenced the early development of Greece. But the Ionians themselves derived the first impulses of their progress from a foreign source. Those Canaanites or "lowlanders" of Syria, whom we call by the Greek name of Phœnicians, inhabited the long narrow strip of territory between Lebanon and the sea. Phœnicia, called "Keft" by the Egyptians, had at a remote period contributed Semitic settlers to the Delta or "Isle of Caphtor;" and it would appear from the evidence of the Egyptian monuments that the Kefa, or Phœnicians, were a great commercial people as early as the 16th century B. C. Cyprus, visible from the heights of Lebanon, was the first stage of the Phœnician advance into the Western waters; and to the last there was in Cyprus a Semitic element side by side with the Indo-European. From Cyprus the Phœnician navigators proceeded to the southern coasts of Asia Minor, where Phœnician colonists gradually blended with the natives, until the entire seaboard had become in a great measure subject to Phœnician influences. Thus the Solymi, settled in Lycia, were akin to the Canaanites; and the Carians, originally kinsmen of the Greeks, were strongly affected by Phœnician contact. It was at Miletus especially that the Ionian Greeks came into commercial intercourse with the Phœnicians. Unlike the dwellers on the southern seaboard of Asia Minor, they showed no tendency to merge their nationality in that of the Syrian strangers. But they learned from them much that concerned the art of navigation, as, for instance, the use of the round-built merchant vessels called γαῦλοι, and probably also a system of weights and measures, as well as the rudiments of some useful arts. The Phœnicians had been first drawn to the coasts of Greece in quest of the purple-fish which was found in abundance off the coasts of the Peloponnesus and of Bœotia; other attractions were furnished by the plentiful timber for shipbuilding which the Greek forests supplied, and by veins of silver, iron, and copper ore.

Two periods of Phœnician influence.

Two periods of Phœnician influence on early Greece may be distinguished: first, a period during which they were brought into intercourse with the Greeks merely by traffic in occasional voyages; secondly, a period of Phœnician trading settlements in the islands or on the coasts of the Greek seas, when their influence became more penetrating and thorough. It was probably early in this second period,—perhaps about the end of the 9th century B. C.,—that the Phœnician alphabet became diffused through Greece. This alphabet was itself derived from the alphabet of the Egyptian hieroglyphics, which was brought into Phœnicia by the Phœnician settlers in the Delta. It was imported into Greece, probably, by the Aramæo-Phœnicians of the Gulf of Antioch, —not by the Phœnicians of Tyre and Sidon,—and seems to have superseded, in Asia Minor and the islands, a syllabary of some seventy characters, which continued to be used in Cyprus down to a late time. The direct Phœnician influence on Greece lasted to about 600 B. C. Commerce and navigation were the provinces in which the Phœnician influence, strictly so called, was most felt by the Greeks. In art and science, in everything that concerned the higher culture, the Phœnicians seem to have been little more than carriers from East to West of Egyptian, Assyrian, or Babylonian ideas.

Influence of Asiatic upon European Hellas.

The legends of European Greece speak clearly of foreign elements in civilization and in religious worship which came in from the East. But they do not constrain us to suppose that those who brought in these new elements were always, or as a rule, strangers to the people among whom they brought them. On the contrary the myths constantly say, or imply, that the new comers were akin to the people among whom they came; as the sons of Ægyptus are first cousins to the daughters of Danaus; as Cadmus and Pelops, though nominally of foreign origin, are thoroughly national heroes and founders. Hence it appears reasonable to conclude that the East by which European Hellas was most directly and vitally influenced was not the Semitic but the Hellenic East; that the Ionian Greeks of Asia Minor, after having themselves been in intercourse with Phœnicia and Egypt, were the chief agents in diffusing the new ideas among their kinsmen on the western side of the Ægean. Asiatic Greeks, who had settled among Egyptians in the Delta, or who had lived amid Phœnician colonies in Asia Minor, would easily be confounded, in popular rumor, with Egyptians or Phœnicians. The Asiatic Greeks, as pioneers of civilization in European Greece, appear sometimes under the name of Carians,—when they are little more than teachers of certain improvements in the art of war, and have a decidedly foreign character—sometimes as Leleges, who are associated especially with Lycia, Miletus, and the Troad, and who, as compared with the "Carians," are the representatives of a more advanced civilization. In the east the seafaring Ionians gave their name to the whole Greek people, as in the Hebrew Scriptures the Greeks are "the sons of Javan,"—the *Uinim* of the Egyptians, the *Iauna* of the Persians. It does not appear that the European Greeks of early days used "Ionian" in this way as a collective name for the Asiatic Greeks. But such names as *Iasion*, *Iason*, *Iasian*, *Argos* point to a sense that the civilization which came from Asia Minor was connected with Ionia. At a later time the Greeks forgot the Ionians and Phœnicians who had brought an Eastern civilization to the western side of the Ægean. Vividly impressed by the great antiquity of this civilization itself, especially in Egypt, they preferred to suppose that they had derived it directly from the source.

Religion.

The appearance of new elements in religious worship is one great mark of the period during which Greece in Europe was still being changed by influences, Greek or foreign, from the East. The worship which the fathers of the Hellenes had brought with them from the common home in Asia was the worship of the "Heaven-father," the unseen father who dwells in æther, whose temple is the sky, and whose altar is most fitly raised on the mountain top, as the ancient shrine of the Arcadian Zeus was the grove on the summit of Mount Lycæus. This is the "Pelasgian Zeus, dwelling afar," to whom the Homeric Achilles prays. But as the united Hellenic race parted into tribes, so to the first simple worship of the Heaven-father was added a variety of local cults. And as mariners from other lands began to visit the coasts, they brought in their own gods with them. Thus Melcarth, the city-god of Tyre, is recognized in Melicertes as worshipped at the isthmus of Corinth. In one Greek form of the worship of Heracles, Astarte—the goddess of the Phœnician sailors—becomes Aphrodite, who springs from the sea. The myth of Adonis, the worship of the Achæan Demeter, are other examples. There are, again, other divinities who came to European Greece, not directly from the non-Hellenic East, but as deities already at home among the Ionians. Such was Poseidon, and, above all, Apollo, whose coming is everywhere a promise of light and joy.

The early states.

Little precise knowledge of the earliest kingdoms and states can be extracted from the legends as they have come down to us, but some general inferences are warranted. The tradition that Minos cleared the archipelago of pirates and established a wide maritime dominion, that he was the first to sacrifice to the Charites, and that Dædalus wrought for him, may be taken at least as indicating that Crete played a prom-

Crete.

inent part in the early history of Greek culture, and that there was a time when Cretan kings were strong enough to protect commerce in the Ægean waters. Again, though Gordius and Midas have passed into the region of fable, there are reasonable grounds for the belief that the ancient kings of Phrygia once exercised dominion over Asia Minor. The Lydians, in whose origin Semitic and Aryan elements appear to have been mingled, have a twofold interest in this dawn of Hellenic history. First, they represent the earliest kingdom in Asia Minor of which anything is certainly known. Secondly, they are on land what the Phœnicians are on the sea,—carriers or mediators between the Greeks and the East. In the north-west corner of Asia Minor, a branch of the Dardani—whose ancestor is described as worshipping the Pelasgian Zeus—founded the kingdom of the Troas, the land of Troy. It has been remarked that the double names of the Trojan heroes,—Alexander, Paris,—Hector, Darius,—point to the twofold relationship of the Trojans, on the one side to Hellas, on the other to Asia. In European Greece we find the race known as the Minyæ, whose early glories are linked with the story of "Jason and the Argonauts" moving southward from the shores of the Gulf of Pagasæ into the valley of Lake Copais, and founding the Bœotian Orchomenus. The early greatness of Thebes is associated with the name of Cadmus, the king-priest who introduces the art of writing, who builds the citadel, who founds a system of artificial irrigation. The Achæan princes, whose chivalrous spirit is expressed in the Homeric Achilles, rule in the fertile valley of the Thessalian Phthiotis. In the Peloponnesus the Pelopidæ at Mycenæ reign over Achæans; and Agamemnon is said to rule, not only "all Argos," but "many islands." The principle on which such legends as that of Agamemnon's sovereignty may best be estimated has been well stated by Mr. Freeman:—[1]

Phrygia.

Lydia.

Troy.

The Minyæ.

Thebes.

Pelidæ in Thessaly.

Pelopidæ at Mycenæ.

"The legend of Charlemagne, amidst infinite perversions, preserves a certain groundwork of real history; I should expect to find in the legend of Agamemnon a similar groundwork of real history. There is, of course, the all-important difference that we can test the one story, and that we cannot test the other, by the certain evidence of contemporary documents. This gives us certainty in one case, while we cannot get beyond high probability in the other. . . . Later Grecian history would never lead us to believe that there had been once a single dynasty reigning, if not as sovereigns, at least as suzerains, over a large portion of insular and peninsular Greece. So later mediæval history would never lead us to believe that there had once been a Latin or Teutonic emperor, whose dominions stretched from the Eider to the Ebro. But we know that the Carolingian legend is thus far confirmed by history; there is, therefore, no *a priori* objection to the analogous features of the Pelopid legend. The truth is that the idea of such an extensive dominion would not have occurred to a later romancer, unless some real history or tradition had suggested it to him. So, again, without some such groundwork of history or tradition, no one would have fixed upon Mykênê, a place utterly insignificant in later history, as the capital of this extensive empire. The romances have transferred the capital of Karl from Aachen to Paris; had it really been Paris, no one would have transferred it to Aachen. . . . Whether Agamemnon be a real man or not, the combination of internal and external evidence leads us to set down the Pelopid dynasty at Mykênê as an established fact."

Traditional migration in Greece proper.

We now come to a phase in the development of early Greece which tradition represents as following, but at no great interval, the age in which a Pelopid dynasty ruled at Mycenæ and fought against Troy. This is the period of great displacements of population within the mainland of European Greece. The first of these migrations is that of the people afterwards known as Thessalians. A fierce tribe of mounted warriors, they passed from Thesprotia in Epirus over the range of Pindus, and subdued or drove out an Æolic population who dwelt about Arné, in the fertile lowlands of southern Thessaly. Those of the Æolians who had not submitted to the conquerors passed southward into the land thenceforth called Bœotia, where, between Orchomenus and Thebes, they founded a new home. Their conquest of Bœotia appears to have been difficult and gradual; and even after the fall of Orchomenus and Thebes, Platæa is said to have maintained its independence. The legend placed these events about 1124 B. C., or sixty years after the fall of Troy. About twenty years later in the mythical chronology occurs the third and more famous migration, known as the return of the Heraclidæ. We need not enter here into the details of the myth. It will be enough to indicate the results to which an examination of the legend leads. The Dorians, migrating southward from the highlands of Macedonia, had established themselves at the northern foot of Parnassus, in the fertile district between that range and Œta, which was thenceforth called Doris. In setting out from these seats to conquer the Peloponnesus the Dorians were associated with other tribes. Among these were the Hylleans, who were believed to be of Achæan origin, and who traced their descent from the hero Hyllus, son of the Tirynthian Heracles. The Hyllean chiefs of the expedition represented themselves, accordingly, as seeking to reconquer that royal dominion of Heracles in the Peloponnesus of which his descendants had been wrongfully deprived by Eurystheus. Hence the Dorian migration itself came to be called the "Return of the Heraclidæ." The migration had two main results:—(1) the Dorians, under leaders claiming Heraclid descent, overthrew the Achæan dynasties in the Peloponnesus, and either expelled or subjugated the Achæan folk; (2) a portion of the Achæans, retiring northward before the Dorian invaders in the south, drove the Ionians on the coast of the Corinthian Gulf out of the strip of territory which was thenceforth called Achaia; and these Ionians sought refuge with their kinsfolk in Attica. It is in the nature of the heroic myths to represent changes of this kind, which may have been the gradual work of generations, as effected by sudden blows. Some comparative mythologers have maintained with much ingenuity that the "Return of the Heraclidæ" is merely one of those alternations which balance each other in the hundred forms of the solar myth. It appears more consistent with reason to believe that there was really a great southward movement of population, which resulted in the substitution of Dorian for Achæan ascendency in the Peloponnesus. We cannot pretend to fix either the exact time at which it commenced or the period which was required for its completion. One thing may, however, be affirmed with probability. It cannot have been done all at once, as the myth says that it was. The displacement of the Achæans was accomplished only by degrees, and perhaps after the lapse of centuries.

1. Change of population in Thessaly.

2. In Bœotia.

3. In the Peloponnesus.

"The return of the Heraclidæ."

The same remark applies to those three streams of migration from European Greece to the coasts of Asia Minor, which are represented as having ensued on the Dorian conquest of the Peloponnesus, and which may naturally be connected with the disturbance of populations which the southward advance of the Dorians caused. The Achæans, driven from their old seats in the south, moved northwards; and, reinforced by Æolic kinsmen from Bœotia and Thessaly, established themselves on the north-west coast of Asia Minor, where Lesbos and Cyme became their strongholds. By degrees their dominion spread inland, until they had become masters of Mysia and the Troad. The Æolic migration which thus created an Asiatic Æolis was unquestionably the slow work of generations. The immediate cause of the Ionic migration, which began later than the Æolic, appears to have been the overcrowding of Attica by the Ionians driven out of Achaia. The Æolic settlements had been the work of a people migrating in large masses. The Ionic colonization seems to have been effected rather by smaller numbers of warlike adventurers, sprung from the noble Ionian families of Attica and the Peloponnesus, who claimed to rule over the Ionic communities already established on the Asiatic coast. The Dorian colonists, following the southward direction of their previous conquests, settled on the south-west coast of Asia Minor. The islands of Cos and Rhodes received Dorian settlers; and, after what was probably a long struggle, the Dorians subdued Crete.

Traditional migrations from Greece proper to Asia Minor.

1. The Æolic migration.

2. The Ionic.

3. The Doric.

While the populations had thus been settling down into the places which they were to occupy during the historical age of Greece, a movement had been in progress on the European

The amphictyonies.

[1] "The Mythical and Romantic Elements in Early English History." *Essays*, 1st series, p. 29.

mainland which tended to quicken among the various tribes a sense of the unity of the race. This was the establishment of local associations among neighboring tribes for the common worship of the same god. These associations were of a federal character; that is, while the members of the association were independent in other matters, they were subject to a common central authority in all that concerned religious worship. Such a federal association was called an *amphictyony*, that is, a *league of neighbors*. The most important of such leagues was the Delphic amphictyony, of which the object was to conserve the worship of Apollo at Delphi. This league arose in Thessaly, where the conquerors who had come in from Epirus sought to establish themselves more firmly by embracing the cult of Apollo. It was afterwards extended through the southern districts until it included most of the tribes dwelling about Œta and Parnassus. The members of the Delphic amphictyony gave a new meaning and value to the federal compact by applying it to enforce certain obligations of humanity in war. They took an oath that they would not raze each other's towns, nor, during a siege, cut off the supply of water. It was in connection with the Delphic amphictyony that the name *Hellene* appears to have been first distinctly recognized as the national name. The earliest collective name of the race, in Greek tradition, had been *Graikoi*. The members of the Delphic amphictyony chose as their federal name that of *Hellenes*,—a name of sacred associations, if we may connect it with that of the *Selloi* or *Helloi*, the priests of the Pelasgian Zeus at Dodona,—in the region which, according to Aristotle, was the most ancient Hellas. The circumstances which gave currency to Hellene as a common appellative have left a reminiscence in the myth that Hellen was nearly related to Amphictyon.

The Delphic amphictyony.

The name *Hellene*.

The Homeric poems may be regarded by the student of history as great pictures of political and social life, illustrating the whole variety of Greek experience down to the close of that age which saw the tides of Æolic, Ionic, and Doric migration flow from the west to the east of the Ægean. It is a distinct question how far recoverable historical fact is embedded in their text, or how far trustworthy inferences may be drawn from them in regard to a supposed series of events. But at least the legends of the Achæan princes and warriors are there, as they came through Æolic minstrels to the poets of Ionia; and, various as may be the ages and sources of the interwoven materials, the total result may be taken as a portraiture, true in its main lines, of the age from which these legends had come down. In the political life described by the Homeric poems the king rules by divine and hereditary right. But he is not, like an Eastern monarch, even practically despotic; he is bound, first, by *themistes*, the traditional customs of his people; next, he must consult the *boule*, the council of nobles and elders; and, lastly, his proposals require to be ratified by the *agora*, or popular assembly. The social life is the counterpart of this. It is a patriarchal life, in which the head of the family stands to his dependants in a relation like that of the king to his subjects. It is, within the family pale, eminently humane; and the absence of a charity which should include all mankind is in some measure compensated by the principle and practice of hospitality. The position of free-born women is high,—higher than in the historical ages; and polygamy is unknown among Greeks. Many of the pictures of manners, especially in the *Odyssey*, have the refinement of a noble simplicity in thought and feeling, and of a genuine courtesy which is peculiarly Hellenic. The useful arts are still in an early stage. The use of the principal metals is known, but not, apparently, the art of smelting or soldering them. Money is not mentioned, oxen being the usual measure of value; and there is no certain allusion to the art of writing.

The Homeric picture of early Hellas.

II. *The Early History of the leading States down to about* 500 B.C.

In the history of the Peloponnesus after the Dorian immigration we begin to be on firmer ground. There may still be large room for doubt as to particular dates or names, but the age left permanent records in the institutions which survived it. The first thing which should be borne in mind with regard to the Dorian immigration is that its direct influence was confined to three districts of the Peloponnesus. Argolis, Laconia, and Messenia were thoroughly Dorianized. Of the other three districts, Arcadia remained almost wholly unaffected, Elis and Achaia were affected only indirectly, through the influx of the populations which the Dorians had displaced. The first rank in the Peloponnesus was long retained by Argos. The ancient primacy of its Achæan princes was inherited by its Dorian rulers; and now, under the dynasty of the Temenidæ, Argos acquired a new prestige as the head of a federative Dorian hexapolis, of which the other members were Phlius, Sicyon, Trœzene, Epidaurus, and Corinth. It was only by slow degrees that the power arose which was destined to eclipse Argos. When the Dorians entered the valley of Eurotas, they found "hollow Lacedæmon" already shared among people of other tribes. Leleges, Minyans, and Achæans had been there before them. Both Æolian and Achæan elements remained in the land. The settlement of the Dorians was made in a strong position under Mount Taygetus, on the right or western bank of the Eurotas; and the fact that, unlike most Greek cities, it was not founded on a rocky base, but on arable soil, was expressed by the name *Sparte* (sown land). It was indeed less a city than a group of rude hamlets,—the camp of a military occupation. And, as a natural stronghold, defended by an alert garrison, it dispensed with walls. Sparta was at first only one member of a Laconian hexapolis. It was at a later stage that Sparta became the head-town of the country, and the seat of a central government. The origin of the dual kingship may probably be traced to this period. Such a dualism has no parallel elsewhere among Dorians; and, as regards one at least of the two royal lines, we know that the Agiade Cleomenes proclaimed himself an Achæan. The two royal lines of the Agiadæ and Eurypontidæ may have taken their beginning from a coalition or compromise between Dorian and Achæan houses. Afterwards, when it was desired to explain the dualism and to refer both lines to a common source, Agis and Eurypon were represented as descended from the twin sons of Aristodemus, Eurystheus and Procles.

The Peloponnesus.

Results of the Dorian conquest.

Argos.

Sparta.

The spread of Spartan power in the Peloponnesus was preceded by the building up of that political and social system which made the Spartan citizens a compact aristocracy, exclusively devoted to the exercises of war. The personality of Lycurgus is shadowy. He has even been classed with those beings who, like Prometheus, Hermes, and Phoroneus, bestow on men that gift of fire without which they could not have attained to a high civilization. But the charge of excessive credulity can scarcely be brought against those who hold, with E. Curtius, that "there really lived and worked in the first half of the 9th century B.C. a legislator of the name of Lycurgus, a man who, as a born Heraclide, was called to take part in public affairs." It is another question whether he was the author of all the institutions which were afterwards ascribed to him. The example of another legislator who stands in a far clearer light of history,—the Athenian Solon,—whom the orators sometimes credit with the work of Clisthenes in addition to his own, may serve to show how loose such ascriptions often were. But at least the work of Lycurgus may be assumed to have marked an epoch in the history of the Spartan system. This system rested, first, on a distinction of three orders. Dorians alone were *Spartiatai*, citizens of Sparta, as opposed to mere Lacedæmonii, and to them belonged all political power. Lycurgus, said the tradition, assigned nine thousand lots of land to as many Spartiatæ; the land descended from father to eldest son, and, failing issue, reverted to the state. The older or non-Dorian population, settled chiefly on the mountain slopes around the Spartan lands, were called *Perioikoi*. They were free farmers, who had no share in the government, and were not required to perform military service. Lastly, the *Helots* cultivated the lands of the Spartans, not as slaves belonging to private masters, but as serfs of the commonwealth; hence no Spartan citizen could sell a Helot or remove him from the land. From each farm the Helots had to produce annually a certain quantity of barley, oil, and wine; if there was a surplus, they could keep it for themselves. The condition of the Helots was thus in some respects better than that of ordinary Greek slaves. But it was such as constantly to remind them that they

The Spartan institutions.

Lycurgus.

had once been a free peasantry. It was this, as much perhaps as positive ill-usage, which made it so peculiarly galling. The hatred of the Helots was a standing menace to the Spartan commonwealth. As Aristotle says, the Spartan kingship meant practically a life-tenure of the chief military command. The government was essentially an official oligarchy, in which the power of the irresponsible ephors was not importantly modified by the gerousia, while the popular assembly played a part hardly more active than that of the Homeric agora, with its formal privilege of simple affirmation or veto. The military training, from childhood upwards, to which the whole social life of Sparta was made subservient, was at first a necessity; but it soon became thoroughly identified with the ambition and with the pride of an exclusive warrior-caste. Sparta was sharply marked off from the other Greek communities by this systematic treatment of war as the business of life. When the military prestige of Sparta began to decline in the course of the 4th century B. C., it was remarked that this was due to the increased attention which other states had begun to pay to the art of war, whereas in old days the Spartans had been like professional soldiers matched against civilians.

Character of the government.

The social life a school of war.

The mountain wall of Taygetus had set a barrier between Laconia and Messenia, which might have seemed to forbid the extension of Spartan power towards the west. If the Dorians in Messenia had fully preserved the warlike character of the race, they would probably have had little to fear. But they seem to have been in some measure enervated by the natural wealth of a country which, at the same time, excited the envy of their neighbors. Myths have grown thickly around the story of the two Messenian wars. This, at least, appears certain: the gradual conquest of Messenia by Sparta occupied not less than a hundred years (about 750–650 B. C.). The legend that, at a critical time, the stirring war-songs of the Attic Tyrtæus raised the sinking spirit of Sparta, agrees with the tradition of a long and doubtful struggle. Nor was the strife confined to the two chief combatants. Messenia was aided by other Peloponnesian states which dreaded a like fate for themselves,—Argos, Sicyon, Arcadia. Sparta was helped by Elis and Corinth. When Messenia had been conquered and the Dorian inhabitants reduced to the state of Helots, Sparta had overcome the most difficult obstacle to her ambition. By conquests, of which the details are obscure, she won from Argolis a strip of territory on the eastern coast of the Peloponnesus, and finally carried her north-eastern border to Thyrea. In southern Arcadia alone the Spartan arms were decisively repulsed by Tegea; and the Tegeans, accepting the supremacy of Sparta, were enrolled, about 560 B. C., as honored allies of the power which they had checked.

Growth of Spartan power.

The repulse warned Sparta that it was better to aim at leading the Peloponnesus than at conquering it; and an opportunity was found of asserting this leadership in a manner far more effective than any military demonstration. At Olympia, in the valley through which the Alpheus passes to the western coast, there was an ancient sanctuary of the Pelasgian Zeus. An amphictyony, or league of neighboring towns, held sacrifice and games there once in four years, the management of the festival being shared between Pisa and Elis. A dispute arose between these two states. Sparta confirmed Elis in the religious superintendence of the festival, and at the same time arrogated to herself the political headship of the sacred league. Every effort was now made by the Spartans to extend the popularity and enhance the brilliancy of the Olympic games. Sparta—already supreme in Laconia and Messenia, already the victorious rival of Argos in the east of the land—now appears at the Olympian shrine of Zeus in a character peculiarly well adapted to attract the loyalty of the western Achæans. The general recognition of Sparta as the first state in the Peloponnesus may be said to date from the time when, under Spartan auspices, the Olympic festival acquired a new celebrity.

The Olympic festival.

For political reasons Dorian Sparta had always cherished the traditions of the Achæan princes; but the monarchy of the Achæan age, if it still existed anywhere, was a rare survival. The form of government which had generally succeeded to it was oligarchy, that is, the rule of a group of noble families claiming descent from the heroes, possessing certain religious rites in which no aliens participated, and claiming to be, by a divine authority, the interpreters of the unwritten law. These noble families made up the state. The commons, who lived in or around the city as artisans, laborers, or farmers, were free men, but had no political rights. The Dorian ascendency in the Peloponnesus was peculiarly favorable to oligarchies. Sparta was, in fact, such an oligarchy, though not of the closest kind,—the Dorian citizens being the privileged class, while the Perioeci answered to the commons elsewhere. It was a fortunate circumstance for the political development of Greece that oligarchy did not, as a rule, pass directly into democracy. A period of transition was needed, during which the people, hitherto debarred from all chance of political education, should learn the meaning of membership in the state.

Transition from monarchy to oligarchy.

This was afforded, at least in some measure, by that peculiar phase in the life of the Greek commonwealths which intervenes between oligarchy and democracy,—the age of the tyrannies. A *turannos* meant one whose power is both superior and contrary to the laws. An absolute ruler is not a *turannos* if the constitution of the state gives him absolute power; nor is a ruler unauthorized by the laws less a *turannos* because he rules mildly. The genesis of the tyrant was different in different cases. Most often he is a member of the privileged class, who comes forward as the champion of the people against his peers, overthrows the oligarchy with the help of the people, and establishes his own rule in its stead. Such was Pisistratus at Athens. Sometimes he is himself one of the people; this was the case with Orthagoras, who (about 676 B. C.) overthrew the Dorian oligarchy at Sicyon. The case of Cypselus at Corinth is intermediate between these two; for he belonged to a noble Dorian house, though not to the inner circle of those Bacchiadæ whose rule he overthrew. Or the tyrant is one who raises himself to absolute power from the stepping-stone of some office with which the oligarchy itself had entrusted him. An example is supplied by Phalaris of Agrigentum, and by the tyrants of some Ionic cities in Asia Minor. Lastly, the tyrant might be a king who had overstepped his constitutional prerogative. Pheidon, king of Argos, is adduced by Aristotle as an instance of this rarer case. In all cases the tyrant properly so-called must be distinguished from a ruler whom a community has voluntarily placed above the law, either temporarily or for his life. Such was properly called an aisumnetes or dictator,—as Pittacus of Mitylene. The benefits conferred on the Greek commonwealths by the tyrannies were chiefly of two kinds. (1) The tyrant often instituted new religious festivals, in which the whole body of the citizens might take part. 'A feeling of civic unity was thus created, which could not exist while the nobles formed a separate caste, as exclusive in their worship as in their other privileges. (2) The court of the tyrant became a centre to which poets and artists were attracted. Such a man as Periander of Corinth (625–585) might aim at resembling an Eastern despot, but his encouragement of liberal arts must still have given an impulse to the higher civilization of Corinth. Polycrates of Samos, the friend of Anacreon, welcomed all men of fine gifts to his court; Pisistratus showed a like care for poetry, and for the artistic embellishment of Athens. The root of evil in the tyranny was its unlawful origin, and its consequent reliance upon force, frequently leading the tyrant to aim at keeping the citizens in a state of helplessness and mutual mistrust. But the founder of a tyranny was usually a man with some inborn qualities for command, and the baser forms of oppression were not required until he had given place to a weaker successor.

The tyrannies.

Their results.

The age of the oligarchies and tyrannies coincides with the most active period of Greek colonization, which received an impulse both from redundant population and from political troubles at home. The two centuries from 750 to 550 B. C. saw most of the Greek colonies founded. Sicily received settlements from both the two great branches of the Greek race. Naxos, founded by the Chalcidians of Eubœa (735 B. C.), with Leontini and Catana, founded soon afterwards by Naxos, formed a group of Ionic communities on the eastern side of the island. Syracuse, founded by Corinth (734 B. C.), Gela, colonized by Rhodians and Cretans (690 B. C.), and Agrigentum, of which Gela was the parent city (582 B. C.), were among the chief of the Dorian commonwealths on the south-eastern and south-western coasts. These Siceliot cities

Colonization.

Sicily.

formed a fringe round the Siceli and Sicani of the interior; but, though in the presence of non-Hellenic populations, they never lost among themselves the sharp distinction between Dorian and Ionian (or "Chalcidic"), a distinction which was long the key-note to the inner history of the Siceliots. The earliest of the Greek settlements in Italy was the Ionic Cumæ on the coast near Cape Misenum, a little to the north-west of Naples. It was founded by Chalcidians of Eubœa, as early, according to the tradition, as 1050 B.C. The Dorian Tarentum,—a colony of Sparta,—and the Achæan (Æolic) settlements of Sybaris and Croton, dated from the latter part of the 8th century B.C. Poseidonia (Pæstum) was founded by Sybaris. Locri, an Æolic settlement near Cape Zephyrium (whence its epithet "Epizephyrian"), and the Ionic Rhegium, founded from Chalcis, complete the series of flourishing cities which made south-western Italy appear as a new and richer land of the Hellenes, as Megale Hellas, *Magna Græcia*. The turning-point in its prosperity was the war between the two foremost of the Achæan cities, ending in the destruction of Sybaris by Croton (510 B.C.). By this event, just at the time when the Ionians of Asia Minor were passing under the sway of Persia, the Greeks of Italy were rendered less able to make head against the native tribes of the peninsula. The name Megale Hellas remained, but its old significance was gone; the spirit of confident progress had been quenched.

Italy.

Sporadic settlements.

The distinctive character of Greek colonization is seen less vividly where, as in Sicily and Italy, Greek communities clustered together, than at those lonely outposts of Hellenic life where a single city stood in barbarian lands. Massalia (Marseilles) was founded by the Ionians of Phocæa about 600 B.C., and became the parent of colonies on the east coast of Spain. If Carthage had not fulfilled the purpose for which it was founded, by serving as the jealous guardian of Phœnician commerce in the western Mediterranean, Greek settlements would probably have multiplied on those shores as rapidly as elsewhere. Cyrene, on the African coast, was a Dorian colony (630 B.C.) from Thera, itself colonized by Sparta, and became the founder of Barca. Corcyra was colonized by Corinth about 700 B.C., and joined with the mother-city in founding settlements (among others, Epidamnus) on the coast of Epirus. The northern shores of the Ægean and the Propontis were dotted with colonies, from the group of towns planted by Chalcis in the peninsula thence called Chalcidice, to Byzantium,—which, like Selymbria, was founded by Megara (657 B.C.). Among the colonies on the western coast of Asia Minor, Miletus was especially active in creating other settlements, particularly for purposes of commerce. Naucratis, in the delta of the Nile, was a trading colony from Miletus, and flourished from 550 B.C. On the southern shores of the Propontis and the Euxine, Cyzicus and Sinope (itself the parent city of Trapezus) were daughters of Miletus. Here too were the remotest of Greek settlements,—Panticapæum (Kertch in the Crimea), afterwards the capital of the Greek kings of the Bosphorus; Olbia (or Borysthenes), on the adjacent mainland; and Istria, at the mouth of the Danube. The above enumeration, though not exhaustive, will serve to mark the wide extent of the area included by Greek colonization.

Nature of the Greek colony.

As the city was the highest unit in the political conception of the Greeks, so each colony contained within itself the essentials of a complete political life. Its relation to the parent-city was one of filial piety, not of constitutional dependence. In so far as the cult of the gods and heroes whom it worshipped was localized in the mother-country, it was needful that a link should exist between the religious rites of the colony and those of its parent; and this religious continuity was symbolized by the sacred fire which the founder (*οἰκιστής*) carried with him from the public hearth to the new settlement. For the rest, Massalia and Olbia were cities of Hellas in as full sense as Athens or Sparta. It was due to the self-sufficing character (*αὐτάρκεια*) of the Hellenic city as such that Hellas was not a geographical expression.

Early history of Attica.

When Attica first comes into the view of history, it already forms a single state of which Athens is the capital: the kingly period is over, and, though a close oligarchy still exists, there are signs of coming change. But the hints of poetical legend, and sometimes the surer evidence of the ground itself, enable us to go further back, and to form at least a general conception of earlier chapters in the story of the land. Of the three plains on the northern shore of the Saronic gulf,—those of Megara, Eleusis, and Athens,—the Attic plain is that which offered the greatest advantage to settlers. It is the most spacious; it is the best watered: it holds the most central position in the district which stretches south-east from the chains of Cithæron and Parnes to the Ægean; it has the best seaboard for navigation and commerce; and it contains the best site for a city. Traces of early immigrants of various stocks survived in the names of places, in worships, and in legends. Eleusis, Piræus, Phaleron, are Minyan names; the myths and cults tell also of Carians, Leleges, Cretans, Tyrrhenians. But the chief influence which came to Attica from beyond sea must have been that of the Phœnician settlement at Salamis (Salama, the place of peace), a name which, as in the Cyprian worship of Zeus Salaminios (Baal-Salam), points to the Phœnician effort to establish friendly intercourse between alien races. Herodotus (viii. 44) distinguishes four periods in the early history of Attica, with each of which he connects an appellative. In the first the inhabitants were "Pelasgoi called Kranaoi," in the second "Kekropidæ," in the third "Athenians," in the fourth "Ionians." The extensive series of rock-dwellings found on the south and south-west of the Acropolis are, by the ingenious and probable conjecture of E. Curtius, connected with the first of these periods. This primitive Pelasgic settlement was the Rock-town (*κρανααί*); its inhabitants were Kranaoi, the dwellers in the rocks. The second period was one in which the Acropolis became the seat of a small number of nobles, and of a princely family claiming descent from the earth-born Cecrops. The citadel becomes the centre of religious and political life; beneath it dwell Pelasgic bondmen, who work for the Cecropidæ as the Cyclopes worked for the Perseidæ at Argos. The city of the Cecropidæ—no longer of the Kranaoi—becomes the head of the twelve cities among which the Attic land was divided. As the leading families are drawn towards the Cecropid city, rivalries ensue, which are mythically represented by the strife of rival gods on the Acropolis. Zeus, the Pelasgic god, has priority of possession. But his honors are disputed by Poseidon, the deity of the Thracians settled on the gulf of Salamis, and of their priestly clan, the Eumolpidæ. The third claimant is Athena, the divinity of a race possessing a higher culture, the giver of the olive to the land. The final victory falls to Athena. But Zeus keeps the place of honor as protector of the whole community,—Polieus; and Athena shares her sanctuary with Poseidon. The mythical Erechtheus,—representing at once the ancient Poseidon and the nursling of Athena,—is the symbol of the victory and the conciliation. This is the third period of Herodotus, "Erechtheus having succeeded to power," the Cecropidæ become Athenians. The fourth and last period is that in which Ionian settlers press forward from their earlier seat on the bay of Marathon, and establish themselves—not without opposition—on the banks of the Ilissus. The worship of the Ionian Apollo takes its place beside that of Zeus and Athena. The Ionic settlement on the Ilissus was included in an enlarged Athens, and the close of the epoch was marked by that union (*συνοίκια*) of Attica into a single state which Attic tradition ascribed to the hero king Theseus.

The four appellatives.

Character of the Attic population.

The light soil of Attica had protected it from such wholesale changes of population as had passed over Thessaly, Bœotia, and the Peloponnesus. In contrast with the occupiers of those lands the Attic population claimed to be indigenous; and the claim was true in this sense that the basis of the population was an element which had been there from prehistoric times. On the other hand the maritime advantages of Attica had been sufficient to attract foreign immigrants. Thus in Attica no one type of life and character prevailed to the same extent as the Dorian in the Peloponnesus or the Æolian in Bœotia. The Ionian element was tempered by others older than itself. This fact is the key to that equable and harmonious development which so remarkably distinguished the Attic people alike in culture and in politics. The institutions which are found existing in Attica in the 7th century B.C. may be regarded as dating from the age which tradition called that of Theseus,—the age, namely, in which the loose canton-system of Attica was knit together into a single state. The

Classes. inhabitants of Attica form three classes,—the Eupatridæ or nobles; the Geomori, free husbandmen; and the Demiurgi, or handicraftsmen. The government was wholly in the hands of the Eupatridæ, who alone were citizens in the proper sense. The Eupatrid order was divided into four tribes, called after the sons of Ion,—Geleon, Hoples, Ægicoreus, Argadeus. Each tribe contained three *phratriai* or clans, and each clan thirty *gene* or houses. The members of each clan were united by the worship of an heroic ancestor, and all the clans were bound together by the common worship of Zeus Herkeios and Apollo Patrous.

Kingship—archonship. The transition from monarchy to oligarchy was more gradual at Athens than it seems to have been elsewhere. First, the priestly office of the king was taken away; and, as the old name *basileus* implied religious as well as civil authority, he was henceforth called simply the ruler, *archon*. But the office of archon was still held for life, and was hereditary. The second step was to appoint the archon for ten years only. The third and last step was to divide the old regal power among nine archons appointed annually (683 B. C.). The first archon, called Eponymos, because his name marked the date of official documents, had a general supervision of affairs, and in particular represented the state as the guardian of orphans and minors; the second archon was high priest (basileus); the third was commander-in-chief (polemarch); the remaining six were the custodians of the laws ("thesmothetæ"). After this reform, two events are the chief landmarks of Attic history before Solon. The first is the legislation of Draco, the second is the revolution of Cylon. Hitherto the Eupatridæ had been the depositaries and sole interpreters of an unwritten law. Draco, himself

Draco. a Eupatrid, was now commissioned, not to frame a new code, but to write down the laws as they existed in oral tradition. To a later age the laws of Draco became a proverb of severity; but their severity was that of the rude age from which they had come down, not of the man who was employed to tabulate them. By this code (620 B. C.), and by the establishment of a court of fifty-one judges (*ἐφέται*) in capital cases, the people were so far secured against abuse of the judicial office. But the existence of serious popular discontent a few years later is shown by the

Cylon. attempt of Cylon (612 B. C.). Stimulated by the example of his father-in-law, Theagenes, the tyrant of Megara, he resolved to seize the supreme power at Athens. Promises of relief and of a new agrarian law gained him adherents among the distressed classes; but when he had succeeded in seizing the Acropolis, he found himself disappointed of popular support and surrounded by the troops of the archons. He escaped. His partisans surrendered, on the promise of the archon Megacles that their lives should be spared; but, when they had left the altars, they were cut down. The "Cylonian crime" was denounced by the people as having brought a pollution upon the city, and the punishment of the whole clan of the Alcmæonidæ—to which Megacles belonged—was demanded as an expiation. The Eupatridæ refused to yield, until Solon, one of their order, prevailed on the Alcmæonidæ to stand a trial before three hundred of their peers. They were found guilty of saerilege, and were banished.

Legislation of Solon Solon was now to come forward as the umpire of still graver issues. The influence of his ardent and lofty nature on the people is expressed in the legend that his recitation of his elegy, "Salamis," fired them to strike the blow by which "the fair island" was won back from the Megarians. The part which he had taken in the Alcmæonid affair was well fitted to make him trusted both by the nobles and by the people. His legislation had a twofold scope. In the first place he

Relief of debtors. aimed at giving immediate relief to a class whose plight was desperate. As there was little money in the land, those in whose hands it was had been able to force up the rate of interest as they pleased. The small farmers (geomori) were being crushed out of existence by a load of debt, mortgaging their farms to their creditors, who, in default of land, could even sell the debtor as a slave. Solon depreciated the value of the silver drachma by 27 per cent., so that a debt of 100 old drachmas could be paid with 73; debts to the state were cancelled altogether. In a fine iambic fragment, Solon calls as witness of his work "the greatest of Olympian deities, the black earth, wherefrom I took up of yore the pillars that had been set in many a place,"—these (*ὅροι*) being the stones that marked a mortgaged homestead. Secondly, Solon aimed at establishing a permanent equilibrium between classes. He classed the citizens by their

New classes. rated property as (1) Pentakosio-medimnoi, (2) Hippeis, (3) Zeugitai, (4) Thetes. The first class alone could hold the archonship; the fourth had no political privilege except that of voting in the assembly. But Solon made the assembly (*ἐκκλησία*) what it

Ecclesia. had never before been, a real power. He gave to it (1) the right of passing laws, (2) the right of calling magistrates to account, (3) the right of electing archons. At the same time he created a council of four

Council. hundred, to be elected annually by the people, through which all business should be introduced to the assembly. He strengthened the old Eupatrid Areopagus, by adding to its jurisdiction in homi-

Areopagus. cide a general power of moral censorship, and provided that the archons of each year should, if found worthy, pass at the end of it into this senate. Athenians of a later age often described Solon as the founder of the democracy. This was not his own conception of his work. We have his own description of it:—"I gave the

Solon's account of his own work. people as much strength as is enough, without taking away from their due share (*τιμῆς*), or adding thereto. But as for those who had power and the splendor of riches, to them also I gave counsel, even that they should not uphold violence. And I stood with my strong shield spread over both, and suffered neither to prevail by wrong." Solon was not a champion of popular rights, but a philosophic mediator between classes.

The removal of the urgent pressure of usury, the substitution of wealth for birth as the canon of privilege, and the bestowal of strictly limited political power on the people were Solon's achievements. It is no proof of their inadequacy that they were soon followed by the appearance of a successful demagogue. The Attic population

Tyranny of Pisistratus. was locally divided into three classes,—the Diacrii or the "highlanders" of the north-east district (the poorest); the Parali, the boatmen and fishermen of the coast; and the "Pedieis," the richer farmers of the Attic plain. Each of these classes formed a political faction, with an ambitious noble at its head. The Diacrii were led by Pisistratus, the Parali by Megacles, the Pedieis by Lycurgus. On the pretence that he had been murderously assaulted by the enemies of the people, Pisistratus obtained a guard of 50 men. It was presently increased to 400. He then seized the Acropolis (560 B. C.). After having been twice driven out by the combined factions of the Plain and the Shore, he finally established himself as tyrant in 545 B. C., and reigned till his death in 527 B. C. He did not abolish Solon's constitution, though he reserved some of the higher offices for members of his own house. His government appears to have been mild and wise. He set the example of submission to the laws. By many new enactments he promoted good order and morality. The convenience of the citizens and the beauty of Athens were consulted by the construction of new buildings, roads, and aqueducts. There were but two things to remind Athenians that this paternal rule had been founded in force,—the presence of hired troops, and the levy of tithes on private lands. Pisistratus was succeeded by his eldest son Hippias. In 514 B. C. Hipparchus, the brother of Hippias, was murdered by Harmodius and Aristogiton, in revenge for an affront offered to the sister of Harmodius. The rule of Hippias, which had hitherto resembled that of his father, now became cruel. The Alcmæonidæ—who had been in banishment since th final return of Pisistratus in 545—had won the favor of the Delphic priesthood by an act of liberality. The temple at Delphi having been burned down, they had undertaken to rebuild it, and, instead of common limestone, which would have satisfied the contract, used Parian marble for the east side of the temple. They now exerted their influence. Whenever Sparta or a Spartan consulted the oracle, the response always included a command to set Athens free. At last Cleomenes, king of Sparta, took the field. The children of Hippias fell into his hands, and, to save

End of Pisistratid rule. them, Hippias voluntarily withdrew from Athens (510 B. C.). The rule of the Pisistratid house was now at an end. In the phrase of the song which gave ill-merited glory to Harmodius and Aristogiton, Athens was once more under equal laws.

But there was a vehement strife of factions. The Eupa-

trid party, under Isagoras, wished to restore the aristocracy of pre-Solonian days. The party of popular rights was supported by the Alcmæonidæ, and led by Clisthenes, whose father, Megacles, had married the daughter of Clisthenes, tyrant of Sicyon. Clisthenes, in the words of Herodotus, took the people into partnership, and by his reforms became the real founder of the democracy. Abolishing the four Ionic tribes, which had included the Eupatridæ, he instituted ten new tribes, which included all the free inhabitants of Attica. Each tribe was composed of several *demes* (townships) not adjacent to each other,—thus securing that the old clans should be thoroughly broken up among the new tribes. The number of the Council (Boule) was raised from 400 to 500,—50 members being elected from each of the ten new tribes. Further, it was arranged that each tribal contingent of 50 should take it in turn to act as a committee (*πρυτάνεις*) of the council,—a board of presidents (*πρόεδροι*), and the chairman of the day, being again chosen in rotation from the committee. A new office was also instituted. The command of the army was given to a board of ten Generals (strategi), one being elected by each of the tribes. In later times the strategi became ministers of foreign affairs. Jury courts of citizens were organized out of the assembly, to share the administration of justice, which had hitherto belonged to the archons and the Areopagus. As a safeguard for the state against party struggles, it was provided that, if the Council and the Ecclesia should declare the commonwealth to be in danger, each citizen might be summoned to indicate by ballot the name of any man whom he thought dangerous, and that, if the same name was written on 6000 tickets (*ὄστρακα*), the man so indicated should go into exile for ten years, without, however, losing his civic rights or his property. This was the institution of ostracism. Finally, choice by lot was substituted for voting in the election to the archonship, thus diminishing the danger of factious partisanship.

Reforms of Clisthenes.

The ten tribes.

The Council.

Generals.

Jury courts.

Ostracism.

Isagoras, the leader of the party opposed to these reforms, had a zealous ally in Cleomenes, king of Sparta. Clisthenes, they alleged, was aiming at a tyranny such as that of his grandfather and namesake at Sicyon. Sparta, the leading Dorian state, was in a manner the recognized champion of aristocracy against revolution. The Spartan herald summoned the Athenians to banish the accursed Alcmæonidæ, and Clisthenes voluntarily left Attica. Cleomenes arrived at Athens with his army. Isagoras was made archon; seven hundred "democratic" families were banished; the newly constituted Council of five hundred was dissolved. But now the people rose in arms. Cleomenes and Isagoras were besieged on the Acropolis. On the third day of the siege they surrendered. Cleomenes and his troops were allowed to withdraw. Isagoras escaped, but his Athenian adherents were put to death. Clisthenes now returned to Athens. He seems, however, to have excited popular indignation by promoting a treaty with Persia, by which the supremacy of the Persian king was acknowledged. He thus lent color to the accusation of his enemies that he was aiming at a tyranny; and he was banished. Cleomenes presently invaded Attica a second time, with the Peloponnesian allies. But the other Spartan king, Demaratus, was opposed to his designs. The Corinthians refused to follow him, and his army broke up when it had advanced no further than Eleusis. Meanwhile the Thebans and the Chalcidians of Eubœa had been induced to take up arms against Athens. Freed from the danger of the Peloponnesian invasion, the Athenians marched against the Thebans. They found them on the shore of the Euripus, and routed them. Crossing the strait into Eubœa, they defeated the Chalcidians on the same day. The lands of the Chalcidian knights (Hippobotæ) were divided in equal lots among four thousand Athenians, who occupied them, not as colonists forming a new city, but as non-resident citizens of Athens. This was the first *kleruchia*. The Spartans, incited by Cleomenes, now made a final effort to repress the democratic strength of Athens. Hippias was invited from his retreat on the Hellespont to Lacedæmon, and a Peloponnesian congress was convened at Sparta to discuss a project for restoring him to Athens as tyrant. The representative of Corinth urged that it would be shameful if Sparta, the enemy of tyrannies, should help to set up a new one. The congress was of his mind. The scheme failed, and Hippias went back to Sigeum.

Strife of factions.

The first *kleruchia*.

In these five years (510–505) which followed the fall of the Pisistratidæ the future of Athens was decided. Athens had become a free commonwealth, in which class grievances no longer hindered the citizens from acting together with vigorous spirit. The results were soon to appear in work done by the Athenians, not for Athens only, but for all Greece.

Athens a free commonwealth.

The time was now drawing near when Greece was to sustain its first historical conflict with the barbarian world. There was not, in the modern sense, an Hellenic nation. But there were common elements of religion, manners, and culture, which together constituted an Hellenic civilization, and were the basis of a common Hellenic character. The Graikoi of Epirus, united in the worship of the Pelasgian Zeus, had become the Hellenes of Thessaly, united in the worship of Apollo. The shrine of Delphi, at first the centre of the most important amphictyony, had now become the religious centre of all Hellas. It was acknowledged as such by foreigners, by the kings of Phrygia and Lydia in the East, by the Etruscan Tarquinii in the west, as afterwards by the Roman republic. In political matters also Delphi was a common centre for the Greek states, mediating or advising in feuds between factions or cities, and giving the final sanction to constitutional changes. A sense of Hellenic unity was further promoted by the great festivals. It has already been seen how Sparta lent new brilliancy to the gatherings at Olympia. The Pythian festival was revived with a fresh lustre after the first Sacred War (595–585), in which Clisthenes, tyrant of Sicyon, and his allies destroyed Crisa, the foe of Delphi. A little later two other festivals were established, the Isthmian and the Nemean, at about the time when the tyranny of the Cypselidæ was overthrown at Corinth, and that of the Orthagoridæ at Sicyon. The games of Nemea and of the Isthmus were new assertions of the Dorian sentiment which was so strongly opposed to tyrannies, and they exemplify the manner in which such festivals were fitted to express and strengthen national sympathy. In the gradual growth, too, of Hellenic art,—with a stamp of its own distinct from that of Assyria, Babylon, Phœnicia, or Egypt,—the Greeks found a bond of union, and the temples were centres at which the growth of such an art was encouraged and recorded. Above all, the Homeric poetry, in which the legends of the heroic age took a form that appealed to every branch of the Greek race, was a witness to the contrast between Greek and barbarian. It was the interpretation of this contrast which made Homer so peculiarly the national poet. Still the unity of Greece had hitherto been little more than an ideal. The only great enterprise in which Greeks had made common cause against barbarians belonged to legend. The first historical event in which the unity of Greece found active expression was the struggle with Persia.

Elements of Hellenic unity.

Delphi.

The national games.

Art and poetry.

III. *The Ionic Revolt and the Persian Wars*, 502–479 B. C.

The twelve Ionian cities on the western coast of Asia Minor formed a community which kept itself thoroughly distinct from the Æolian colonists to the north and the Dorians to the south. The Pan-Ionic festivals preserved the memory of the common descent. The Ionian life and culture had a character of its own. But the Ionian cities had no political cohesion, nor had they any recognized leader. One after another they became tributary to the kings of Lydia. The process of subjugation commenced at the time when the Lydian dynasty of the Mermnadæ (about 716 B. C.) began to make themselves independent of Assyria. It was completed by Crœsus, to whom, about 550 B. C., all the Ionian cities had become subject. Crœsus was friendly to the Greeks; he respected their religion, and enriched its shrines; he welcomed distinguished Greeks to Sardis. All that was exacted from the Ionians by Crœsus was that they should acknowledge him as their suzerain, and pay a fixed tribute. The Persians, under Cyrus, defeated Crœsus and conquered Lydia about 547 B. C. The whole coast-line of Asia Minor was afterwards reduced by Harpagus, the general of Cyrus. The Persians, zealous monotheists, destroyed the Greek temples. But it was not till

The Ionian cities under Lydia; under Persia.

the reign of Darius, who succeeded Cambyses in 521 B. C., that the Ionians felt the whole weight of the Persian yoke. Darius, the able organizer of the Persian empire, preferred that each Ionian city should be ruled by one man whom he could trust. He therefore gave systematic support to tyrannies.

The Ionic revolt.

It is characteristic of the political condition of Ionia that the revolt was not a popular movement, but was the work of two men, each of whom had private ends to serve. Histiæus, tyrant of Miletus, had rendered a vital service to Darius during his Scythian expedition (510 B. C.) by dissuading the other Greek leaders from breaking down the bridge over the Danube, which secured the retreat of the Persian army. Having been rewarded with a principality in Thrace, he presently became suspected of ambitious designs. Darius sent for him to Susa, and detained him there on the pretext that he could not live without his friend. Meanwhile Aristagoras, the son-in-law of Histiæus, ruled at Miletus. In 502 Aristagoras undertook to restore the exiled oligarchs of Naxos, and for this purpose obtained 200 Persian ships from Artaphernes, the satrap of western Asia Minor. The enterprise miscarried. Aristagoras, dreading the anger of Artaphernes, now began to meditate revolt. He was encouraged by secret messages from Histiæus, who hoped to escape from Susa by being sent to suppress the rising. Aristagoras laid down his tyranny, and called on the people of Miletus to throw off the Persian yoke. The other Ionian cities followed the example. They deposed their tyrants and declared themselves free. The Æolian and Dorian settlements made common cause with them. Cyprus also joined in the revolt (500 B. C.). Aristagoras next sought aid beyond the Ægean. Sparta held aloof, but five ships were sent by the Eretrians, and twenty by the Athenians. The united Greek force surprised Sardis, and set fire to it, but was presently driven back to the coast. The Athenians then went home. Darius was deeply incensed by this outrage. The whole Persian force was brought to bear on Ionia, and Miletus was invested by land and sea. In a sea fight off Lade, an island near Miletus, the Ionians were decisively defeated by a Persian fleet of nearly twice their number, partly through the shameful desertion of the Samians and Lesbians during the battle (496 B. C.). The Persians soon afterwards took Miletus by storm (495 B. C.). The Greek cities of the Asiatic sea board and of the Thracian Chersonese successively fell before them.

First Persian expedition against Greece.

But the vengeance of Darius was not yet complete. He could not forget that Greeks from beyond the sea had helped to burn Sardis, and he resolved that the punishment of Athens and Eretria should be as signal as that of his own vassals in Ionia. A Persian army, under Mardonius, crossed the Hellespont and advanced through Thrace. But the Persian fleet which accompanied it was shattered by a storm in rounding Mount Athos. The progress of Mardonius was also checked by the Thracians, and he retreated to Asia.

Second Persian expedition.

The ambition of Mardonius had been to bring all European Hellas under the rule of the Achæmenidæ. The second Persian expedition, guided by more cautious counsel, had a narrower scope. It was directed strictly against those states which the great king had vowed to punish. The intrigues of the Pisistratidæ were busy in promoting it, and Hippias was to lend his personal guidance to its leaders. But before the new force set out Persian agents were sent through Greece to demand the symbols of submission from the cities. Most of the islands feared to refuse. Ægina, now a prosperous maritime power, complied from another motive than fear. Even Persia was welcome to her as an ally against Athens. The Athenians called upon Sparta, whom they thus recognized as the head of Greece, to punish this treason to the Hellenic cause; and Cleomenes, after overcoming the opposition of his royal colleague, Demaratus, took an arbitrary revenge on the Æginetans by depositing ten men of their chief families in the hands of the Athenians.

Battle of Marathon.

In 490 B. C. the second Persian expedition crossed the Ægean under the command of Datis and Artaphernes. Naxos was sacked, Eretria was betrayed. It seemed hardly doubtful that Athens too must fall. The Persians landed in the bay of Marathon, enclosed by the spurs of Brilessus (Pentelicus) and the hills of the Diacria. They thus avoided the dangers of a voyage round a rocky coast; and no part of Attica, Hippias told them, was so favorable to cavalry. The Athenians had sent for help to Sparta; but a religious scruple forbade the Spartans to march before the time of the full moon. Nine thousand Athenian citizens, with the slaves who carried their shields, went forth to meet the Persians at Marathon. On the way they were joined by a thousand Platæans,—the whole force of that city,—who came to stand by their old protectors. Miltiades, formerly the ruler of the Chersonese, was one of the ten Athenian generals. Five of these voted for awaiting Spartan help. The other five, led by Miltiades, were for giving battle at once; and the vote of the polemarch, Callimachus, turned the scale in their favor. The Greeks charged down from the hillside upon the Persians. The Greek centre was driven in, but the Greek wings prevailed, and then closed upon the Persian centre. The Persians fled to their ships. Six thousand Persians fell. The Greek loss was about 192. Believing that traitors at Athens had signalled to the Persians to surprise the city while undefended, the army hastened back. The Persian fleet soon approached, but seeing troops on the shore, sailed away for Asia.

Miltiades.

After the victory of Marathon Miltiades was all-powerful at Athens. He asked the people to give him a fleet, in order that he might strike another blow at Persia while the effects of Marathon were fresh. His demand was granted. But he employed the fleet in an attempt to wreak a private grudge on the island of Paros. At the end of twenty-six days he returned to Athens baffled, and suffering from a wound in the thigh. He was indicted for having deceived the people, and was sentenced to a fine of about £12,000. Being unable to pay it, he was disfranchised as a public debtor. His wound mortified, and he died, leaving debt and dishonor to his son Cimon. Aristides was now the most influential man at Athens, as Themistocles was the ablest. Themistocles foresaw that the Persians would return, and that Athens could resist them only on the sea. He aimed therefore at creating an Athenian navy. Already (491 B. C.) he had persuaded the Athenians to set about fortifying the peninsula of the Piræus, which, with its three harbors commanded by the height of Munychia, offered greater advantages than the open roadstead of Phalerum. He now urged that the revenues from the silver mines of Laurium should be applied to building a fleet. The frequent hostilities between Athens and Ægina enforced the advice. Before 480 B. C. Athens had acquired 200 triremes. Aristides was at the head of a party who viewed this movement with alarm. Had not the naval empire of Miletus, Chios, and Samos been transient? The land-holding citizens who had fought at Marathon would give place to a mob of sailors and traders. An unstable democracy would carry the state out of the ancient ways. The strife of parties came to an issue. An ostracism was held, and Aristides was banished,—probably in 484 or 483 B. C. Themistocles remained the leader of Athens in the new path which he himself had opened. Athens was now the first maritime power of Greece.

Policy of Themistocles.

The repulse at Marathon had probably not prevented the Persian commanders from representing their expedition as in a great measure successful. Darius resolved on the complete subjugation of Greece. But, when vast preparations had been in progress for three years, he died leaving the throne to Xerxes, the eldest of his four sons by Atossa, the daughter of Cyrus (485 B. C.) Xerxes was not, like his father, a born ruler or a trained warrior. But he was profoundly convinced that all human beings were the natural slaves of the Persian king; and he was influenced by a strong war-party in the palace, with Atossa and Mardonius at its head. The house of Pisistratus, the ambitious Aleuadæ of Thessaly, and Demaratus, the exiled king of Sparta, united in urging an invasion of Greece. It was in vain that Artabanus, the uncle of the king, argued on behalf of the moderate party at the court. Orders were given to raise such an armament as the world had never seen, a host which should display the whole resources of the empire from the Indus to the Ægean, from the Danube to the Nile. Forty-six nations were represented by the forces which wintered at Sardis in 481 B. C. A fleet of 1200 triremes, and about 3000 transports and smaller craft, assembled near Cyme and Phocæa on the Ionian coast. In the spring

Xerxes.

Third Persian expedition.

of 480 B. C. Xerxes led about a million of men to the Hellespont, whither the fleet went before to meet them.

Condition of Greece.

Greece was probably never stronger than it was at this time. The population of the Peloponnesus may have been about two millions. Athens, according to Herodotus, had 30,000 citizens. The Bœotian towns and the islands were prosperous. The proportion of slaves to freemen varied from perhaps four to one at Athens to as much as ten to one at Corinth or Ægina. Life was still simple and vigorous. Society was not divided into rich classes enervated by luxury and poor classes enfeebled by want. The public palæstras were schools of physical training for war. But that which Greece lacked was political unity. Aristocracy and democracy were already rival forces. Everywhere the aristocrats felt that a victory over Persia must have a national character, and must so far be a victory for the people. They inclined therefore to the Persian cause; and the stand in defence of Greece was eventually made by a few states only. Sparta, as the leading city of Greece, took the first step towards the formation of a national party, by convening a congress at the isthmus of Corinth in the autumn of 481. Here Themistocles showed his statesmanship by prevailing on the Athenians to abstain from disputing the hegemony of Sparta. Most of the Peloponnesian cities were represented at the congress. But Argos and Achaia, jealous of Sparta, held aloof. In Bœotia, Thebes, —the enemy of Athens,—favored Persia. In Thessaly the dynasty of the Aleuadæ were the active allies of the invader. Gelon of Syracuse refused to aid unless he were to lead. The Corcyreans promised sixty ships, but did not send them. Crete also failed to help. The states which fought against Persia were then these only,—Sparta with her Peloponnesian allies, Athens, Ægina, Megara, Platæa, Thespiæ. This national league expressed indeed the principle of Greek unity, but Greece was far from being united. The "medizing" party was strong, and it counted some adherents in many even of the patriotic cities. Wherever democracy had enemies Persia had friends.

Political divisions.

Plan of defence.

The first idea of the national defence was to arrest the torrent of invasion at some northerly point which could be held against great numerical odds. Tempe proving untenable, it was resolved to make a stand at Thermopylæ. When Leonidas had fallen with his 300 Spartans and the 700 Thespians who shared their heroic death, the next object of the Peloponnesian allies was to guard the isthmus of Corinth. The peculiar misfortune of Athens in the war was her position between two gates, the first of which had been forced by the enemy. The Greek leaders seem to have assumed at first that it was vain to oppose the Persian land forces in an open field. Xerxes occupied Athens, and the flames which destroyed its houses and temples at last avenged the burning of Sardis. The Greek ships, which had gained some advantage over the Persian fleet at Artemisium in the northern waters of the Eubœan strait, had moved to Salamis as soon as it was known that the Persians had passed Thermopylæ. The homeless population of Athens had been conveyed to Salamis, Ægina, and Trœzen before the arrival of Xerxes. And now the forecast of Themistocles was verified. Athens, and Greece itself, were saved chiefly by the Athenian ships,—200 in number out of a total of 366. The Peloponnesian leaders wished to withdraw the fleet to the isthmus. Themistocles saw that if it left Salamis it would disperse. He sent word to Xerxes that the Greeks meditated escape. The Persian fleet surrounded them in the night. Next day the battle of Salamis was fought. Of 1000 Persian ships, 200 were destroyed; the rest fled. It was on the same day that Gelon of Syracuse defeated the Carthaginians at Himera in Sicily (480 B. C.). Xerxes lost heart and retreated to Asia, leaving Mardonius with 300,000 men to finish the war. In the summer of 479 Athens was again occupied and destroyed by the Persians. Now at length Sparta came to the rescue. Pausanias, the guardian of the young son of Leonidas, led 110,000 of the allies into Bœotia, and utterly defeated the army of Mardonius near Platæa (479 B. C.). On the same day the troops of the Greek fleet defeated those of the Persian fleet in a battle on the shore at Mycale near Miletus. This victory set Ionia free from Persia.

Athens.

Battle of Salamis.

The Persian wars had revealed both the weakness and the strength of Greece. The hereditary aristocracy of Thessaly had shown that they were eager to establish the supremacy of their house with the help of Asiatic despotism. Such states as Argos and Thebes had not been ashamed to indulge jealousy and party spirit by betrayal of common cause. Even Sparta and the Peloponnesian allies had been disposed to confine their endeavors to the defence of their own peninsula, leaving Athens and the northern cities to their fate. On the other hand the struggle had brought into strong relief the contrast between absolute monarchy and constitutional freedom. This appeared in two things the Greek strategy was superior; and the Greek troops fought better. Athens, in particular, had shown how both the intelligence and the spirit of citizens are raised by equal laws. The mistakes of the invaders,—which, to a Greek mind, might well have seemed the work of Ate,—were such as are natural when a vast force is directed by the intemperance of a single will. Artemisia and Demaratus advised Xerxes to occupy Cythera. The Thebans advised Mardonius to sow dissension among the Greeks by means of bribes. Both counsels were judicious, and both were neglected. Time is, in war, the surest ally of superior numbers and resources; but the impatience of the Persian commanders staked everything on a few pitched battles. Again the Persians, unlike the Lydians of old, destroyed the Greek temples. They thus conferred an immense moral advantage on their antagonist. He could no longer doubt that he was helped by his gods.

Lessons of the Persian wars.

IV. *The Period of Athenian Supremacy*, 478–404 B. C.

In the space from the Persian to the Peloponnesian War the central interest belongs to Athens. The growth of Athenian empire, the successive phases through which it passed, and its influence on the rest of Greece, the inner development of Athenian life, political, intellectual, social, —these are the salient features in a period of about fifty years. The first care of Themistocles after the repulse of the Persian invasion was to restore the fortifications of Athens. The jealous interference of Sparta, instigated by Ægina and Corinth, was defeated by his ingenuity. A wall of larger circuit than the old one was built round Athens, and a strong wall was also carried round the Piræus. The Persians had been driven out of Ionia, but they still held many places on the Thracian and Asiatic coasts. The Spartan Pausanias, commanding the Greek fleet, took Byzantium from the Persians in 478. He now formed the design of making himself a despot, and his adoption of the manners of a Persian grandee became so offensive to the Greek captains that they requested the Athenian commanders to assume the leadership of the fleet. Pausanias was recalled to Sparta, and his successor found that the hegemony had already changed hands. The league, of which Athens now became the head (477 B. C.), was intended to continue the national defence against Persia. Its special purpose was to guard the Ægean. Aristides was chosen to assess the rate of contribution for the members. The representatives of the several cities met at the temple of Apollo in Delos, where the common fund was also deposited. Hence the league was called the Confederacy of Delos. It was only gradually that this free confederacy, with Athens for a president, passed into an Athenian empire over tributary cities. At first each city contributed ships to the common fleet. But the practice arose of allowing some cities to contribute money instead of ships. A city which did this had no control over Athens, and no protection against attack. One after another of the discontented allies revolted from Athens, and was forcibly reduced to the condition of a subject. Naxos was the earliest example (466 B. C.); Thasos was the next (465 B. C.); and as early as 449 B. C. only three insular allies remained free,—Samos, Lesbos, and Chios. The transfer of the common fund from Delos to Athens (about 459 B. C.) was merely the outward sign of a change in which most members of the original league had already been compelled to acquiesce. In the earlier years of the Confederacy the work for which it had been formed was not neglected. Of the successes gained against Persia the most notable was the victory of Cimon over the Persians, both by land and by sea, at the mouth of Eurymedon (466 B. C.) But, as Athens assumed more and more distinctly an imperial character, the common fund came to be regarded as a tribute which could be applied to exclusively Athenian

Pausanias.

Confederacy of Delos.

Gradual change in its character.

objects. This was the grievance which made the very name of the "tribute" (φόρος) so hateful.

Culmination of Athenian power.

The years 457–455 B. C. may be taken as marking the greatest extension of the Athenian empire. It was in 457 that their victory at Œnophyta in Bœotia, following on their defeat at Tanagra, enabled the Athenians to break up for a time the oligarchical league over which Thebes presided. Democracies were established in the Bœotian towns, and Athens was virtually supreme, not only in Bœotia, but also in Phocis and Locris. In 455, after a struggle of some years, Athens conquered Ægina. But now the tide began to turn. In 453 the defeat of the Athenians at Coronea destroyed the power of Athens in Bœotia, Phocis, and Locris. Oligarchies were restored. First Eubœa and then Megara revolted from Athens. The Spartans, released from a truce of five years (452–447), invaded Attica. They advanced, however, no further than the Thriasian plain; and it was believed that their leader, the king Pleistoanax, had taken Athenian bribes. Freed from this danger, Pericles was enabled to reduce Eubœa. But the dream of an Athenian land-empire was over. In 445 a truce for thirty years was concluded between Athens and Sparta. Athens gave up all dependencies on the mainland of Greece. Henceforth the Athenian empire was to be maritime only.

Thirty Years' Truce.

Between the conclusion of the Thirty Years' Truce and the events which led to the Peloponnesian War the most important incidents were—first, the revolt of Samos and its reduction by Athens (440 B. C.); next, the foundation by Athens of two settlements, Thurii, on the site of Sybaris in southern Italy, and Amphipolis, on the Strymon, in Thrace.

Constitutional changes at Athens.

Meanwhile the inner political life of Athens had passed through great changes. Soon after the Persian wars, the fourth or poorest class of the Solonian timocracy had been made eligible to the archonship. This was done on the proposal of Aristides himself. The maritime population of the Piræus was now large, and it had become impossible to exclude the main body of the citizens from the chief offices of the state. The development of Athenian democracy had been secured by that loyal unity of civic action and feeling which the Persian wars had produced. Themistocles, whose policy had been the source of those new impulses, did not remain to direct them; he was accused of complicity in the Persian intrigues of Pausanias, and ostracized (about 471 B. C.). Aristides died in 468. Cimon, the son of Miltiades, was now at the head of a conservative party. The other party, which was rather progressive than properly democratic, was led by Pericles, an Alcmæonid, and Ephialtes. A blow was dealt to the influence of Cimon and his party when the Spartans insultingly dismissed an Athenian force which had marched, under Cimon, to help them in reducing the insurgent Helots on Mount Ithome (464 B. C.). Soon afterwards some important reforms were proposed and carried by Ephialtes. The powers of the Areopagus were diminished. Probably it lost its general censorial power and its veto upon legislation, retaining its jurisdiction in homicide. The archons and generals were deprived of their discretionary judicial powers. Henceforth the people was to be the final judge both in criminal and in civil causes. The juries chosen from the Heliæa were now organized as a permanent system of courts, every juror receiving a fee from the state for each day of his attendance. Cimon was ostracized; and the exasperation of the conservative party was shown by the assassination of Ephialtes (457 B. C.). Cimon was succeeded in the leadership by his kinsman Thucydides, son of Melesias; and when, in 443 B. C., Thucydides also was ostracized, there was no longer any disciplined resistance to the policy of Pericles. Athens was now strengthened and embellished by a series of public works. Already in 457–456 two long walls had been built, one from Athens to Phalerum, the other from Athens to the Piræus; and about 445 a third or intermediate wall, parallel to the latter, was built on the proposal of Pericles. The Odeion, a theatre for musical performances, arose on the east side of the theatre of Dionysus, under the Acropolis. On the Acropolis itself the Erechtheion, the shrine of Athene Polias, which had been burned by the Persians, was rebuilt on a greater scale; and the Parthenon, the magnificent temple of the Virgin Athene, containing the chryselephantine statue of the goddess by Phidias, was constructed under his superintendence from the plans of Ictinus and Callicrates (438 B. C.). The Propylæa or portals, forming a colonnaded entrance to the Acropolis on the western side, were completed a few years later.

Public works.

Pericles.

The period known as "the age of Pericles" may be roughly defined as the years from 460 to 430 B. C. The idea which pervades the whole work of Pericles is that the Athenian people, having been called upon by circumstances to rule over a wide alliance, must be trained to rule worthily. Pericles was opposed to extending the empire of Athens; but he was resolved to hold it, because he saw the danger of giving it up. And, in order that it should be held securely, he saw that the people must be educated, first, politically, by constitutional freedom, and next, intellectually and socially, by general cultivation. The *theoricon*, or money given to the citizen to pay for his seat at the theatre, was doubtless a party expedient, like the pay provided for the juror and for the citizen-soldier; it belonged to a plan for breaking the exclusive power of wealth. But it also fitted into the system by which Pericles sought to bring the citizens collectively under the influence of art in all its noblest forms. Painting, music, sculpture, architecture, had each its place in this scheme; but for the statesman's object no single instrument was perhaps so potent as the drama. It was a time of contending forces, in which one chief peril was lest the generation to which a larger future was opening should lose its hold on what was best in the past. The religious tradition and the new ethical subtlety were nowhere reconciled in so lofty an ideal as by Sophocles; nor could any presentment of art rival the theatre in its power of quickening a sympathetic enthusiasm.

The "age of Pericles" would have produced better results for the political future of Athens if Pericles himself had been less great. As Thucydides says, the nominal democracy was virtually the rule of one man. The informal sovereignty of Pericles hindered the rise of those who might otherwise have been trained to succeed him. During his lifetime the need of a restraining force was not felt in the reformed institutions, for that force was supplied by a single mind. But when he was gone it was seen that the new equilibrium of the state depended on a Pericles being at its head. Probably Pericles himself believed that there were men who could continue what he had begun; and if he was wrong, that cannot detract from the glory of what he did for his own time.

V. *The Peloponnesian War*, 431–404 B. C. *The Period of Spartan and then of Theban Ascendency*, 404–362 B. C.

Causes of Peloponnesian War.

In examining the causes which led to the breach of the Thirty Years' Truce, and to the Peloponnesian War which followed it, Thucydides distinguishes two alleged or immediate causes from a third cause which was not alleged, but which lay deeper than either of the others. The two alleged causes were—(1) the active help given by Athens to the Corcyræans in their quarrel with Corinth concerning Epidamnus, a colony of Corcyra; (2) the Athenian blockade of Potidæa, a Corinthian colony which had revolted from Athens. The more essential cause was the growth of Athenian power, and the alarm which this caused to the Lacedæmonians. In truth the affair of Epidamnus and the affair of Potidæa were merely the sparks which happened to kindle the flame. That long conflict which we call the Peloponnesian War had been prepared from the time when the Athenian democracy, founded by Clisthenes, had become a power in Greece through the successful struggle against Persia. From that time there were two antagonistic principles, represented by two rival cities—oligarchy by Sparta, democracy by Athens. The other cities grouped themselves naturally around these. All Greece was divided between these two ideas. The Peloponnesian War is the collision between them. It would be inconsistent with the limits and the scope of this sketch to enumerate the details of the war in each of its twenty-seven years. Yet we must aim at indicating the periods into which it falls, the leading characteristics and tendencies which it presents.

First period of the war, 431–421 B. C.

1. The first period of the Poloponnesian War comprises the years from its commencement in 431 B. C. to the peace of Nicias in 421—hence sometimes called the Ten Years' War. As one of its main features was the frequent invasion

of Attica by the Peloponnesians, the latter called it the Attic War. The result of it was that Sparta had gained nothing, and that Athens had lost nothing except Amphipolis. By the peace of Nicias Athens kept all places which had surrendered voluntarily. Those allies of Sparta from which these places had been taken were naturally discontented. Corinth and Thebes especially were aggrieved. In spite of all the mistakes of Athens—in spite of the desolating plague—in spite of such reverses as the defeats at Delium and Amphipolis, and the loss of the Chalcidic towns—Athens remained on the whole triumphant; and against what Brasidas had done for Sparta might be set the victories of Phormio and the capture of Sphacteria. On the other hand the peace of Nicias had brought disaffection into the Spartan confederacy.

Second period, 421–413 B. C.

2. The second period of the war extends from the peace of Nicias in 421 to the catastrophe of the Sicilian expedition in 413. The four years immediately following the peace of Nicias are the only years during which the great fundamental antithesis on which the whole war rested was temporarily obscured. Many of the allies of Sparta were discontented, and the intrigues of Alcibiades were active among them. But it was in vain that oligarchical allies were gained for the moment to the democratic cause. The normal relations were soon restored. Then came the Athenian expedition to Sicily, ending in a crushing disaster. Thucydides thinks that the mistake lay, not so much in an original miscalculation of strength, as in the failure at Athens to support the expedition after it had gone. It is indeed possible that with other guidance Athens might have conquered Syracuse. But at least it was essential that Athens should put forth its whole strength, if only for the reason that no people resembled the Athenians so closely as the Syracusans. Yet never had the Athenians fought under greater disadvantages. The Athenian forte was in attack; at Syracuse they had to act on the defensive. The bold and versatile Alcibiades was made a public enemy. Nicias, timid and in weak health, is opposed to Gylippus, who unites a Dorian energy of hatred to Athens with something like Ionian command of resource. And, when everything had been lost except a chance of saving the army, the perversity of Nicias defeated the prudence of Demosthenes. The Sicilian disaster was the turning-point of the war. Pericles had warned the Athenians against needless ventures and a policy of aggrandizement. They had incurred a needless risk of tremendous magnitude, and had lost. If they had won Alcibiades would probably have raised a tyranny on the ruins of their democracy.

Third period, 413–404 B. C.

3. The third and last period of the war is from the Sicilian defeat in 413 to the taking of Athens by Lysander in 404, a few months after the battle of Ægospotami. This is the period called the Decelean War, because Decelea in Attica was occupied by the Spartans in 413, and continued to be a permanent base of their operations against Athens. As the sea board of Asia Minor was the scene of much of the fighting, it is sometimes also called the Ionian War. In this last chapter the war takes a new character. After the Sicilian overthrow Athens was really doomed. The Decelean War is a prolonged agony of Athenian despair. Athens had now no hope but in her ships; and the leaders had to find their own supplies. The Spartan treasury was also empty. This want of money on both sides gave the mastery of the situation to Persia. And it was due to the factious treason of Alcibiades that the aid of Persia was given to Sparta. Athens was ultimately conquered, not by the Spartan confederacy, but by the disloyalty of Athenians bent on ruining political opponents. The "Revolution of the Four Hundred," with its brief success, greatly contributed to the exhaustion of the city. Even at Ægospotami, even when Lysander was before Athens, it was the baneful influence of Athenian faction that turned the scale. When Athens had been taken and the walls destroyed, Sparta was once more the first power in Greece. When Thrasybulus and the patriotic exiles had overthrown the rule of the Thirty Tyrants, they restored the Athenian democracy, but they could not restore the old Athenian power.

Altered character of Sparta.

Sparta itself was changed. The old Spartan institutions had taught a simple reliance on disciplined strength. In the Peloponnesian War Sparta had won the victory with Persian gold. Already the love of money had found its way into the state which had once been so carefully protected from it. Differences of degree had arisen between the citizens, whose equality had been the very basis of the old Spartan life. Citizens who had been impoverished by the rise of prices, and who could no longer pay their share of the public tables, were now distinguished as "inferiors" (ὑπομείονες) from those who retained their full civic rights (ὅμοιοι). Spartan commanders abroad were not always inaccessible to bribes. The habit of military discipline indeed remained. Spartans were still distinguished, as a rule, by gallantry in the field, by care for the dead, and by attention to the ritual of the gods. Nor had the valley of the Eurotas remained closed to the higher culture of Greece. The old type of Spartan leader — the rough soldier incapable of eloquence or of finesse — had ceased to be the only type. An Athenian might have envied the powers of persuasion and the diplomatic tact of such Spartans as Brasidas, Lysander, or Gylippus. But the qualities of the old Sparta were seldom fused into a perfect harmony with the new accomplishments. Such men as Lichas and Callicratidas were rare. The balance of political power, as it existed in the old constitution, had also been unsettled. The kings were still, as of old, the commanders-in-chief on land. But the new office of the admiral (ναύαρχος) was invested with the chief command at sea. The supreme control of the state had passed more and more into the hands of the ephors, and the ephors, chosen annually, were not always incorruptible.

Spartan rule in Greece

Sparta had waged the Peloponnesian War in the name of freedom. The Greek cities were to be liberated from the all-absorbing tyranny of Athens. Now, however, Sparta altogether failed to redeem these pledges On the contrary she aimed at setting up a tyranny of her own. Oligarchical governments were established, controlled in each city by a Spartan garrison under a Spartan harmost or military governor The earliest and one of the worst cases was the tyranny of the thirty tyrants at Athens, set up by Lysander, and supported by Spartan arms until, after eight months, the Athenian exiles under Thrasybulus marched from Phyle upon Athens. The Athenian democracy was formally restored in September, 403 B. C., and the liberators used their victory with a wise moderation. Four years later Socrates was put to death, because a party blindly zealous for the old beliefs of Athens could not see that such thought as his led to the only firm basis for a new social order.

Greece and Persia.

The retreat of the 10,000 Greeks under Xenophon, in 401 B. C., marks a turning-point in the relations of Greece to Persia. It was to the Greeks a striking revelation of Persian weakness, an encouragement to schemes of invasion which would before have seemed wild. Sparta now began a war against the Persians in Asia Minor—partly to escape from the reproach of having abandoned Asiatic Hellas to the barbarian. Agesilaus, on whom the lesson of the famous retreat had not been lost, was encouraged by success to plan a bolder campaign. But in 394 B. C. the Athenian Conon, commanding the fleet raised by the satrap Pharnabazus, utterly defeated the Spartan fleet at Cnidus. Soon afterwards, under his protection, the Long Walls of Athens were restored. The Spartan power in Asia Minor was at an end. The oligarchies were overthrown, and the Spartan governors expelled

Battle of Cnidus.

Corinthian War.

The reverses of Sparta did not end here. At the instigation of Persia an alliance was formed between Athens, Thebes, Argos, and Corinth In the territory of the latter state the allies waged war on Sparta, to whose aid Agesilaus was recalled from Asia. When the Corinthian War had lasted six years, the peace of Antalcidas was negotiated between Sparta and Persia (387 B. C.). By it the Greek cities in Asia, with Cyprus, were given up to Persia. Lemnos, Imbros, and Seyros were assigned to Athens. All other Greek cities were declared independent. The meaning of this was that they were to be independent of each other—isolated for purposes of defence—and all alike dependent on the Great King. The Corinthian War had begun from Persian intrigue, it ended with a peace dictated by Persia. But the Spartan policy had gained its own ends. The so-called "autonomy" of the Greek cities disarmed the rivals of Sparta. Now, as at the end of the Peloponnesian War, a prospect of dominion was opened to

Peace of Antalcidas.

her. The Persian king, whom this disgraceful peace practically recognized as suzerain of Greece, was to be merely the guarantor of terms under which Spartan ambition might be securely pursued.

A few years later these designs met with their first serious check. In 382 B. C. the Spartans treacherously seized the Cadmea or citadel of Thebes. They held Thebes for three years. But in 379 a party of Theban exiles, under Pelopidas, surprised the Spartan garrison and recovered the city. A still greater discouragement to Sparta was the establishment of a new Athenian Confederacy—precautions being taken against the members passing, as under the Delian Confederacy, into the condition of mere tributaries. Thebes joined the new confederacy, and presently succeeded in restoring the old Bœotian league, of which Thebes was the head. But the rise of Thebes had excited Athenian jealousy. Peace was made in 371 between Athens and Sparta. Thebes, thus isolated, was at once attacked by the Lacedæmonians. They invaded Bœotia, but were defeated by the Thebans under Epaminondas at Leuctra, 371 B. C. This destroyed Spartan power outside of the Peloponnesus. Epaminondas next invaded the Peloponnesus itself. He resolved to set up rivals to Sparta on her own borders. He therefore united the cities of Arcadia into a league, with a new city, Megalopolis, for its capital; and he gave independence to Messenia, which for three centuries had been subject to Sparta—laying the foundations of a new capital, Messene, around the great natural citadel of Ithome. The Arcadian league did not long hold together. Mantinea led a group of Arcadian towns favorable to Sparta. In 362 B. C. a battle was fought near Mantinea between the Spartans and the Thebans. The Thebans were victorious, but Epaminondas fell. With his death the temporary supremacy of Thebes came to an end. Sparta had, however, been reduced from the rank of a leading state. Xenophon closes his *Hellenica* with these words:—"There was more confusion (*ἀκρισία*) and tumult in Greece after the battle than before."

Revolution at Thebes.

New Athenian Confederacy.

Theban victory at Leuctra.

Epaminondas.

Political confusion is indeed the general characteristic of the period between the end of the Peloponnesian War and the Macedonian conquest of Greece. In the preceding century Athens and Sparta had been the vigorous representatives of two distinct principles. The oligarchic cities rallied round Sparta, the democratic round Athens. But at the end of the Peloponnesian War Athens was exhausted. Sparta, now predominant, but suffering from inner decay, exercised her power in such a manner as to estrange her natural allies. Thus both the normal groups of states were broken up. New and arbitrary combinations succeeded, seldom lasting long, since they were prompted merely by the interest or impulse of the hour. In this period of unstable politics the moment most promising, perhaps, for the future of Greece was when Athens had formed a new naval confederacy, and was also allied with the Bœotian league. But the alliance was broken by Athenian jealousy of Thebes,—not to be renewed until Greek independence was on the eve of receiving its death-blow. The work of Epaminondas in one sense died with him; the brief hegemony of Thebes passed away. But in another sense the results which he achieved were enduring. He had been for Thebes such a man as Pericles was for Athens—a ruling personal influence in a democratic commonwealth; and he had raised Theban policy to the old Athenian level. The aims of Thebans were no longer confined to the circle of Theban interests; Thebes now aspired to be what Athens had been—the champion of national freedom and greatness. The power founded by Epaminondas was transient; but this large Hellenic patriotism made itself felt in some degree as a permanent inspiration, preparing the Thebans to stand by the Athenians in the last struggle for Greek freedom.

General character of the period, 404–338 B. C.

Work of Epaminondas.

VI. *The reigns of Philip and Alexander*, 359–323 B. C.

Three years after the death of Epaminondas Philip came to the throne of Macedon. His power rapidly grew. A warlike people, ruled by an able and ambitious king, was now the northern neighbor of Greece. The most obvious vice of Greek politics at this period was disunion; but the disunion itself was only the symptom of a deeper decay. No one city of Greece any longer retained the vigor required in a leader. Had either Athens or Sparta now possessed such vital force as they showed in the Persian wars, no local or temporary feuds would have prevented the organization of national defence. Nothing marks the decay of the Greek commonwealths more significantly than the fact that they did not even recognize the urgency of the danger. Demosthenes had the old Greek spirit; but he stood almost alone. The principles on which he constantly insisted, and which give unity to his entire career, are mainly two:—first, the duty of the Athenian citizen to sacrifice personal ease and gain to the service of Athens; secondly, the duty of Athens, as the natural head of free Greece, to consult the interests of all the Greek cities. The energy of Demosthenes was not first roused by the progress of Philip. Before there was danger from the quarter of Macedon, Demosthenes had seen clearly that the decay of public spirit threatened the destruction of Hellenic life. As he said to the Athenians afterwards, if Philip had not existed they would have made another Philip for themselves. And the condition of Athens was at least not worse than that of any other city which could have aspired to lead.

Decay of Greek civic life.

Demosthenes.

A strategist so keen-sighted as Philip must early have perceived that he had little to fear from combined resistance, so long as he was careful not to attack too many separate interests at the same time. Greeks, he saw, were past fighting for each other as Greeks. This was the key-note of his policy to the last. While making aggressions on one Greek city or group of cities, he always contrived to have others on his side.

Philip.

Philip's career in relation to Greece has two periods. The end of the first period is marked by his admission to the Amphictyonic Council; the end of the second, by the battle of Chæronea. During the first period Philip is still a foreign power threatening Greece from outside. He takes Amphipolis from the Athenians; he destroys Potidæa, he acquires towns on the Thracian and Messalian coasts; he defeats the Phocians under Onomarchus, and even advances to Thermopylæ, to find the pass guarded by the Athenians; finally, he destroys Olynthus and the thirty-two towns of its confederacy. In the second period he is no longer a foreign power. Having intervened in the Sacred War and crushed the Phocians, he has taken the place of Phocis in the Amphictyonic Council, and has thereby been admitted within the circle of the Greek states. The First Philippic and the three Olynthiac speeches of Demosthenes belong to the first of these periods. The speeches On the Peace, On the Embassy, On the Chersonese, and the two later Philippics, belong to the second. In the Third Philippic, the climax of his efforts before Chæronea, Demosthenes reviews the progress of Philip from the Hellenic, not merely from the Athenian, point of view. Philip has destroyed Olynthus, he has ruined Phocis, he has sown dissensions in Thessaly; Thebes is afraid of him; he has gained Eubœa and the Peloponnesus; he is supreme from the Adriatic to the Hellespont; and the last hope of Greece is in Athens. Demosthenes succeeded in winning back Byzantium to the Athenian alliance, and in persuading Thebans to fight by the side of Athenians; but he could not avert the catastrophe of Chæronea.

First period of his relations to Greece, 359–346 B. C.

Second period, 346–338 B. C.

After the victory which made him master of Greece, Philip deprived Sparta of her conquests in the Peloponnesus. The Messenians, Arcadians, Argives, recovered their old possessions. A congress was then summoned at the isthmus of Corinth. Macedonia and the Greek states were united in a federal league. A federal council was constituted to guard the federal laws; and the Delphic Amphictyony was recognized as a tribunal to which this council should refer any breach of those laws. Philip, representing Macedonia, the most important member of the league, was acknowledged as its head or president. His position in regard to the Greek cities was thus in form much the same as that of Athens or Sparta in former days. It was nominally an hegemony, with somewhat more stringent powers, corresponding to the more systematic organization of the league; in practice it was military kingship over Greece. Yet Demosthenes had not failed. The condition of the

Philip president of an Hellenic league.

Greek states under Philip was favorable in proportion as they had given him trouble. Thessaly had actively helped him, and had been completely subjugated. The Peloponnesian rivals of Sparta had not been active either in helping or resisting him, and they were now more dependent on Philip than they had formerly been on Sparta. Athens alone had effectively resisted him, and Athens was treated by him with the prudent respect due to a serious antagonist.

Sicily. Timoleon.

If Greek liberty had received a fatal blow in Greece proper, there was another part of Hellas in which, almost simultaneously, it had been vindicated with splendid success. While Demosthenes was making his heroic resistance to the designs of Macedon, the enemies of Hellenic freedom in Sicily had been encountered with equal vigor and happier fortune by Timoleon. A few years after the defeat of the Athenian armament in 413, Sicily had suffered two invasions of the Carthaginians. Selinus and Himera, Agrigentum, Gela, and Camarina, had successively fallen. The first Dionysius, in consolidating his own tyranny at Syracuse, had been content to leave half the island in the hands of the foreign foe. The feeble misrule of his son, Dionysius II., produced a series of revolutions. A party at Syracuse invoked the aid of Corinth. Timoleon was sent with only 1200 men (343 B.C.). His first work was to deliver Syracuse from the contending forces of Dionysius and a rival named Hicetas, and to restore the Syracusan democracy. His next work was to drive the Carthaginians out of Sicily. He defeated them with crushing effect at the river Crimesus (340 B.C.). The Sicilian Greeks were now free. Sicily entered on a new period of prosperity, which lasted until Agathocles became tyrant of Syracuse (317 B.C.). Thus the brightest days, perhaps, of Hellenic Sicily coincided with those in which the cities of the Hellenic mainland were learning to bear the Macedonian yoke.

405–367 B.C.

The time seemed now to have come for an enterprise which, since the retreat of the Ten Thousand, had been the dream of many Greek captains, but which none had yet been in a position to attempt. Philip, in the forty-seventh year of his age, had declared war against Persia, and was preparing to invade Asia at the head of an army gathered from all Greece, when he was assassinated by a young Macedonian noble in revenge for a private affront (336 B.C.). Alexander, Philip's son and successor, was only twenty. Marching into Greece, he promptly repressed an insurrectionary movement, and was recognized by a new assembly at Corinth as commander-in-chief of the Greek armies. He next marched against the tribes on the northern borders of Macedonia. While he was absent on this expedition, the Thebans rose against the Macedonian garrison. Alexander returned, took Thebes, and razed it to the ground (335 B.C.). At Corinth he received the homage of the Greek states, and then returned to Macedonia.

Death of Philip.

Alexander.

Alexander was now free to execute the design of Philip. As captain-general of Hellas, he sets forth to invade the Persian empire, and to avenge the wrongs suffered by Greece at the hands of the first Darius and of Xerxes. The army with which he crossed the Hellespont in 334 B.C. numbered perhaps about 30,000 infantry and 4000 cavalry. It was composed of Macedonians, Greeks, and auxiliaries from the barbarian tribes on the Macedonian borders. The devotion of native Macedonians to their hereditary king was combined with the enthusiasm of soldiers for a great general. Even if the military genius of Alexander had not been of the first order, his personal authority over his Macedonian troops, and through them over the rest, would still have been greater than was ever possessed by a Greek citizen commanding fellow-citizens.

Alexander invades Asia.

Alexander's career of conquest has three stages, marked by his three great battles. The victory at the Granicus (334 B.C.) gave him Asia Minor. The victory at Issus (333 B.C.) opened his path into Syria and Egypt. The victory at Arbela (331 B.C.) made him temporary master of the whole East. In accomplishing the first two of these stages Alexander was not compelled to assume any new character. The king of Macedon, the elective captain-general of Greece, needed no other titles by which to hold the lands to which he came as a deliverer from Persia. The later history of these lands is the proof. Asia Minor was by degrees thoroughly Hellenized, and remained Greek till the Turks came in the 11th century. Syria and Egypt were not indeed Hellenized as whole countries, but their capital cities, Antioch and Alexandria, were Hellenic; and the control established by Alexander was retained by Macedonia or by Rome for centuries. At the third stage, however, Alexander's conquests entered upon an entirely new phase, and compelled him to take up an altogether new position. Neither in his Hellenic nor in his Macedonian capacity could he put forward any effective claim to hold the Persian empire proper,—the empire stripped of its Egyptian, Phœnician, and Hellenic dependencies. He could hold Persia only as a Persian king, as the successor of those Achæmenid kings whose dynasty he had overthrown. The constitutional king of Macedonia, with limited prerogatives, the elective captain of Greece, must now assume a third and distinct character. He must be also a Persian king, a constitutional despot. The merely European influences represented by Alexander might leaven the East, but they could not lastingly possess or transform it. Hellenic cultivation, like Roman power, was not permanently introduced over any wide area east of the Euphrates. This fact is enough to illustrate the enormous difficulty of the task which Alexander had undertaken. It seems not impossible that policy may have been mingled with vanity in his exaction of divine honors. Greeks or Macedonians could never pay him the slavish homage which Persian subjects rendered to their king. But the contrast between European and Asiatic royalty would at least be less glaring if the master of Persia were also acknowledged as the son of Zeus Ammon.

Three stages of his career.

Greek settlements in Asia.

The colonies planted by Alexander in his progress through Asia make the beginning of a new period in Hellenic history. Hitherto we have had to do with a people whose Hellenic unity rests, not merely on community of language and civilization, but also upon community of blood. Now, by the side of this natural Hellenic nation, there arises an artificial Hellenic nation, with a common language and civilization, but not exclusively of Hellenic blood. The Macedonians may be regarded as the founders of this artificial nationality. They were doubtless of a stock kindred to the Hellenic, in what degree, it is less easy to say—but (with the exception of their kings) they were generally regarded by the Greeks as standing half-way between Greeks and barbarians. Philip did much to Hellenize Macedonia; and the Macedonian colonies of Alexander became in their turn centres from which the influence of Hellenic civilization was diffused through Asia. Henceforth there are two Hellenic types: the Greek of Greece proper, who preserves in some degree the marked individuality of the old Greek character; and the Asiatic Greek, more readily affected by foreign surroundings, more pliant and less independent. The history of the modern Greek nationality dates from the days of Alexander.

Results of Alexander's conquests.

The results of Alexander's conquests were beneficent chiefly in two ways: first, by liberating the hoarded treasures of the Eastern kings, and so stimulating industry and commerce; secondly, by opening Asia to a new civilization, which helped to promote intellectual and moral progress, even in those places where its influence was limited or transient. In the process of doing this much that was valuable may have been destroyed. But it can hardly be questioned that on the whole the gain far outweighed the loss. If Alexander had not died at the age of thirty-two, leaving his work unfinished, it would perhaps have been easier to judge how far he deserves the credit of having contemplated these benefits to mankind. There is nothing to show that he intended to govern otherwise than as an absolute ruler, with a better machinery for controlling his subordinates than had been possessed by the Persian kings. Such a view is not inconsistent with the fact that his colonies enjoyed municipal freedom. Nor can it be proved that he meant his colonies to be anything more than military strongholds or commercial centres. But it may at least be said that, if his object had been to diffuse Hellenic cultivation over Asia, he could have adopted no more effectual means. It is conceivable that, in his vision of that complex empire which imposed such almost irreconcilable tasks upon its ruler, the idea of engrafting Eastern absolutism on Greek politics may have co-existed with the idea of Hellenizing Asiatic society.

In that period of Hellenic history which closes with Alexander we are tracing the gradual development of a race with special gifts of mind and body, which strongly

distinguish it from all other races. The Hellenes set the Hellenic stamp on everything which they create,—first, on their language itself, then on their politics, their literature, and their manners. Every element of their life receives its mature shape from themselves, even when the germ has been borrowed; the Hellenes are an original people in the sense that they either invent or transform. At a very early time they have the political life of cities, and they never rise from the conception of the city to the higher unity of the nation. Their love of clear outline and their sense of measure shrink from every vague abstraction; the principle of order itself is by them identified with "the limit;" the indefinite is a synonym for disorder and evil. The city, an easily comprehended whole, satisfies this instinct; but there is room within its framework for the gradations of monarchy, oligarchy, democracy; for the various modes of acting and thinking which characterize Achæans, Dorians, Ionians. As the leading commonwealths grow to maturity, two principles of government stand out in contrast,—oligarchy and democracy. Each is represented by a great city round which the lesser states are grouped. The inevitable collision comes, and the representative of democracy is at last vanquished. But in the hour of victory oligarchy is discredited by the selfish ambition of its champion. A time of political confusion follows, in which no one city can keep a leading place. Separate interests prevail over principles; public spirit declines. The disunion of the cities—incurable, because arising from a deep inner decay—enables the crafty king of a half-barbarian country to make himself the military dictator of Greece. But just when the better days of Hellenic civilization seem to be over, a new career is opened to it. Men who are not of Hellenic blood help to diffuse the Hellenic language, thought, and manners over a wider field: and the life of the modern Greek nation begins. (R. C. J.)

Section II.—Post-Classical Greek History.

The later history of the Greeks, from the end of Alexander the Great's reign to the taking of Constantinople by the Turks, may be divided most naturally into five periods, viz.—I. The period of Greek subjection: from the death of Alexander to the accession of Constantine the Great as sole emperor, 323 B. C. to 323 A. D. II. The period of Greek revival: from Constantine the Great to Leo III. (the Isaurian), 323–716 A. D. III. The period of Byzantine prosperity: from Leo III. to Isaac I. (Comnenus), 716–1057 A. D. IV. The period of Byzantine decline: from Isaac I. to the taking of Constantinople by the Latins, 1057–1204 A. D. V. The period of Greek survival: from the taking of Constantinople by the Latins to its conquest by the Turks, 1204–1453 A. D.

In the limited space of an article like the following, it is impossible to enter into detail with reference to the events of any of these periods. It may be well therefore if we turn our attention especially to the causes which were from time to time at work, to the characteristics and tendencies of various ages, and to the changes that came over society.

Importance of the post-classical history.

The history which we thus enter upon is of importance and interest in a different way from that of the classical age of Greece. That age was a unique development in respect of national life and character, of social and political institutions, and of every form of cultivation, and was marked by concentrated energy and intense vigor. The later period is important because of its wide-reaching influence on the world at large, and because it is one, and that the more continuous, of the two great chains of events, in eastern and western Europe respectively, which connect the earlier and later history of civilized man. To the younger student, who is already acquainted with the previous history of Greece and Rome, and has learnt something of the condition of the modern world through the history of England, no other period is probably so instructive and suggestive. He is led into byways of history and remote countries, which have in themselves an element of romance. He comes into contact with races from every branch of the human family in the freshness of their early vigor; and amongst many other lessons he learns one, which cannot be learnt too early, and which historians and students of history are disposed to overlook, that the unfortunate are not therefore to be despised. To more advanced students its value consists in its explaining the existing state of things in a considerable part of Europe and Asia, which cannot be explained otherwise; and still more in the illustrations it affords, both by way of similarity and contrast, to circumstances in the history of western Europe; such, for instance, as the abolition of serfdom, the relations of immigrant races to the original inhabitants, and systems of law and finance. Besides this, so much civilization filtrated from the East to the West in the course of the Middle Ages that a knowledge of Byzantine history is necessary to a proper understanding of that of western Europe. It will suggest also, if properly studied, that while battles, sieges, and other salient events may be the turning-points of history, the inhabitants of any particular country are more affected by influences which lie below the surface—by alterations of trade-routes and changes in the tenure of land, by the effects of judicious or injudicious taxation, by the administration of justice, and by the relations of different classes to one another.

Misconceptions. Character of the later Greeks.

It is desirable at starting to notice two misconceptions which have prevailed, and in a less degree still prevail, with regard to different portions of this period. The first of these concerns the character of the Greeks during the time of their subjection to the Romans, and in particular under the early emperors, in which age they are often supposed to have been a demoralized and unprincipled race. Such expressions as the "Græculus esuriens" and "Græcia mendax" of Juvenal, and similar ones which are found in Tacitus and other writers of that time, have become proverbial, and have been taken to describe, as those authors undoubtedly intended them to describe, the people at large. There was some justification for the retort of Lucian, that the Romans spoke truth only once in their lives, and that was when they made their wills. The fact is that these descriptions represented faithfully enough the lower class of Greek adventurers who came to Rome from Alexandria and the Asiatic cities to seek their fortunes; and the Roman writers, with their usual contemptuous ignorance of everything provincial, confused these with the Greek nation. The later Greeks no doubt had degenerated from their great forefathers; but it is only fair to remember that this was to a great extent the result of their circumstances. The rapid growth of Greek culture and Greek political ideas was naturally followed by rapid decay. In sculpture the early archaic style developed in a few decades of years into the manly and perfect style of Phidias, and the change was equally rapid to the luxurious style of Praxiteles, in which the elements of decadence were already traceable. The same thing is apparent in the history of the drama. And in like manner in politics, the constitutions of the various states, which were so well suited to the development of Greek individuality, contained in themselves no element of permanence, owing to the opposing elements which were brought face to face within so narrow an area; and in their relations to one another, all combination on a large scale was prevented by what has been aptly called the "centrifugal" character of Greek politics, so that they were destined inevitably to fall under the dominion of any great empire that should arise in their neighborhood. Again, it must never be forgotten that the splendid products of Greek genius and Greek character sprang from the black soil of slavery, and could not have existed without it; so that here too we find an element of rottenness, which wa sure in the end to produce decay. Consequently, from the time the Greeks lost their liberty, they ought in all fairness to be judged by a different standard from their predecessors, and we ought to be satisfied if we find in them such good qualities as characterize a more ordinary people—industry, respectability, intelligence, good-citizenship, capacity for local self-government, and readiness to make the most of their opportunities. In all these respects the Greeks were among the best of the provincials of the Roman empire.

Power of the Byzantine empire.

The other misconception relates to the Byzantine empire, which has been commonly regarded as a period of steady decline and feebleness and decrepitude. The author who is mainly responsible for the prevalence of this view is Gibbon; and it is strange that a writer who was gifted with such profound historical insight should not have perceived that the state which accomplished such great things could not have been powerless. The passage in which he expresses himself on this subject is well known. "I should have abandoned without regret," he says, "the Greek slaves and their servile historians, had I not reflected that the fate of the Byzantine monarchy is passively connected with

the most splendid and important revolutions which have changed the state of the world." Yet it was this same empire which beat back for centuries, and ultimately survived, first the Saracens and afterwards the Seljuks, both of which peoples would otherwise have overrun Europe, and which, even in its decline, kept at bay, for more than a hundred years, the Ottomans when at the height of their power, thereby providing the Western nations with a breathing space, without which the career of Turkish conquest would certainly not have been arrested at Vienna, but might have extended to the Elbe or the Seine. During the 8th, 9th, and 10th centuries its military power was the strongest in Europe, and the individual prowess of its aristocracy was unrivalled, while at the same time its long succession of able emperors and administrators is such as no other monarchical government can show. Its influence is further shown by its missionary efforts, resulting in the conversion to Christianity of the south Slavonic nations and the Russians, and the consequent spread of civilization throughout the countries they inhabited; by its widely extended commerce both by land and sea; and by its art, especially its architecture, which contributed to the formation of other styles from Egypt to the north of Russia, and from India to Spain. Finally, its social and political excellence appears in the state of education, in the regularity of its administration, especially in the matter of justice, and, above all, in the legal standard of the coinage being maintained invariable from first to last, which is a rare proof of a highly organized system. When its situation in the midst of barbarous nations is considered, and the intermediate position it occupied between Asia and western Europe, it may safely be pronounced one of the most powerful civilizing agencies that the world has seen.

I. *Period of Greek Subjection: from the Death of Alexander to the Accession of Constantine the Great as sole Emperor*, 323 B. C. *to* 323 A. D.

Effect of Alexander's conquests.

The conquests of Alexander the Great differed from those of almost every other great conqueror in this that they were followed up by a scheme of civil government, the object of which was to secure the well-being and promote the civilization of all his subjects. That he was not the ambitious madman which he is often represented as being is amply proved by the forethought with which his campaigns were planned, and by his attention to the commissariat and to other details connected with the transport and maintenance of his vast armies. But his true greatness is most clearly shown by his endeavoring to introduce unity into his vast empire, not by subjecting one race to another, or crushing out the hope of further resistance by an iron rule, but by establishing in it centres of permanent institutions and common culture. These were the Greek colonies with municipal government which he founded at intervals throughout Asia. By these the subject countries, without being forced into a common mould, or organized in defiance of their feelings and prejudices and without reference to their national institutions, were gradually leavened by the system that existed among them, and obtained a certain infusion of the Hellenic character and Hellenic modes of thought. Though Alexander himself did not survive to complete his project, yet enough had been accomplished at the time of his death to leave its influence firmly imprinted, even when his empire fell to pieces and was partitioned among his generals. The consequences of this to Asia were of incalculable importance, and continued unimpaired until the tide of Mahometan conquest swept over the country; and even then it was from Greek literature and art that the Arabs obtained the culture for which they have been celebrated. But its effect was hardly less marked on the Greeks themselves. The Hellenic world was henceforth divided into two sections—the Greeks of Greece proper, and the Macedonian Greeks of Asia and Egypt. Between these there existed a common bond in similarity of education, religion, and social feelings, in the possession of a common language and literature, and in their exclusiveness, whether as a free population ruling a large slave element, or as a privileged class in the midst of less favored races; but the differences were equally striking. The former retained more of the independent spirit of the ancient Greeks, of their moral character and patriotism; the latter were more cosmopolitan, more subservient, more ready to take the impress of those among whom they were thrown, in them the Ulysses type of Greek character, if we may so speak—its astuteness and versatility—became predominant. This distinction is all-important for the subsequent history, since, in the earlier period, it is rather the Greeks of Hellas who attract our attention, whereas after the foundation of Constantinople the Macedonian Greeks occupy the most prominent position. At the same time a change passed over the Greek language; while the ancient dialects were retained, more or less, in the provinces of Greece proper, the Attic dialect became the court language of the Macedonian monarchs, and was used almost exclusively by prose writers. Gradually Macedonian and other provincialisms crept into it, and it was modified by simpler expressions, and words in more general use, being substituted for those preferred by the classic writers of Athens; and thus was formed what was called the common or generally used dialect. The non-Greek inhabitants of the countries in which the Greeks were settled were described as "Hellenizing," and consequently their language, such as we find it in the Septuagint and the New Testament, was called Hellenistic Greek. The literary spirit also migrated to Alexandria, which became for a time the home of the principal Greek culture, and nurtured the genius of Theocritus, the first of pastoral poets, the taste and erudition of Aratus and Apollonius Rhodius, and the research of Aristarchus and other eminent Homeric critics.

Events during 323–146 B. C.

The period of somewhat less than two centuries (323–146 B. C.) which intervened between the death of Alexander and the conquest of Greece by the Romans was a sort of twilight between liberty and subjection. The Lamian War, as the contest between a number of the Grecian states, with Athens at their head, and Antipater, one of Alexander's immediate successors in Macedonia, was called from the siege of Lamia, which was its most prominent event, soon convinced the Greeks that it was idle for them to struggle single-handed with their great neighbor. After that the country formed a bone of contention between the neighboring potentates in Macedonia, Asia Minor, Syria, and Egypt; and most of the states, with the exception of Sparta, were in the power sometimes of one sometimes of another of them. though the contest of their masters secured them from time to time a partial independence. At length the constant danger to which their liberties were exposed suggested the necessity of some kind of combination on the part of the separate states, and the famous Achæan league arose (280 B. C.), which revived the dying energies of the Greeks, and has thrown a lustre over their period of decline. For the origin of this federation we must go back to the early history of the district of Achaia in northern Peloponnesus, the inhabitants of which, from being isolated from other races by their position between the Arcadian mountains and the Corinthian Gulf, and occupying a succession of valleys and small plains, found a federal union to be the most natural political system by which they could be held together. Throughout the greater part of their history this people exercised little influence on the fortunes of Greece, but in her time of greatest need they came forward as her champions. The league was now revived, with a more definite organization and a wider political object, and under the leadership of Aratus, the greatest of its early "strategi," it wrested Sicyon from the power of its tyrant, and Corinth from the hands of the Macedonians, until at last it embraced Athens, and almost the whole of the Peloponnesus. Unfortunately Sparta held aloof. That city, which had succeeded in maintaining its independence, had fallen into the hands of a narrow oligarchy of wealthy proprietors, who rose in violent opposition to their reforming kings—men whose names would be a glory to any period—Agis and Cleomenes, and succeeded in putting the first to death, while the latter was enabled to overpower them through the influence won by his military successes. But circumstances involved Aratus in a war with Sparta, and here the old Greek spirit of discord betrays itself. When hard pressed by Cleomenes, the Achæan leader applied to the Macedonians, and the result was that Antigonus Doson invaded the country, and at Sellasia inflicted a final and crushing blow on the Spartan power (221 B. C.). The same spirit appears in the Social War, which occurred shortly after this between the Achæans and the Ætolian league, a similar confederation in northern Greece, and was fomented by Philip V. of Macedon. Subsequently, when the Romans made war on Philip for assist-

GREECE (ANCIENT).

ILLYRICUM
MACEDONIA
THRACIA
PROPONTIS
EPIRUS
THESSALIA
Dolopia
Phthiotis
Aetolia
Acarnania
Peloponnesus
Messenia
Laconia
Argolis
Achaia
Elis
Arcadia
Boeotia
Attica
Megaris
Phocis
Locris
Aegean Sea
Ionian Sea
Myrtoum Mare
Creticum Mare
Carpathium Mare
Thracium Mare
Propontis
Lydia
Mysia
Caria
Ionia
Aeolis
Phrygia
Pisidia
Pamphylia
Cilicia
Lycia
Lycaonia
Galatia
Bithynia
Paphlagonia
Pontus
Cappadocia
Armenia
Syria
Crete
Cyprus
Rhodes
Lesbos
Chios
Samos
Lemnos
Thasos
Samothrace
Euboea
Corcyra
Cephallenia or Samos
Leucas or Leucadia
Zacynthus
Cythera
Scyros
Andros
Tenos
Naxos
Paros
Amorgos
Ios
Thera
Melos
Cimolos
Seriphos
Siphnos
Cythnos
Gyaros
Syros
Myconos
Delos
Rhenea
Icaria
Patmos
Carpathos
Casos
Rhodes
Telos
Nisyros
Symae
Cnidus
Halicarnassus
Miletus
Priene
Myus
Samos
Ephesus
Colophon
Lebedos
Teos
Erythrae
Clazomenae
Phocaea
Cyme
Aeolis
Pergamos
Adramyttium
Atarneus
Antandrus
Assus
Gargara
Abydos
Dardanus
Ilium
Sigeum
Rhoeteum
Tenedos
Alexandria Troas
Scamandria
Lampsacus
Parium
Priapus
Cyzicus
Dascylium
Apollonia
Artaxata
Nicaea
Prusa
Hadrianeum
Adramyttium
Gordus
Tmolus M.
Sardis
Philadelphia
Myrina
Hermus
Caicus
Cayster
Ephesus
Magnesia
Tralles
Nysa
Hierapolis
Laodicea
Colossae
Apamea Cibotus
Maeander
Marsyas
Mylasa
Stratonicea
Cnidus
Physcus
Lycus
Cadmus
Cybra
Xanthus
Patara
Phaselis
Olympus
Cragus
Limyra
Myra
Andriace
Antiphellus
Caunus
Cadi
Lagina
Hydrela
Cos
Calydna
Chalcedon
Astacus
Nicomedia
Bithynium
Prusias
Hadrianeum
Ancyra
Pessinus
Gordium
Tavium
Amisus
Sinope
Cerasus
Trapezus
Colchis
Iberia
Albania
Armenia
Mesopotamia
Cilicia
Tarsus
Issus
Pylae Amanicae
Antioch
Seleucia
Laodicea
Apamea
Palmyra
Damascus
Phoenicia
Judaea
Arabia
Egypt
Nile
Euphrates
Tigris
Cyprus
Paphos
Salamis
Citium
Amathus
Curium
Soli
Tamassus
Crete
Cnossus
Gortyna
Lasaea
Phaestus
Hierapytna
Itanus
Olus
Lyctus
Cydonia
Aptera
Polyrrhenia
Cisamus
Rhithymna
Panormus
Heraclea
Ida M.
Dicte M.
Leuce
Dromedes
Ornithes
Gaudos
Hippocorona
Matala
Phoenix
Diospolis
Memphis
Alexandria
Pelusium
Canopic Mouth
Sebennytic Mouth
Tanitic Mouth
Damietta Mouth
Rosetta Mouth
Mareotis L.
Natron Lakes
Libya
Cyrenaica
Barca
Cyrene
Apollonia
Ptolemais
Berenice
Taucheira
Hesperides
Euesperides
Automala
Catabathmus Magnus
Catabathmus Minor
Syrtis Major
Syrtis Minor
Lotophagitis
Meninx
Gigthis
Leptis Magna
Oea
Sabratha
Tripolis
Abrotonum
Cydamus
Garama
Augila
Ammonium
Oasis Magna
Oasis Parva
Oasis Hammonis
Oasis Jovis
Oasis Dionysiados
Oasis Minerva
Oasis Augilae
Oasis Ammonis
Oasis Apollinis
Oasis Solis
Oasis Alexandri
Oasis

GREECE (MODERN).

Corfu
Nom. CORFU
Santa Maura (Leukada)
CEPHALONIA
ZANTE (Zakynthos)
Zante
Jenina
Prevesa
Parga
Arta
Amaxiki
Thiaki (Ithaka)
Argostoli
Missolonghi
Patras
Gulf of Patras
Gulf of Corinth or Lepanto
Gulf of Arkadia
Gulf of Kalamata or Messenia
Gulf of Marathonisi
Cape Matapan
Cerigo (to Argolis & Corinthia)
Turnavo
Larissa
Volo
Gulf of Volo
Karditza
Fersala
Lamia
Talanta Chan.
Eubœa, Egripos, or Negropont
Nom. EUBŒA
Skyros
Psara
Khios
Aglo Strati
North Sporades
Skopelos
Khilidromi
Pelagonisi
Skiathe
Sarakino
Skantzura
Pipéri
Xerokhori
Rovias
Kumi
Aliveri
Egripos
Oropos
Thebes
Tanagra
Livadia
Galaxidi
Salona
Lidoriki
Mt. Parnassus
Mt. Oeta
Thermopylæ
Vrachori
Karpenisi
Amphissa
Mesolonghi
Lepanto
Vostitza
Aigion
Kalavryta
Kalogria
Andravida
Katakolo
Pyrgos
Agulinitza
Andritzena
Dimitsana
Argos
Tripolitza
Nauplia
Epidaurus
Egina
Megara
Eleusis
Salamis
Athens
Piræus
Corinth
Zaptiko
Perachora
Vylia
Chalcis
Aulis
Oreo Mt.
Kalamo
Marathon
C. Doro
Andros
Andro
C. Kyomo
Tinos
Tzia
Makronisi
C. Colonna
Giura I.
Syra
Hermopolis
Mykonos
Dragonisi
Thermia (Kythnos)
Giorgi I.
Serphos
Siphenos
Naxia
Paros
Antiparos
Nikaria
Amorgos
Nios
Milo
Polyhandros I.
Santorini
Therasia
Christiana
Cerigotto
Hydra & I.
Spezzia
C. Skyli
Poros
Kranidi
Leonidi
Prasto
Vervena
Sparta
Mistra
Kalamata
Andrusa
Gargaliani
Prodano
Navarino
Modon
Sapienza
Shiza
Cabrera
Neocastro
Messenia
Arkadia
Laconia
Leontari
Skorpha
Agia
Plaka
Vigla
Timorion (Hagios)
Port Hieraka
C. Krenidi
Monemvasia
C. Malia
Elaphonisi
Modano
Capsali
Belopulo
Kalloneros
Kimolo
Anti-Milo
Platy
Sikinos
Pholegandros
Amorgopulo
Ios
Denusa
Makaridhes Is.
Karos
Arkadia
Pharakla
Kalamaki
Kalamata

ing the Carthaginians in the Second Punic War, the consul Flamininus persuaded both these powers to join in attacking him. At Cynoscephalæ in Thessaly, not far from the scene of a greater battle, Pharsalia, the power of the Macedonian monarchy was broken (197 B. C.), and Philip renounced his supremacy over the Greeks, to whom Flamininus proclaimed their freedom at the ensuing Isthmian games. The final overthrow came in the time of Perseus, the son of Philip, who was defeated at Pydna (168 B. C.), and his dominions, with the adjacent parts of Greece, were reduced to the form of a Roman province. The later years of the Achæan league had been illumined by the leadership of Philopœmen, "the last of the Greeks," as Plutarch has called him, in whose time the whole of the Peloponnesus, including even Sparta, was for a time included in the alliance. But the days of Greece were numbered, and the only question was how soon the remainder should be absorbed by the advancing tide of Roman conquest. At last a pretext for interference presented itself, and the reduction of the country to bondage was signalized by the pillage and destruction of Corinth under Mummius (146 B. C.). The entire area southward of Macedonia and Epirus was constituted the province of Achaia, the title of which thus perpetuated the name of the Achæan league. The struggles in which that and the Ætolian confederation had taken part are an evidence of the revival of a spirit of patriotism in the breasts of the Greeks, and we may well lament over the ruin of their independence; but the truth must be told that this was not the feeling of the majority of the population at the time. The selfishness and cupidity of the Greek aristocracy, such as those whom we have already noticed at Sparta, had imposed so heavy burdens on the people that the great body of them cheerfully acquiesced in the Roman rule. Polybius has preserved to us the saying which expressed the sentiment of the time: "If we had not been quickly ruined, we should not have been saved."

Roman conquests in the West and East.

From the time of the Roman conquest the existence of Greece was merged in that of a greater political unity, so that for the next four centuries, until the commencement of the barbarian inroads, it can hardly be said to have a history of its own. But we must not on this account suppose that the Greeks occupied exactly the same position as the rest of the Roman provincials. In this respect there is a marked difference between the results of the Roman conquests in the West and the East. The inhabitants of the western portion of the empire were at the time of their subjection in a low state of civilization, and destitute of any element of strength in their social and national life. It was natural, therefore, that nations so undeveloped should easily receive the impress of Roman institutions, and should adopt the manners and ideas of their conquerors. The Romans in fact treated them for the most part as inferior beings and did not at first even regard them as absolute proprietors of the lands they cultivated. But in the East the case was different. There the Romans met with a civilization more advanced than their own, which they had already learned to respect, and an elaborate system of civil government and social usages which could not be set aside without undermining the whole fabric of society. Hence the Greeks, while subjected to the Roman administration, were allowed to retain a great part of their institutions, together with their property and private rights, and, from their superiority to the other conquered peoples, remained the dominant power in the East. Even in Asia the despotism of Rome was much modified by the municipal system of the Greek colonies and by the influence of Greek culture. Thus it came to pass that, while the Western nations were assimilated to Rome, in the East the Roman empire became Greek, though the Greek nation in name became Roman. The effects of this are visible at every turn in the subsequent history, and to this cause must be referred many anomalies which are traceable at the present day in the condition of eastern Europe.

Roman rule in Greece.

It was a part of the Roman policy, in dealing with conquered countries, to treat them at first with mildness, until they became inured to the yoke, and when this was the case, and precautionary measures had been adopted to prevent the possibility of successful revolt, to deal with them more harshly and increase their burdens. This was what happened in the case of Greece. For some time the people at large had no reason to regret the change. The fact of their subjection was not impressed too forcibly upon them, and several cities, such as Athens and Sparta, were allowed to rank as allied states. Their taxes were not increased, and they did not at once perceive the difference caused by the money that was levied being taken out of the country instead of being spent in it. This was, however, the most systematically ruinous part of the Roman system. The Government never paid attention to the provinces for their own sake, but regarded them as an instrument for maintaining the greatness and power of Rome. The immense sums that were drained from them never returned, but were expended in the maintenance of the Roman army, and in the public games and architectural embellishment of the metropolis. Objects of local usefulness, such as roads, ports, and aqueducts, received no attention from the central authorities, and no money was supplied towards their maintenance. Within a century also, when these evils were beginning to make themselves felt, the Roman rule became very oppressive. Though the custom duties were not unreasonable in their nominal amount, they became exorbitant through the system of farming and subletting, and as a special tribunal existed for the enforcement of the collectors' claims, the farmers exercised a most tyrannical power over the mercantile population of the shores of the Mediterranean. In the wake of these harpies followed the usurers, to meet whose claims proprietors had constantly to sell their possessions. The direct weight of the public burdens was further increased by the exemptions enjoyed by Roman citizens in the provinces, and by privileges and monopolies which were granted to merchants and manufacturers; and large sums had to be paid to the Roman governors, both for the maintenance of their establishments, and to obtain exemption from the quartering of troops. But these more or less authorized exactions bore no proportion to the illegal extortions of the proconsuls, who simply pillaged the provincials. No more perfect scheme could have been devised for promoting oppression than that under which these officers were appointed. While on the one hand they superintended the financial administration, on the other they exercised the judicial power; and the only tribunal to which they were responsible was that very senate by which they were appointed, and of which they themselves were members. A governor like Verres had it in his power to ruin a province for several generations, and such instances were not rare. The treatment of Greece in this respect was no exception to the general rule.

The period, however, during which the greatest injury was inflicted on Greece was that of the Mithradatic War (86 B. C.). At the commencement of the struggle many of the leading men and states declared in favor of Mithradates, thinking that under his auspices they might regain their freedom. But the appearance of Sulla with an army soon undeceived them, and they laid down their arms, with the exception of Athens, which was only reduced after an obstinate defence. When the city was at last taken by storm, the majority of the citizens were put to the sword, their possessions seized by the soldiers, the Piræus utterly destroyed, and Attica ravaged. In the same campaign Delphi and the other principal shrines were plundered, and an immense amount of property was ruined throughout the country. Great injury was also inflicted by the Cilician pirates. The existence of these was a result of the jealousy with which the Roman Government regarded the maintenance of armed forces by the provincials, either by land or sea, lest they should be made an instrument of revolt; and since they had no interest in maintaining order, except where their own authority was threatened, the subject nations were so far from profiting by their protection that they were exposed to attack without possessing the power of defending themselves. The confined seas and numerous bays and islands of Greece have always been favorable to piracy, and at this time the evil reached such a height that the welfare of the state was threatened, and Pompey was entrusted with the office of eradicating it; but before this was accomplished many of the wealthiest cities in Greece and Asia Minor had been attacked and pillaged. With the accession of Augustus a brighter era seemed to have dawned; and under the early emperors, who desired to strengthen themselves against the senate, the interests of the provincials were more considered. Greater regularity also was introduced into the taxation, by the land and capitation taxes being regulated by a periodical census. But the old evils to a great extent remained, and these were further aggra-

vated at a later time by the depreciation of the coinage, which proceeded with fearful rapidity, and caused widespread distress among the commercial and laboring classes.

Condition and character of Greeks.

The result of these changes is traceable in the condition and character of the Greek people. The conquests of Alexander the Great suddenly threw into circulation the accumulated treasures of the Persian empire, and a great part of these passed into the hands of the Greeks, both in Asia and Europe. The facilities thus created for obtaining wealth increased the material prosperity of the Greek race at large, so that in all probability it never was more numerous than during the period immediately preceding its subjugation by the Romans. Though all calculations respecting the numbers of the population in ancient states are necessarily hazardous, yet it seems probable that the Greeks at that time may have amounted to more than seven millions. But with Greece proper the case was different. There the increase of wealth raised the standard of living considerably above what it had been in earlier and more frugal times, so that the less moneyed class were tempted to emigrate in large numbers to seek their fortunes in the great Asiatic cities, and in the service of the Eastern monarchs, where so great openings presented themselves. The decrease of this class produced a larger accumulation of property in the hands of large owners, and greatly augmented the number of slaves. Under the Romans the wealth of the country, great as it was, was soon dissipated by fiscal exactions, by plunder in war and the private pillage of officials, and by the confiscation of the possessions of individuals, with a view to which a system of accusations was regularly promoted. The natural result of this, combined with the self-indulgent habits which had grown up among the upper classes, was a steady diminution of the population. The first of the Romans who perceived the evils arising from this state of things, and endeavored to remedy them, was the emperor Hadrian, who had the merit of personally visiting the provinces, and whose tastes naturally led him to sympathize with the Greeks. Though much of the money which he expended in the country in the construction of temples and other splendid edifices tended to the gratification of his private fancies, yet a real improvement in the condition of the people was effected by his restoration of the roads which had fallen out of repair, and the erection of baths and aqueducts. He also lightened the taxation, and raised the Greeks to the rights of Roman citizenship, thereby anticipating the edict of Caracalla, by which that privilege was extended to all the free inhabitants of the empire (212 A. D.). The depopulation of Greece, however, continued; but while in this way the power of the nation was being weakened, and its material resources diminished by the loss of much of the capital that had been invested in the improvement of the country, the actual condition of the inhabitants was for the time improved, because the decrease in their numbers had been more rapid than the destruction of property. Possessing the necessaries of life in abundance, and having but little money to spend on anything beyond, they sank into that condition of indifference and ease in which at last the barbarian nations found them.

It has already been remarked that the character of the Greeks at this period ought not to be judged from the prejudiced statements of Roman writers, nor by reference to the standard of their great forefathers. The introduction of the wealth of Persia had undoubtedly a demoralizing effect on the nation, both in Asia and Europe; but when we consider that throughout a great part of the area that they occupied they were long the dominant class, and had hardly any check to restrain them in the indulgence of their passions, it is rather a matter for wonder that they resisted temptation so far as they did. At least they never sank to such a depth of degradation as the Romans of the imperial times, and in Europe the struggles of the Achæan league show that a value was still set on manly virtues. After this the Greeks became the educators of the Romans, whose upper classes resorted for instruction to the university of Athens; and if the rhetoric and philosophy which were taught there partook sometimes of the nature of literary trifling, and the instructors themselves were characterized by vanity and pedantry, they maintained at all events the standard of cultivation in the world at that time. The love of art still prevailed amongst them, and the quiet, studious life of the Greek cities formed in the eyes of many a favorable contrast to the violent struggles and inordinate passions of Rome. But the disbelief in the national religion which had grown up among the educated classes, notwithstanding the maintenance of the temples and their worship, tended to cause a separation between the upper and lower grades of society; and this, together with the isolation produced by the great size of the estates, which withdrew individuals from the scrutiny of their fellow citizens, weakened the force of public opinion, and thus lowered the moral standard. It can hardly be doubted that the consciousness of this, and the feeling of the need of a higher morality, was one main cause of the eagerness with which philosophy continued to be pursued by the Greeks, since in it they hoped to find the groundwork of truth and justice. Thus during a period of six centuries the European Greeks had gradually degenerated, though for the most part from causes external to themselves; they seemed to have become an insignificant and almost commonplace people. Yet the outline of the character was the same, though the colors had faded; and considering the length of the time, and the agencies at work, we may be surprised at finding that the change had not been greater. It remained to be shown that the finer qualities and more vigorous elements were only dormant; and this was brought to light in the latter half of the third century by two influences, which we must now proceed to explain.

Gothic invasions.

The first of these was the invasions of the Goths. These were the earliest of the barbarians to break through the Roman frontier, and the defeat and death of the emperor Decius in Mœsia (251 A. D.), and the subsequent incursions of the Goths into Thrace and Macedonia, warned the Greeks of the peril that impended over them. Immediately the walls of Athens were repaired, the fortifications across the isthmus of Corinth restored, and vigorous preparations made for defence. The invaders soon made their appearance both by land and sea, and one division, landing at the Piræus, succeeded in carrying Athens by storm; but an Athenian of rank called Dexippus, afterwards the historian of these events, succeeded in assembling a sufficient force to compel them to retire. This reverse was the prelude to their total overthrow, for succors were meanwhile arriving from Italy, by which their separate bands were attacked in detail and destroyed. Some years later, after other inroads, during which many cities of Greece successfully defended themselves, the power of the Goths was broken by the emperor Claudius II. at the great battle of Naissus (269 A. D.). But it was clearly proved at this time that the spirit of the Greeks, which had had no opportunity of displaying itself since the siege of Athens by Sulla, was not extinct, and that, if they had been unwarlike in the interval, it was mainly because their masters had denied them the use of arms. It is not to be overlooked that, when the same barbarians subsequently attacked the Western empire, it went down before them, the reason being that the nations of the West had no such distinctive nationality as the Greeks, and no such municipal institutions to rally round. Anyhow the Greek character was benefited by the public spirit thus evoked, and by the activity infused into society by the feeling that every man might be called on to defend his person and property.

Christianity.

The other and far more important influence which regenerated the Greeks at this time was Christianity. This religion, which had long been working in secret, though in ways which it is almost impossible to trace, now began to produce a marked impression on Greek society. Its power was the greater because it had worked from below upward, and had permeated to a great extent the lower and middle classes. It improved the moral condition of the Greeks by elevating their views of life, by quickening the conscience, and by infusing earnestness into the character; and it renovated their social condition by pointing out to them their duties to one another, by encouraging corporate feeling, and in particular by purifying the domestic relations through its influence on the female sex. At the same time the habit of meeting for the administration of their communities accustomed the Christians to discussion and action in common, and the fact that they formed a powerful corporation independent of the state, which was the reason why they were persecuted by the Roman authorities, was in itself a means of political education. Such an influence, which not merely pervaded every relation of life, but penetrated also to the motives and springs of action, is sufficient of itself to account for the regenera-

tion of the Greeks, which the historian traces in its effects at the end of the 3d century.

The scene now changes, and from the land of Hellas our attention is transferred to the city of Constantinople.

II. *Period of Greek Revival: from Constantine the Great to Leo III.* (*the Isaurian*), 323–716 A. D.

The principal events of the first half of this period, the two centuries which intervened between Constantine and Justinian, are—the foundation of Constantinople (330 A. D.).; the emperor Julian's attempted restoration of Paganism (361); the defeat of Valens by the Goths near Adrianople, and his death (378); the establishment of Christianity by Theodosius the Great as the religion of the empire (388); the partition of the Roman empire between Arcadius and Honorius (395); the publication of the Theodosian code (438); and the extinction of the empire of the West (476). The reign of Justinian (527–565) comprises the great campaigns of Belisarius and Narses, whereby the kingdom of the Vandals in Africa was overthrown, and Sicily, Italy, and southern Spain were recovered to the Roman empire, the Greek possessions in Italy being henceforth governed by an exarch, who resided at Ravenna; the building of the church of St. Sophia at Constantinople, and the reformation of the Roman law. Finally, in the century and a half between Justinian's death and the accession of Leo III., occurred the birth of Mahomet (571); the victorious expeditions of Heraclius against the Persians (622–8); and the seven years' siege of Constantinople by the Saracens in the reign of Constantine Pogonatus (668–675).

Reforms of Constantine.

The reforms effected by Constantine formed one of the greatest revolutions the world has ever seen, and his sagacity is shown by the completeness with which they were carried out, and by the permanence of their effects, for from them proceeded both the strength and the injuriousness of the Byzantine system, which lasted even to the latest days of the empire. To describe them in brief,—he centralized the executive power in the emperor, and constituted a bureaucracy for the administration of public business; he consolidated the dispensation of justice throughout his dominions; he rendered the military power, which had hitherto been the terror and bane of the state, subservient to the civil power; he adopted a new religion, and established a new capital. Henceforth the world was ruled by the emperor and his household, and this administration was wholly irresponsible; and as the interests of the Government were unconnected with those of any nationality and any class of its subjects, there was sure to be a continual struggle between the rulers and those whom they governed. In order that the emperor might be regarded as a being of a different order from the people, he and his court were surrounded by lavish splendor; and in order to check the ever imminent danger of rebellion through pretenders to the throne, the offices of the court were made magnificent prizes, so that ambitious persons might feel that advancement could be obtained by a safer method than civil war. But to meet these expenses, and at the same time to maintain a powerful army, an elaborate system of taxation was necessary; taxation, in fact, came to be regarded as the first aim of government, and the inhabitants of the empire were impoverished for objects in which they had no direct concern. The principal instrument which Constantine used for enforcing this was the Roman municipal system, and this he introduced into Greece, notwithstanding the existence of a national and traditional organization. According to this, each town, with the agricultural district in its neighborhood, was administered by an oligarchical senate called the *curia*, elected from among the landed proprietors; by them the municipal officers were appointed, and the land-tax collected, for the amount of which they were made responsible; while those who did not possess land, such as merchants and artisans, paid the capitation tax, and formed an inferior class. As wealth declined, the oppressiveness of this system was more and more felt, especially as the private property of members of the *curia* was confiscated when the required amount was not forthcoming; and hence, in order to prevent a further diminution of the revenue, an elaborate caste-system was subsequently introduced, which fixed the condition of every class, and required a son to follow the calling of his father, lest the number of persons liable to a certain kind of taxation should decrease. With the same view, the free rural population came to be tied to the soil, to prevent the ground from falling out of cultivation. Since, however, it was foreseen that such a system would produce discontent, the people everywhere were carefully disarmed, and the profession of arms was made a thing apart, the military class being separated from all others. For the same reason barbarians were much used as troops, because they could have no sympathy with the citizens. The harshness of this system caused general poverty, and deep-seated hatred of the central government, often resulting in a disposition to call in the barbarians; while its jealousy was the origin of the weakness of the empire, because the provincials, who were really stronger than their invaders, were never allowed to defend themselves. In the West it contributed greatly to the overthrow of the empire, and in the East it repressed the spirit of Hellenic life by interfering with the ancient city communities; and though the force of the Greek character, and the social condition of the countries they inhabited, saved them from destruction, yet, as we look down the long vista of succeeding ages, we may see its baneful effects producing ever-increasing misery.

Evils of his system.

Yet we must not overlook the strong points of Constantine's system. The first of these was the regular administration of justice which he introduced. This the inhabitants of the empire felt they could not obtain elsewhere, and the possession of it reconciled them to many otherwise intolerable grievances. So conscious were succeeding emperors of this that we find strictness observed in this matter until quite a late age of the Byzantine empire. Another was the amount of ability and experience which it secured for the public service. We have called the administrators of public affairs a bureaucracy, and the household of the emperor, but they were not the less a body of most highly trained officials, thoroughly organized in their various services. Each department of the state formed a profession of itself, as completely subdivided, and requiring as special an education, as the legal profession at the present day. The perfection of this machinery accounts for the empire not having fallen to pieces in times of internal dissension, sometimes accompanied by foreign invasion; and the facilities it afforded for developing talent are seen in the long succession of able administrators which the system produced, and which came to an end at the commencement of the 11th century, when it began to be disused. And besides this, though the rigorously oppressive taxation was injudicious as well as injurious, yet it may be doubted whether any other system than the high-handed centralization which has been described could have prevented dissolution. Its force is certainly proved by its vitality, and the first great dismemberment in particular was brought about, not by internal causes, but by the power of the Saracens.

Its merits.

The choice of the site of New Rome—which is perhaps the finest position in the world, as it commands the meeting-point of two great seas and two great continents, and rises in seven hills on its triangular promontory between the Propontis and its land-locked harbor the Golden Horn—is an additional proof of the penetration of Constantine; and the event justified his selection, for on numerous occasions nothing else than the impregnability of the seat of government could have saved the empire from destruction. Though the establishment of a new capital was in itself a consummate stroke of genius, yet to some extent it was forced upon the emperor by his conversion to Christianity, for this placed him in direct antagonism to Old Rome, which was still the headquarters of paganism. And whatever might be the feelings of the people, on the part of the administrators themselves the prepossessions to be overcome in deciding on such a change were less than might be supposed, for the government, absorbed as it was in the unceasing care of maintaining and defending the empire, had long ceased to be Roman in its sympathies, and had become cosmopolitan. The new city at the time of its foundation was Roman: its senators were transported thither from Rome; the language of the court was Latin; and the condition of the lower classes was assimilated to that of the old capital by their being exempted from taxation and supported by distributions of grain. But from the first it was destined to become Greek; for the Greeks, who now began to call themselves Romans, an appellation which they have ever since retained, held fast to their language, manners, and prejudices, while they availed themselves to the full of their rights as Roman citizens. Hence, in Justinian's time, we find all the highest

Constantinople.

offices in the hands of Greeks—not Hellenic Greeks but a Græco-Roman caste, the descendants of the Macedonian conquerors of Asia; and Greek was the prevailing language. The turning point in this respect was the separation of the East and West in the time of Arcadius and Honorius. Still the Roman system remained permanent, especially in the community of interest created between the emperors and the populace by the largesses and the expenditure on public amusements, the money for which was drained from the provinces; and this fact explains the antagonism that remained between the provincials and the inhabitants of the capital, and the toleration which the latter showed of the tyranny of their rulers. How deeply these abuses were rooted in the city of Constantinople is shown by the circumstance that Heraclius, in despair of otherwise carrying out his schemes of retrenchment and reform, conceived the design of removing the seat of government to Carthage—a plan which he would have carried out had he not been prevented by the unanimous opposition of the Greeks.

The Greek Church.

Whether the conversion of Constantine to Christianity was due to sincere belief or to policy, or, as is perhaps most likely, to a combination of the two motives, there can be no doubt that religion had before that time obtained a great influence over the Greeks, and that the cause of the Christian Church and that of the Greek nation were already closely interwoven. Nothing could show more clearly the mastery obtained by the new faith than the subsequent failure of the emperor Julian to revive paganism. We have already seen how life and energy were restored to Greek society by this influence before the end of the 3d century; it was also the unanimity with which it was adopted by that people which inspired them to combine in self-defence, and saved them from the fate of the disunited Western empire. From that early period dates the feeling of brotherhood which pervaded the Greek Church, and the strong attachment which has always existed between the Greek clergy and their flocks, further cemented as it was at a later period by the influence which the clergy exercised in maintaining the people's rights and defending them against aggression. Paganism, however, continued to be recognized until the time of Theodosius the Great, when Christianity was substituted for it by legislative enactments. But the orthodoxy of the Eastern Church, which came to be, and still is, its most distinctive feature, and the identification of the Orthodox Church with the Greek nation, dates from a different time, viz., from the reigns of the Arian successors of Constantine, to whose personal opinions the people were strongly opposed. The political effect of this union ultimately became very great, and resulted in the loss of important provinces to the empire. When the Orthodox had the upper hand, they soon began to clamor for the persecution of heretics, and the emperors being on the same side acceded to their demand. The natural effect of this was disaffection in those regions, such as Syria and Egypt, where the majority of the population were either Nestorians or Eutychians; and the evil was aggravated by the suspicion to which the provincial clergy were exposed, because they were not Greeks, of being heterodox. The alienation from the central government thus produced greatly facilitated the conquest of those countries by the Saracens. It should also be noted that from the time of Constantine the emperors claimed, and were acknowledged, to be supreme over the church in all civil and external matters—a power which, as we shall see, proved to be of great importance at the time of the iconoclastic controversy; and the extensive judicial and administrative authority which Theodosius conferred on the bishops was the origin of that political subserviency, and at the same time of those simoniacal practices, which have been the opprobrium of their order in the Eastern Church.

Reign of Justinian I.

The reign of Justinian, which, from the important events which it contained, has naturally much attracted the notice of historians, was a period of false brilliancy. The character of that emperor in many respects resembles that of Louis XIV. Both were men of moderate ability, gifted with great industry and application to business, and with a remarkable power of employing the talents of others; both were fond of splendor and foreign conquest; and both impoverished and ruined their subjects. At the time of his accession Justinian found in the exchequer a large sum of money amassed by Anastasius I., and had he employed this in lightening taxation and improving the position of his subjects, instead of wasting it in wars of his own seeking and lavish expenditure on public buildings, he would have greatly strengthened his kingdom. No doubt the conquests of his generals were splendid, and testify to the greatness of the armies of the empire at this time. No doubt also the compilation of the *Pandects*, *Code*, and *Institutes* was a magnificent work, which has left indelible traces on the legal systems of Europe. And it is an honor to any age to have developed the Byzantine style of architecture, a style thoroughly Greek in its unity and proportion; for, whereas the Romans had borrowed the ancient Greek style, and, adding to it the arch, had used it for wholly incongruous purposes, the Greeks in turn appropriated the arch and dome, and created a new and harmonious style. But the effects of his reign on his dominions were ruinous. He riveted tighter the fetters which Constantine had invented, but he lacked the penetration of Constantine in perceiving the needs of his time. He dissolved the provincial militia, which to some extent still existed in Greece. The population were ground down by taxation, the revenues of the free cities in Greece were seized, and at last the fortifications fell into disrepair, and a great part of the army was disbanded, so that when Zabergan, king of the Kutigur Huns, invaded the country from the north in the year 559, he was able to approach within 17 miles of Constantinople. How great the demoralization was is shown by the state of the empire under Justinian's immediate successors. Within less than twenty years after his death the conviction of a great change impending was so widely spread that a story was rife that it was revealed to the emperor Tiberius II. in a dream that on account of his virtues the days of anarchy should not commence during his reign. The condition of things has been described as "universal political palsy."

Barbarian invasions.

The 400 years which elapsed between Constantine and Leo III. were the great period of the barbarian invasions. The Goths, who, as we have seen, had overrun Greece in the latter half of the 3d century after their great defeat at Naissus (Nisch), were more or less kept in check, and became in some degree a civilized and Christian people in the country of Dacia, to the north of the Danube, which they had permanently occupied after the Roman colonies in that country were withdrawn by Aurelian. But in the reign of Valens, when the Huns were overrunning Europe, they were pressed onwards by those invaders, and occupied Mœsia between the Danube and the Balkan, which province was peacefully ceded to them. It was only in consequence of treacherous treatment by the Romans that they afterwards entered the empire as enemies, and fought the campaign which ended in the defeat and death of that emperor (378). They were again checked by Theodosius, and persuaded to enlist in great numbers in the imperial service; but during the reign of his successor Arcadius, the famous Alaric roused the spirit of his countrymen, and ravaged the whole of Greece even to the Peloponnesus (395), before he turned his thoughts to the invasion of Italy. For a time both Goths and Romans were the victims of Attila, who with his hordes of Huns swept over the lands south of the Danube (442–7), and was only induced to retire by an agreement on the part of Theodosius II. to pay him an annual tribute. But again, in the reign of Zeno (475) the empire was in imminent danger from the Goths under Theodoric, who, like Alaric, had lived at Constantinople, and like him also withdrew into Italy. Towards the beginning of the 6th century the Goths made way for more barbarous invaders, Bulgarians of Turanian origin, and various Slavonic tribes, for whose pastoral habits the now depopulated country was better suited than for a more civilized population. But they in turn were soon swallowed up by the Avars, whose vast monarchy occupied a great part of eastern Europe, and whose armies, in the time of Heraclius, threatened Constantinople itself. It was in order to impose a permanent check on that people that this emperor induced the Servians and Croatians to occupy the districts eastward of the Adriatic, Dalmatia and Illyricum which were deserted, owing to their constant inroads. These Slavonic settlers paid allegiance to the empire, and as they formed agricultural communities, introduced an element of permanence into the country. The Avar power disappeared as suddenly as it had risen, and at the end of the 7th century its place is taken by the Bulgarian king-

dom, which lasted for nearly 350 years and was the great antagonist of the Byzantine empire in its most flourishing period. At the close of this long enumeration of invasions, we cannot help being astonished at the successful resistance that was offered to them. No doubt the conformation of the European provinces of the Eastern empire, with their successive mountain barriers, was a source of strength from the ease with which they could be defended; but this could hardly have saved the Greeks had it not been for the number of their walled cities, their superiority in the art of war, the courage of the people when called out by circumstances, and the strong position of the capital.

Persian wars.

On the side of Asia, during the same period, a long struggle was maintained with Persia. The dynasty of the Sassanides, which arose on the ruins of the old Parthian kingdom, had raised that country to great power and prosperity. The second in order of its princes, Sapor I., had taken the emperor Valerian prisoner (257), and a century later Julian lost his life when fighting in Persia. The ill success of Justinian in his Persian wars ought fairly to be ascribed as much to the ability of his great opponent, Chosroes Nushirvan, as to his own shortcomings; but the fact remains that even Belisarius won small glory from those contests, and after a struggle of twenty years' duration a treaty was concluded, which required the European monarch to pay an annual subsidy of thirty thousand pieces of gold. War, however, continued during the reigns of his successors Justin II. and Tiberius II., until an honorable peace was concluded by Maurice, the son-in-law of the last named emperor, at whose court Chosroes II., the rightful sovereign, had been received when he was an exile. This prince, when he was reinstated on his paternal throne, showed his gratitude to the Romans. But when Maurice was dethroned by the rebel Phocas, the Persian monarch declared war, professedly with the design of avenging his benefactor. The greater part of the Asiatic provinces were laid waste, and a Persian army was for a time encamped on the shores of the Bosphorus, so that it seemed as if the Roman empire was about to be conquered by Persia. From this it was saved by Heraclius, who was not only one of the ablest of the emperors, but one of the greatest of military leaders. He warded off the impending danger, and in seven campaigns, by a series of brilliant victories, dealt a deathblow to the Persian power. The struggle was unavoidable, and Heraclius, in entering upon it, was actuated by no vain desire of military renown; but the effects of it were disastrous to the Romans also. The period when it occurred was that of the rise of the Saracens, and the exhaustion caused by it contributed in no slight degree to the extension of their power.

Condition of the population.

We turn now to the condition of the Greeks during this period. In the interval between the first Gothic invasions and the accession of Constantine the material prosperity of Greece had increased, owing partly to the devastation of the provinces to the north of that country, the wealthy inhabitants of which were forced to take refuge in Greece, and partly to the insecurity of the Red Sea, Egypt, and Syria, which caused the commerce of Central Asia to take the route of the Black Sea, whence the trade of the Mediterranean passed once more into the hands of the Greeks. It can hardly be said that the reforms of Constantine benefited the population, because of the severe exactions they introduced; for, as has been already mentioned, the rich were forced to supply from their own incomes any deficiency that might occur in their district, and by this means, before Justinian's time, the class of great landed proprietors had been extinguished. But the fixed position which the clergy and the lawyers obtained under Constantine's system was a general advantage, because this constitutional check modified the oppressiveness of the Government in its dealings with the people. In the case of the latter of these two orders the effect would have been greater, had not Latin been the language of legal business until after the time of Justinian. The period of 120 years between the death of Arcadius and that emperor's accession was a time of improvement. During the long reign of Theodosius II. the power was in the hands of his sister, the philanthropic Pulcheria, and of his ministers, and these seem to have ruled judiciously; and the five succeeding emperors, Marcian, Leo I., Zeno the Isaurian, Anastasius, and Justin, were all men born in the middle or lower class of society, and of provincial origin, and had come to the throne at a mature age. The sympathy which they thus had with the body of their subjects accounts for their economy, and for their endeavors to restore the resources of the empire and alleviate its burdens, and generally to introduce regular forms of procedure into public business. Far different was the case with Justinian, whose severe demands for money distressed all classes of his subjects. But it was on Athens that his hand was most heavily laid. That city was still a literary capital where Hellenic learning was cultivated; and if the *Hero and Leander* of Musæus and that graceful pastoral romance, the *Daphnis and Chloe* of Longus, are to be assigned to so late a date as the fifth century, the spirit of the ancient literature had not long been extinct among the Greeks. The ancient buildings still existed in all their splendor; the citizens lived a life of quiet, self-complacent ease; and the paganism, of which it was now the centre, had been purified from its vices by the maxims of philosophy and the influence of Christianity. It remained for Justinian, in his merciless centralization, to close its schools and confiscate their revenues. At the same time the Olympian games were brought to an end. From this time onward the inhabitants of Hellas are but little heard of, and at the beginning of the 8th century we find them spoken of by Byzantine writers under the contemptuous title of Helladici, while the Greek nation is represented by the population of Constantinople and Asia Minor. Yet this period was not wholly disadvantageous to Greece. As the danger from the invading barbarians increased, its citizens regained the power of using arms, and revived a municipal administration to direct their efforts. It was also in Justinian's reign that silk worms were introduced from China, and the manufacture of silk became a profitable source of revenue to Thebes and other towns.

Athens.

Extinction of slavery.

One result of the financial legislation of this time was a change which, though the lawgivers certainly did not foresee it, was most beneficial in its effects. This was the gradual extinction of slavery in the Eastern empire. The power that effected this was not Christianity, for that religion had recognized slavery as an institution, nor yet civilization, for that among the Greeks was intimately connected with the employment of slaves. It was rather produced by an alteration that was taking place in the condition of certain classes, which annihilated the distinction between the freeman and the slave. When the oppressiveness of taxation had destroyed the wealthy proprietors, and, in order to prevent the land from falling out of cultivation and thus diminishing the revenue, the cultivators of the land were tied to the soil, the poorer class of freemen began to sink down into the condition of serfs. On the other hand the slaves who were employed in agriculture became for the same reason an object of solicitude to the legislature, and their proprietors were forbidden to alienate them. They thus acquired a recognized position, not far removed from serfdom; and when all the lower class were reduced to the same state of poverty, the difference in the political status of the two orders came to be obliterated. Many centuries elapsed before this change fully worked itself out. The slave trade was still an important branch of commerce in the Roman empire, and freemen were sold as slaves if they failed to pay their taxes; but henceforth the system was doomed to ultimate extinction. When we consider the extent to which slavery prevailed in the ancient world, and the misery which it caused, we cannot regret the circumstances which caused it to disappear, even though they were accompanied by much suffering.

The system, not the people, at fault.

It is important also to remark, now that we are approaching the period of change from ancient to modern society, that the decline of civilization in the later Roman empire was not owing to degeneration in the people themselves, or to an inevitable downward tendency in highly civilized communities. It is a mistake to attribute to decay in human character changes that are clearly traceable to the need of such external resources as are indispensable for its development. The prohibition to carry arms necessarily renders a people unwarlike. Where municipal institutions are discouraged, public opinion soon becomes powerless. When the resources which might be employed in constructing roads are withdrawn, communication ceases, and with it the interchange of ideas and other influences by which the intellect is quickened. The degradation was produced by the injustice of the Government, which pillaged its subjects,

and systematically destroyed all independence among them. Whenever the iron hand was removed, they showed signs of renewed life and vigor, but the strength of the central power was too great to encourage any hope of resisting it successfully. They had no choice but to sit down under it, and suffer it to drain their life-blood by slow degrees.

Threatened extinction of the empire.

At the commencement of the 8th century the extinction of the empire of the East appeared to be imminent. The same causes which had overthrown the Western empire were threatening it with destruction. The Saracens had overrun all its Asiatic possessions, and had attacked the capital itself, while in Europe it was threatened by the Bulgarians. The provinces were falling off: Syria, Egypt, Africa, and the conquered provinces of Spain were wholly lost, and in Italy the dominions of the exarchate were greatly circumscribed by the Lombards. At home rebellion prevailed in the army, and anarchy in the government, six emperors having been dethroned within the space of twenty-one years. It seemed as if the Greek race itself would be destroyed; in the countries conquered by the Saracens the Greeks were almost exterminated, and Greek civilization proscribed, while Hellas was threatened with occupation by the barbarians. But at this moment the helm of the state was seized by a man who, by his force of character and his great abilities, inaugurated a new state of things, and gave the empire a new lease of life. This man was Leo the Isaurian.

III. *Period of Byzantine Prosperity: from Leo III. to Isaac I. (Comnenus)*, 716–1057 A. D.

The Byzantine empire.

Considerable difference of opinion has existed as to the precise time at which the Roman empire of the east may be said to have ended, and the Byzantine empire to have commenced. Gibbon remarks that "Tiberius by the Arabs, and Maurice by the Italians, are distinguished as the first of the Greek Cæsars, as the founders of a new dynasty and empire." The question turns on modifications of the old Roman system of administration, and the introduction of a new order of things, which lasted until the overthrow of the state. These commenced, no doubt, shortly after the death of Heraclius, and were closely connected with the victorious advance of the Saracens, which necessitated a reform, and at the same time concentrated the empire, and confined it more and more within the districts inhabited by Greeks. But the altered state of things did not become apparent, nor were the changes systematized, until the time of Leo III., and therefore he may most rightly be regarded as having inaugurated the Byzantine empire. The first century and a half of the present period embraces the iconoclastic controversy, while the two remaining centuries coincide with the rule of the Basilian dynasty. It was a time of great men and great achievements, both in government and war, and the events it contains amply suffice to defend the Byzantine empire from the imputation of feebleness and decrepitude; and those who delight to find in history strongly marked characters and stirring incidents will be amply rewarded here. Few personages stand out in stronger relief than the ruthless, yet ascetic, warrior Basil, the slayer of the Bulgarians; and few occurrences are more romantic than the death of Leo the Armenian, who defends himself with the crucifix in his chapel, where he was chanting the prayers in the early morning, while his successor lies in fetters in the neighboring dungeon.

Reforms of Leo III.

We must first notice the reforms, which caused the reign of Leo III. to be an era in the history of the empire. These extended to almost every branch of the administration. In respect of the army, he reorganized the military establishment by placing the various bodies of soldiers in the different "themes," or departments, each with a general of its own, thereby providing for local defence, and avoiding the danger of rendering the military commanders too influential—a system which defended the empire for five centuries. The geographical arrangement in themes was introduced by Heraclius, but reorganized by Leo, and bore somewhat the same relation to the previous division into provinces that the departments in France bear to the earlier distribution of that country. In respect of finance, he brought the taxation immediately under the emperor's cognizance, so that thenceforth the emperors were their own finance ministers. All local agencies for collecting the taxes were abolished, and their functions transferred to the imperial officers, who took census regularly. By this means he raised more money than his predecessors, but the increased prosperity of the people showed that the burden did not fall so heavily. In respect of justice, in order to obviate the difficulties which had arisen in the administration of Justinian's elaborate laws, especially since the facilities for communication throughout the empire had decreased, he published in Greek an abridged manual called the *Ecloga*, and codified the military, agricultural, and maritime laws. In respect of religion, he aimed at counteracting the element of superstition which had crept into the church, and through it was corrupting the public mind. But this last point calls for separate consideration, since the worship or prohibition of images became the burning question of the age.

Iconoclasm.

The history of iconoclasm is the history of Constantinople during the 8th century and the first half of the 9th, and involved a great part of the empire in its distractions. There can be little doubt that, in his opposition to image worship, Leo represented the opinion of a large part of the enlightened laymen of his time, while the great body of the clergy, but especially the monks, together with the mass of the population, were passionately attached to the statues and pictures, as objects of reverence, not to say of adoration. But the fact that the stronghold of iconoclasm was Asia Minor, and especially that part of it which bordered on the countries occupied by the Saracens, suggests that it was in part owing to the spread of Mahometanism, the rigidly guarded spirituality of which creed was a standing protest against more material conceptions of religion. Nor should we overlook the deeply rooted feeling in the mind of Orientals of the opposition between spirit and matter, which would naturally cause them to be alive to such questions of controversy. The emperors of this time were those of the Isaurian, Armenian, and Amorian dynasties, all which names remind us that they came from the Asiatic provinces; whereas the great restorer of images, the empress Irene, during whose regency the second council of Nicæa in their favor was held (787 A. D.), was an Athenian. But the matter was complicated by a further issue; the question of images was closely connected in the minds of the emperors, and especially of Leo III. and his hard-handed son Constantine Copronymus, with that of their supremacy in matters of religion. They viewed with jealousy the independent power of the church, and were glad of the opportunity this controversy afforded of strengthening their control over this department, and claiming to the full those ecclesiastical rights which, from the time of Constantine the Great onward, had attached to the imperial authority. As this move was only part of a system of centralization, the monks and others who supported image worship were from one point of view the assertors of liberty against aggression, and they were recognized as such by a certain number of thinking men, who watched with anxiety the growth of despotism. As toleration was unknown to the age, persecution was carried on by both sides with equal fierceness, and the contest swayed to and fro, until it was brought to an end by the final restoration of images under Michael III., the last of the Amorian line (842). Its effects on society had been remarkable. At first its influence was bracing, as was shown by the renewed vigor which pervaded the empire; for both sides were thoroughly in earnest, and among the iconoclasts in particular an element of Puritan energy was evolved. But in its later stages, when the people at large were weary of the strife, and the struggle was felt to be in reality one between church and state, the prevalent hypocrisy generated disrespect for religion, and this was followed by general immorality. It further caused the loss to the empire of its dominions in central Italy. So great was the alienation produced by this movement in the minds of the popes Gregory II. and III. that thenceforward the holy see was for the most part either active in its opposition to the Byzantine power or lukewarm in support of it. At last, in 751, Ravenna was captured by the Lombards, and the Greek exarch retired to Naples.

Subsequent ecclesiastical affairs.

The subsequent ecclesiastical affairs of this period must be briefly dismissed, though they exercised an important influence on the fortunes of the Greeks. The final separation of the Eastern and Western Churches took place in 1053, though events had long before been leading up to it. Already in the middle of the 9th century, when the pope interfered, between the rival patriarchs Ignatius and Photius, a rupture

was very nearly occurring; and at last, though the formal causes of division were theological, yet the assumptions of the see of Rome and political antagonisms were in reality more influential motives. The bitterness thus created culminated in the capture of Constantinople by the Latins at the time of the fourth crusade; and the subsequent refusal of aid by the Western nations to the Greeks greatly facilitated the success of the Ottomans. From this, the greatest breach in the Christian world, we turn with thankfulness to the missionary efforts of this age. In the middle of the 9th century two brothers, Cyril and Methodius, preached the gospel to the southern Slavonians, and converted them to Christianity. By Cyril the alphabet called Cyrillic was invented, which was generally adopted by the Slavonic peoples. About the same time the Bulgarians renounced their paganism, through the influence of a sister of their king, Bogoris, who had been educated as a prisoner at Constantinople, and afterwards restored to her native country. The rest of the nation had been prepared for this change by the numerous Christian slaves who had previously been carried off by them in war. A century later Christianity was introduced by Greek influence among the Russians, whose capital was now at Kieff, and who were among the most dreaded foes of the Eastern empire. If the missionary spirit is the best evidence of the vitality of a church, it is clear that that of Constantinople, however much corrupted by formalism, was still animated by the spirit of true religion.

Saracen wars.

The Persian monarchy, which for 400 years had been the rival of the Roman power in Asia, had now succumbed to the victorious arms of the Saracens; and that people again, during the next four centuries, were engaged in almost continual war with the Byzantine empire. In the reign of Constantine Pogonatus, the caliph Moawyah besieged Constantinople for seven years by land and sea, the invaders retiring to Cyzicus for the winter (672–9); but owing in great measure to the newly invented Greek fire, he was obliged at last to desist from the attempt, and almost the whole of his force was destroyed. Notwithstanding this reverse, the attempt was renewed within a year after Leo III.'s accession by Moslemah, brother of the caliph Suleiman, with an enormous host; but the skill of the Byzantines in military defence, which was equal to that of the Romans in their best days, baffled his attempts, and a winter of extraordinary severity ensuing ruined the attacking army. The importance of this result was incalculable to Europe—far greater than that of the victory of Charles Martel at Tours. The Saracen empire was now at its height, and reached from the Indus to the Atlantic; and it was the full brunt of this power, now in full tide of conquest, which was resisted at Constantinople. Had that city fallen, there was no power that could have prevented it from overrunning Europe. After this, Asia Minor continued for ages to be the battle-ground of the two opposing empires, until it was so devastated and depopulated by successive campaigns as to be fit only for the occupation of the nomad tribes who were to succeed. In the midst of these struggles the invasions of Haroun al Rashid, the splendor of whose court obtained for him a reputation in the West which he did not enjoy among his contemporaries in the East, appear hardly more than plundering incursions. The Byzantine nobles, who were trained in this school of war, were distinguished for their military spirit and personal prowess; and the troops of which the armies were composed were so powerful and well disciplined that the Saracens would never meet them in the field except with far superior numbers. By sea, however, the empire was less successful than by land. During the first half of the 9th century both Crete and Sicily were conquered by these enemies, and in the year 904 occurred the memorable sack of Thessalonica. A Saracen fleet appeared before that city, and, after storming the sea-wall, pillaged the whole place and butchered the citizens without respect of sex or age. The most famous successes were those of Nicephorus Phocas and his successor John Zimisces. The former of these great commanders, who before he became emperor had reconquered the island of Crete, at the end of a brilliant campaign in Syria obtained possession of Antioch (968) after it had been in the hands of the Mahometans for 328 years. Five years later Zimisces carried his victorious arms even to the banks of the Tigris. But while the disorganized state of the caliphate of Baghdad, in the early part of the 11th century, removed all fears from that quarter, a new enemy began to appear on the eastern frontier of the empire—the Seljuk Turks. Unfortunately, at this critical conjuncture, a fatal mistake was made. The safety of that frontier had long been guaranteed by the Armenian kingdom of the Bagratians, whose country was admirably adapted for defence, and whose population were a hardy race of Christian mountaineers. In the year 1045 the emperor Constantine IX. destroyed this kingdom, and thereby laid his dominions open to the invaders.

Bulgarian wars.

In Europe, at the same time, the empire was exposed to the attacks of a foe hardly less formidable, and in closer proximity—the Bulgarians. After the extinction of the Avars, this people, who had long been in subjection to them, had founded an important monarchy in the ancient Mœsia at the end of the 7th century; and henceforward the Byzantines had to defend their European possessions, not as before against a succession of migatory tribes, but against the concentrated force of a single nation. In the time of Constantine Copronymus we find that it required all the energy and military talents of that emperor to keep them at bay, and on one occasion they carried their ravages up to the neighborhood of the capital. In the beginning of the 9th century their king, Crumn, defeated and slew the emperor Nicephorus I., who had invaded his territory, in a night attack on his camp, and converted his skull into a drinking-cup for his table. We have already noticed how, later in that century, the nation embraced Christianity, and at the same time a tract of country on the southern side of the Balkan range was ceded to them, and received from them the name of Zagora. By this time also they had imperceptibly changed their nationality and their language, for by intermingling with the more numerous Slavonian tribes of the countries in which they settled, they lost the traces of their Hunnish origin, and became to all intents and purposes a Slavonic race. By the neighborhood of Constantinople, and the trade between that city and the German and Scandinavian peoples which passed through their country, they became a commercial nation, and advanced in the arts of life. But the rapacity of the Greeks in imposing heavy customs on their traders involved them again in war with the empire, and when peace was re-established, the treaty between Romanus I. and their king, Simeon, was made under the very walls of Constantinople (923). In the reign of Nicephorus Phocas the Russians, who had not long before appeared on the scene of action, were invited by the Greeks to invade Bulgaria, and they so effectually crushed the Bulgarians (968) that his successor, John Zimisces, was obliged to come to their aid, in order to save his own territory from falling a prey to the new comers. It was shortly after this that the great and final struggle commenced. Under their chief, Samuel, a man of great vigor and ability, they extended their conquests over Macedonia and Thessaly, and made plundering incursions into Greece and the Peloponnesus. But finding that the plains of Bulgaria were unfavorable to him as a seat of war, on account of the superior discipline of the imperial forces, Samuel transferred his seat of government to Achrida, on the confines of Macedonia and Albania, and thence he extended his kingdom from the Adriatic to the Ægean, so that the country he ruled was as extensive as the European portion of the Byzantine empire. But these events coincided with the culminating period of Byzantine greatness, and Samuel found a worthy rival in Basil II., who from his subsequent victories obtained the title of "Slayer of the Bulgarians." By him the Bulgarian power was brought to an end; and the whole people submitted to the dominion of the Greeks (1018).

The Russians.

The third people with whom the empire had to contend at this time was the Russians. In the reign of Michael III., the last of the Amorian dynasty (865), the inhabitants of Constantinople were astonished by the appearance in the neighborhood of the city of a fleet of 200 small vessels, which passed down the Bosphorus from the Black Sea. The enemy contained in these was the Russians, who not long before had established themselves at Kieff on the Dnieper, and whose restless spirit and love of plunder prompted them to attack the strongest city in the world, Their ignorance of the art of war rendered them no formidable foe to the Byzantine forces, but their daring and cruelty produced a profound impression on the civilized and peaceful citizens. Similar attacks were made in 907 by Oleg and in 941 by Igor, but

the influence of trade and the introduction of Christianity into Russia gradually promoted more peaceful relations, and the Byzantines employed the powerful tribe of the Patzinaks, who occupied the northern shores of the Black Sea, to counterbalance their opponents. But the campaign of John Zimisces on the Danube in 971, which followed on the negotiations of his predecessor for the subjugation of the Bulgarians, showed how important a military power the Russians had become, for he found in their chief, Swatoslav, an enterprising and powerful adversary, whom it required all his skill to overcome. Once more, in the time of Constantine IX. (1043), the Scandinavian Varangians, by whom the Russians were mostly represented in their marauding expeditions, appeared before Constantinople, but with no better success than before; and from this period the alliance of that people with the Byzantines was long uninterrupted, and the two nations were bound together more and more by religious sympathy. In the days of the Comneni the Varangians regularly formed the bodyguard of the emperor.

Constitutional changes.

Constitutional changes were usually of slow growth in the Byzantine empire, yet at the end of this period we find considerable alterations to have been effected. Under the early iconoclastic emperors there was a tendency towards the greater concentration of power in the hands of the sovereign, but Basil I. converted the government into a pure despotism. This he effected by abolishing the legislative functions of the senate, which body, though now a shadow of its former self, had existed in one form or another all along, and exercised a certain influence in controlling the absolute power of the emperor. When this restraint was removed, and the senate reduced to an administrative council, no further check remained except the fear of revolution. Basil also tacitly introduced what, strange to say, had never existed in the Roman empire, and even now was only partially recognized—the principle of legitimacy in succession. With a view to this he established the custom that his descendants should be born in the "porphyry chamber," so that the name Porphyrogenitus might become a title of legitimacy. In this way a partial antidote was created to that inveterate disease of the Byzantine empire which a French writer has called *la maladie du trône*—the ambition to be emperor at all hazards, notwithstanding the risks involved both in the attempt and the possession of the office. The growth of the idea is proved by the loyalty shown a century and a half later to the empress Zoe, an aged, profligate, and incapable woman, on account of the legitimacy of her descent. But the greatest change of all, and one that contributed greatly to the subsequent decline of the empire, was effected at the end of this period. This was the abolition of the system of training officials to conduct the various departments of the state, and the entrusting those offices to eunuchs of the imperial household. The object of this was to lessen the power of the territorial aristocracy, and to diminish the chance of rebellion, by placing the government in the hands of men who could not found a dynasty; but from this time onward the efficiency of the administration began to wane. It was the disregard of the aristocracy involved in this change that caused the conspiracy of the nobles in Asia Minor which set Isaac Comnenus on the throne. It should also be noticed that few of the emperors throughout this period were Greeks, most of them being either Armenian or Slavonian by extraction. This circumstance accounts for a certain freedom from prejudice and independence of view which may be traced in their actions, but at the same time it caused them to be wanting in sympathy with their subjects.

Condition of the people.

During a considerable part of this period, notwithstanding the desolating wars which we have described, the prosperity of the inhabitants of the empire was very great. Finlay, who is excellently qualified to judge in a matter of this kind, gives it as his opinion that under the iconoclast emperors their moral condition was superior, not only to that of all contemporary kingdoms, but to that of any equal number of the human race in any preceding period. The society of this time has been too much judged of by the murders and mutilations which were rife in consequence of the struggles for the throne; but it should be remembered that these were confined almost entirely to the court and its surroundings, and did not affect the mass of the people. And their material prosperity was equally great. The emperor Theophilus, notwithstanding his lavish expenditure, is recorded to have left at his death a sum equal to five million sovereigns—an amount of money which could hardly have been extorted from a people otherwise than wealthy. This was the result of the commerce of their immense mercantile marine, which had in its hands the whole of the carrying trade between Asia and western Europe. To this it should be added that, under Basil the Macedonian and his successors, care was taken to moderate the burden of taxation, a policy that accounts in great measure for the duration of his dynasty, which occupied the throne of Constantinople longer than any other. Unfortunately the riches thus obtained tended after a time to accumulate in the hands of the few, and from the reign of Basil II. the middle class, that element which society can least of all afford to dispense with, began rapidly to diminish. As a consequence of this, in the 11th century manufactures declined in the cities, while in the country the immense estates of the aristocracy were cultivated by Mahometan slaves or Slavonian serfs; and this higher class itself began to feel the lethargy of wealth, and though still unconscious of coming change, was on the eve of impending decline.

Modern Greek nationality.

In the year 747, during the reign of Constantine Copronymus, the empire was visited by a fearful pestilence, which, both in the mortality and the demoralization of society it produced, must have rivalled, to judge by the accounts left us by the Byzantine historians, those of Florence and London, of which Boccaccio and Defoe have drawn such vivid pictures. As this calamity was the primary cause of the immigration of foreign settlers into Greece, it is intimately connected with the question of modern Greek nationality; and consequently the present appears a fitting place briefly to discuss this subject, on which great differences of opinion, turning mainly on the mediæval history of the country, have prevailed. The controversy originated in the famous thesis of Professor Fallmerayer of Munich, that, owing to the great influx first of Slavonian and afterwards of Albanian colonists, not a single drop of Hellenic blood flows in the veins of the Greeks at the present day. The discussion of this point has enlisted much ability and learning on both sides, but the question appears now to have been pretty well set at rest by the abandonment of Fallmerayer's hypothesis. How early barbarian settlements began to take place in Greece it is difficult to determine; but though the occupation of the Peloponnese by Avars and Slavonians at the end of the 6th century, on which much stress has been laid, is doubtfully historical, yet colonies of those races probably established themselves in the northern part of Greece. But that the great change in this respect was produced by the pestilence is shown by the oblivion of Hellenic names of places which dates from that time. For, though a fair number of ancient names of seaport towns, such as Patræ, Corinth, and Epidaurus, and some names even in a district so extensively occupied by Slavonians as Arcadia, have been preserved to the present day, yet the great majority of the modern names are now, and have been since the 8th century, either Slavonic or of later Greek origin. Not only was the country greatly depopulated by the plague, but a considerable portion of the native middle class was induced by the emperor to migrate to the capital, in order to fill up the void in the inhabitants which had been caused by its ravages. The districts which were thus left vacant were soon after occupied by Slavonian tribes, so that until the middle of the 9th century they formed a large part of the population. But in the latter part of that century the Greeks began to recover a numerical superiority, and from this period dates the process of the absorption and Hellenizing of the Slavonians, so as to form the mixed race of which the greater part of the population of Greece is now composed. In effecting this change the Greek Church played an important part. The affinity between the ancient and modern Greeks has been traced by several lines of reasoning. It has been pointed out how great is the resemblance of character between them, and that too in points presenting the sharpest contrast to the character of the Slavonic races. The survival of old beliefs and classical superstitions at the present day has been carefully observed. The language is a lineal descendant of the ancient speech, and contains next to no Slavonic element; and lest it should be thought that this language had been imported into the provinces from one or more great centres, and had not survived in the districts themselves, it is proved that numerous classical words

and forms, which have been lost to the language at large, still survive in the local dialects. Thus, though the physical connection between the modern Greeks and the ancient Hellenes, in certain districts at all events, may be slight, as seems to be implied by the difference of physiognomy, yet in all that really constitutes a people, their character, feelings, and ideas, the former are the lineal descendants of the latter.

IV. *Period of Byzantine Decline: from Isaac I. to the taking of Constantinople by the Latins*, 1057–1204, A. D.

The Comneni.

At the commencement of the preceding period there was a prevailing fear among the inhabitants of the empire that its extinction was imminent, and we have seen how this was followed by an age of unexampled prosperity. The feeling of the time on which we now enter was completely the opposite of this, and yet it was a period of decline. The long duration of the empire, notwithstanding numerous vicissitudes, its superiority to contemporary nations in power and wealth, and its apparent security from foreign enemies inspired the people with a belief in its permanency, and blinded them to the seeds of disease that were already working. Yet before the end of the 11th century the Seljuk Turks had occupied all the inland part of Asia Minor, and had established their capital at Nicæa, in the immediate neighborhood of Constantinople. It would, however, be a mistake to suppose that, in its external relations at all events, the whole of the Comnenian period was a time of decay. On the contrary, during a considerable period it witnessed a remarkable revival; and the three great emperors of that dynasty, Alexius, John, and Manuel Comnenus, whose long reigns extend over an entire century (1081–1180), were men who would be conspicuous figures in any age. All of them were distinguished by personal courage and skill in war, by literary culture, and by sagacity in politics; but in other respects they represented very different types. The first, Alexius, was indefatigable in business, patient in maturing his schemes, and active in carrying them out, but vainglorious, unprincipled, and fond of artifice. From this Ulyssean phase of Greek character we turn to a true Achilles, his son John, the most amiable character that ever occupied the Byzantine throne —a man irreproachable in morals, open-hearted, generous in action, prudent in council, and pious without superstition. The last of the three, Manuel, presents us with a nature spoiled by the early possession of absolute power, but gifted with most of the features admired by his contemporaries —handsome in person, tall of stature, and so powerful that, at a tournament at Antioch in which the chivalry of the West took part, he unhorsed every antagonist—but passionate in temper and ill-regulated in mind. In an age which produced men like these it may well be inquired, What were the sources of decline?

Causes of decline.

In the first place, the emperors were almost the only capable men. This was the natural effect of the centralization of the system. The neglect of the education of persons intended to be employed in the administration, and the employment of creatures of the court for offices of trust, were now bearing their fruit. Everything depended on the existing sovereign; and it only required the vices of a thoroughly profligate man like Andronicus Comnenus, the last of his dynasty, to ruin the state. As might be expected also under these circumstances, disorder soon crept into every branch of the public service. The census, which for eleven centuries had been carefully compiled, was now neglected; justice, which more than anything else had united the provinces to the empire, was more imperfectly administered; and the army became inferior to those of Western nations. This last change was produced partly by the degeneracy of the nobles in military spirit, owing to the growth of luxury, partly by the officers being appointed by favoritism, and the habit of disbanding troops at the end of a campaign, in order to save money to defray the expenses of the court. At the same time the great diminution of the middle class, owing to the extension of the large properties, lessened the number of those who were willing to defend their liberties against invaders. The privileges also, in respect of trade, which were conceded by Alexius I. to the Venetians and by Manuel to the Genoese and Pisans, to the detriment of the native merchants, commenced the decline of Greek commerce; and this was accelerated by the piracy that arose, when the money that had been contributed by the commercial communities for the maintenance of local squadrons of galleys was ordered to be remitted to Constantinople. To all this must be added the influence of the higher Greek clergy whose subserviency to the state had increased since the separation from the Western Church and the conservatism of whose ideas discouraged all attempts at progress on the part of the people.

The crusades.

The age of the Comneni is the time of the crusades. Those famous expeditions will produce a very different impression on the mind according as they are regarded from the point of view of the East or the West. From the latter point of view they may be regarded as bringing to a focus the religious and martial enthusiasm of the time, as forming a safety-valve for restlessness, as enlarging the ideas and elevating the spirit of the people. But to the great mass of the Easterns they appeared as hardly better than marauding expeditions, and as producing unmitigated evil. Though the first crusade (1095) was partly undertaken in consequence of the solicitations of Alexius for aid against the Seljuks, yet as soon as the first undisciplined bands entered the country they pillaged the natives; and when the more organized companies followed, though many of their leaders, like Godfrey and Tancred, were men of the highest character, yet it required all the address of the Byzantine monarch to transmit these armies into Asia without some irreparable injury being done to his capital. No doubt the faults were not all on one side, for the suspicion and falsity of Alexius gave just ground of complaint to the crusaders. But he had a very difficult part to play. Had he placed himself, as was proposed, at the head of the crusade, he had no reason to expect obedience on the part of the feudal nobles, while at the same time he left his kingdom exposed to the danger of rivals at home and fresh bands from abroad. Accordingly he chose the ignoble part, and followed in their footsteps with the view of regaining what he could to his dominions. The second and third of these expeditions passed through the empire with comparatively little injury, though in the latter of the two the island of Cyprus was lost to Richard of England; but the ill-will that was manifested by the Greeks on those occasions ripened in the minds of the Westerns those seeds of hatred which at last bore fruit in the great buccaneering expedition which is commonly called the fourth crusade (1204). This event, of which a narrative has been left us from both sides, by the Greek historian Nicetas and the Frank chronicler Villehardouin, is certainly one of the most disgraceful transactions in history. A certain lustre has been shed over it by the age and blindness of the doge Dandolo, who was one of the principal leaders; but that a Christian force assembled for the purpose of fighting the infidels should turn its arms against the most important Christian city of the time is an act of unparalleled baseness; nor can anything be conceived more deliberately mean than the treaty by which the spoil of the empire was partitioned beforehand between the nations who took part in the attack. From this blow Constantinople never recovered, though it is fair to add that hardly less injury had been caused by the storm and plunder of the city during the rebellion which set Alexius Comnenus on the throne.

The Seljuks.

In Asia this period opens with a great disaster, the defeat of Romanus IV. by Alp Arslan, in the battle of Manzikert in Armenia (1071). Gibbon has eloquently described the scene, in which the Seljuk sultan, after placing his foot on the neck of the captive emperor, spares his life, and hospitably entertains him. The Seljuk race of Turks were already masters of a great part of western Asia, and in the reign of Malekshah, Alp Arslan's successor, their dominions extended from the banks of the Jaxartes to the Mediterranean. The empire had now entered on the third great struggle of four centuries' duration, which it maintained in the East—first with the Persians, next with the Saracens, and finally with the Turks, whether Seljuk or Ottoman. But the present contest was commenced under altered circumstances. It was soon felt how fatal was the policy which had denuded the Armenian frontier of its native defenders, and how few obstacles were presented in Asia Minor to an invading force when a large portion of the free population had disappeared. And the character of the invaders also had changed; for, whereas the Persians and Saracens had felt an interest in civilization, the Turkish hordes were composed of nomad barbarians, whose object in war was plunder, and who occupied the countries they conquered as

pastoral tribes. Hence their system of warfare consisted in exterminating the agricultural population by successive inroads, until one district after another lay open for their permanent settlement. Within three years after the battle of Manzikert, the Seljuk power extended over the greater part of Asia Minor; and when, in the year 1080, Nicæa fell into their hands, that place became the capital of a separate kingdom, which was called the sultanate of Roum, that is, of Rome. From thence they were driven back by the crusaders at the time of the first crusade, and transferred their seat of government to Iconium, in a more remote position in the south-east of the country. After this they carried on a succession of wars with the Byzantine Government, the most remarkable event in which was the great battle at Myriocephalus, on the borders of Phrygia, in which the emperor Manuel was signally defeated. During the distractions that prevailed at Constantinople shortly before the fourth crusade, it might have been in the power of the Seljuks to seize that city, and so to anticipate the Latins; but at this time the kingdom was divided between the ten sons of the sultan, Kilidji-Arslan II., and thenceforward the power of the Seljuks was less formidable.

Wars in Europe.

Meanwhile the European dominions of the emperors had been assailed by a variety of foes, among whom the Normans were the most conspicuous. In the year 1071 Robert Guiscard succeeded in expelling the Byzantines from their remaining possessions in southern Italy, and fired by the ambition of rivalling his great compatriot, who four years and a half before this had made himself master of England, he conceived the design of conquering the Byzantine empire. With the object of carrying this into execution, he laid siege to Dyrrhachium, the most important Greek city on the Adriatic, and after defeating Alexius Comnenus, who had come to its relief, succeeded in making himself master of the place. Being forced to quit the country, he entrusted the campaign to his son Bohemund, who was defeated by the emperor, and withdrew into Italy. Fortune, however, ordained that these two chieftains should once more be brought into collision in Syria, and hence arose another Norman war, in which Bohemund was foiled by the strength of Dyrrhachium. At a later period, in the reign of Manuel, Greece was invaded by King Roger, who had received an affront from that emperor, and the cities of Thebes and Corinth were sacked in the most barbarous manner. But the most famous of these inroads was in 1185, and resulted in the siege of Thessalonica, which place was taken by the Normans, and treated with a cruelty that almost rivalled that of the Saracens in the former siege. Besides these wars, there were others with the Patzinaks, the Hungarians, the Servians, and the Venetians. But towards the end of this period the empire received a blow from the revolt of a people who on this one occasion appear prominently in history—the Wallachians. This race, who, like the Greeks, claimed the name of Romans or Roumans, were the descendants of the Roman colonists in Dacia, whom the emperor Aurelian transplanted to the southern side of the Danube. There it is probable they intermingled with the natives, but they retained the Latin tongue, from which the modern language is derived. About the 13th century, it would seem, the great body of the nation once more migrated northward to the seats they now occupy; but those of whom we are speaking here were settled on the Balkan, where they had maintained themselves in their mountain fastnesses, owning an allegiance more or less qualified to Constantinople. In the reign of Isaac Angelus (1186), however, when they were heavily taxed, robbed of their cattle, and misused in other ways, they rose under the leadership of three brothers, Peter, Asan, and John, and having made a league with the Bulgarians, raised the standard of revolt, and established what is called the Bulgaro-Wallachian kingdom. Its successive rulers contended with varied fortune against the Byzantine Government, but succeeded in maintaining their position in Thrace and Macedonia, to which countries for a time Thessaly also was added, forming, however, an independent province, with a governor of its own. The emperor Baldwin, the first of the Latin emperors of Constantinople, was captured by them in battle, and put to death. The kingdom continued to exist until the Turks made their appearance on the scene, when, in common with the other independent sovereignties in these regions, it was finally overthrown.

Bulgaro-Wallachian kingdom.

State of Greece.

The period from the end of the 9th century to the fourth crusade was to Greece a time of prosperity. Though its inhabitants were looked down upon as provincials by the people of Constantinople, and the country itself was treated with neglect (Basil II. was the only emperor who for several ages visited Athens), yet in material well-being it was one of the most flourishing parts of the empire. Though barbarian inroads were still not wholly unknown—one of the Uzes in particular is mentioned in 1065—yet security generally prevailed, and from the middle of the 11th century the coasts had nothing to fear from Saracen corsairs. The land produced corn in abundance, so that it even supplied the capital in a time of dearth. The silk manufactures of Thebes, Athens, and Corinth were a source of great wealth, and much of the commerce of the time was in the hands of the people of Greece. The port of Monemvasia, in eastern Laconia, which gave its name to the Malmsey wine, was especially famous as a mediæval emporium. How far Hellenic feeling and Hellenic traditions survived among the Greeks we have no means of discovering, but the probability is that these to a great extent perished, along with the Hellenic names, at the time of the great Slavonic immigration. The whole population had become Christian, though as late as the 9th century paganism existed among the inhabitants of the mountainous regions of Laconia. But in the latter half of the 12th century decline was ready to set in. Their commerce was passing into the hands of the Western traders; the silk manufacture was transferred by the Norman Roger to Palermo; and the profits of industry were absorbed by taxation, so that no surplus remained to be invested in works of public utility. The writings of Michael Acominatus, the noble and learned archbishop of Athens at the time of the fourth crusade, give clear evidence that in that city the decay had already commenced.

The modern language and literature.

It is during the 12th century that we first meet with compositions in the popular Greek tongue, among the earliest specimens being poems by a monk called Ptochoprodromus, addressed to the emperor Manuel Comnenus. The literary language of this time was still the same which had been used throughout the Byzantine period—the "common" dialect of the Macedonian Greeks, as it had been transmitted with various modifications by the later Greek writers and the fathers of the church. The Byzantine histories and other works which were composed in it are usually stilted and pedantic in style, and conventional in their ideas and their treatment of events; but it is possible to treat them too slightingly. Some of the writers, like Michael Psellus and Eustathius of Thessalonica, were men of undoubted ability and learning; and, besides this, it was the taste for these subjects, however faulty, which maintained the high level of cultivation that distinguished the Byzantines from the people of all other contemporary states during the Middle Ages, and caused the ancient literature to be preserved. This language was also that spoken at court, so that it is not till the time of the Palæologi that we find the highest circles and polite composition invaded by the vulgar tongue. But from the 4th century after Christ, if not earlier, there had been a divergence between the written and the spoken language, so that the two formed, so to speak, an upper and a lower stratum. Until the time of the iconoclasts, in all probability, the ancient speech was generally intelligible, but from the end of the 9th century it was a dead language to the great bulk of the nation. The change which the popular idiom was passing through, as might be expected, was twofold, arising, first, from the usual tendency of speech to become more analytical and of words to modify their meaning, and, secondly, from the loss of vocabulary, the mutilation of grammatical forms, and the confusion of syntax, which is produced by want of cultivation. At the same time it passed through no such violent process of disintegration as befel Latin in its change into the Romance languages, so that its historical continuity was never broken. But when it emerges to view in the compositions of the 12th century it is already a modern language, and its forms differ little from those of the Romaic of the present century, though of course the vocabulary was as yet free from the intrusive elements—Italian, Albanian, and Turkish—which subsequently crept into it. The metre in which these poems were composed was regulated entirely by accent, and not

by the quantity of the syllables, and the verse usually employed was the so-called "political," *i. e.*, popular verse, which corresponds to some of our longer ballad metres. The favorite subject was romances, and in the treatment of these, as well as to some extent in the stories themselves, subsequently to the Frankish occupation the influence of the French romances is clearly traceable.

V. *Period of Greek Survival: from the taking of Constantinople by the Latins to its Conquest by the Turks*, 1204–1453 A. D.

Partition of the empire.

The empire of the East never recovered from the effects of the fourth crusade. It was then broken into a number of separate fragments, and though some of these recovered their cohesion, and the end did not arrive for two centuries and a half, yet the strength of the system was gone, and paralysis crept more and more over the enfeebled frame. In accordance with the provisions of the partition treaty, a Latin emperor was set up at Constantinople, and Baldwin, count of Flanders, was elected to the office; Latin kingdoms were established in different provinces — one at Thessalonica, which was of short duration, another at Athens under the family of De la Roche, and a third in the Peloponnesus under Champlitte and Villehardouin, which was called the principality of Achaia or the Morea. Of the occupation of the last-named of these countries an account is given in one of the most curious of mediæval Greek poems, *The Book of the Conquest*, the French original of which also exists. But even the districts which remained in the hands of the Greeks did not continue united. An independent empire was established at Trebizond on the Black Sea by a scion of the house of Comnenus. Another principality was founded in Epirus, the despot of which, after overthrowing the Latin state of Thessalonica, established at that place an empire of his own. But the headquarters of the legitimate Greek monarchy were at Nicæa, the original capital of the Seljuk sultans in Asia Minor. Theodore Lascaris, a man of no mean ability, who had been acknowledged as emperor before the capture of Constantinople, having taken up his abode in that place, succeeded in maintaining himself in opposition to the crusaders, the Seljuks of Iconium, and the Greeks of Trebizond; and his successors continued to reside there for nearly sixty years. When the difficulties of the Westerns in Constantinople became increasingly greater, and their downfall appeared imminent, it was for a time a question whether that city should become the prize of the emperor of Nicæa, or of the emperor of Thessalonica, or of the Bulgaro-Wallachian sovereign; and this rivalry involved many alliances and wars. The man who ultimately decided it in favor of Nicæa was Michael Palæologus, who became the founder of the last dynasty that ruled the Greek empire (1261).

Empire of Nicæa.

The Palæologi.

The character of Michael, which was too faithfully reflected by many of his successors, represented most of the unfavorable qualities of the Greek race. Though a brave soldier, he was intriguing, selfish, and unscrupulous, as he soon showed by the deposition and blinding of the young emperor, whose guardian and colleague he was appointed to be. He entered on the possession of a ruined capital, which the barbarism of the Western nobles had reduced to a state of poverty and filth, and his attempts to restore it were misdirected and unsuccessful. His one object, when he had established himself on the throne, was to maintain his despotism; and, while he recovered part of the Peloponnesus to the empire, he ruined his subjects financially by debasing the coinage, and commercially by allowing the Genoese and Venetians to appropriate most of the carrying trade of the Greeks. But the act by which he gave the deepest offence was the reunion of the Eastern and Western Churches, which amounted to the submission of the Greek Church to the pope, to which he consented at the council of Lyons (1274), in order to persuade Gregory X. to prohibit Charles of Anjou from invading the empire. The narrowness of the theological spirit among the Greeks at this period was greater than we can well conceive, but it was a not unnatural outburst of national feeling which roused the people in opposition to this measure. The subsequent attempt in the same direction at the councils of Florence and Ferrara (1438–9), when the nation was reduced to the direst straits, met with no better reception at home. Under the successors of Michael the empire continued for 170 years, but the whole of this time was a long death sickness. The doom of the empire was forecast by the powers that came to prey on its weakness—the Catalans, who plundered those whom they had undertaken to aid; the knights of St. John, who seized Rhodes, a conquest which they rendered memorable by their gallant defence of that island against the Mahometans; and the Servians, who, under Stephen Dushan, established an important empire, which lasted until it was destroyed by Sultan Amurath at the great battle of Cossova (1389). Even the emperors themselves, from the endowments and gifts which they lavishly bestowed on monasteries, especially those of Athos, seemed to be providing beforehand for a day when their possessions would pass into the hands of others.

The Ottomans.

The nation was now arriving at the maturity which was to bring this time-worn empire to an end. Shortly before the Greeks regained possession of Constantinople, the Mongols, whose vast hordes had overrun a great part of Europe and Asia and had destroyed the caliphate of Baghdad, entered Anatolia, and shattered the power of the Seljuks of Iconium. But on the ruins of this dynasty another and far more terrible dominion arose. Towards the end of the 13th century Othman, the chief of a Turkish tribe in northern Phrygia, penetrated through the passes of Mount Olympus, which the jealous policy of Michael Palæologus had denuded of the protection of the warlike mountaineers who occupied them, and descended into the lowlands of Bithynia. By his son, Orchan, the city of Broussa was captured, which became thenceforth the capital of the Ottoman race. The extraordinarily rapid rise of this people to be one of the greatest powers that the world has seen was due in great measure to the remarkable ability of its successive rulers, but in no slight degree also to the institution of the Janissaries—an inhuman but most efficient system, by which Christian children were torn from their homes and educated as Mahometans in the household of the sultans, to whose personal service, as a bodyguard, they were for life devoted. As early as the year 1346 we find Cantacuzene, then the prime minister of John V., and afterwards himself emperor, entering into alliance with Orchan, and giving him his daughter in marriage. The first step towards a permanent settlement of the Turks in Europe was made in 1354, when Gallipoli was occupied by Orchan's son, Suleiman. Seven years from this time Amurath I. made himself master of Adrianople, and before his death that sultan saw the Greek emperor his vassal and tributary. It seemed now as if the fall of Constantinople could not long be delayed, when with one of those turns of the wheel of fortune which form the surprises of history, Bajazet, the most powerful of all the Ottoman rulers, was defeated and taken prisoner by Timur the Tartar at the battle of Angora (1402), and civil war setting in between his sons gave the Eastern empire a new lease of existence. But within twenty years again the capital was besieged by Amurath II., though he failed to take it, owing partly to the strength of its fortifications, and partly to a rebellion that broke out in his family. The empire was now reduced to Thessalonica, a part of the Peloponnesus, the city of Constantinople, and a few neighboring towns.

End of the empire.

In the midst of the gloom which hangs over this last period, it is consoling to find a ray of light that illumines its closing scene, in the heroic end of the last Constantine. The story is a sad one. The city was beleaguered by land and sea by the warlike hosts of Mahomet II.; no further succor could be expected from the West; and the emperor, who had adopted the Latin rite, was thereby estranged from the great mass of his subjects. But he had determined not to survive his empire, and he died in a manner worthy of the greatest of his predecessors. On the eve of the final assault he rode round the positions occupied by his troops, to cheer them by his presence; and then, having partaken of the eucharist in St. Sophia's after the Latin form, and having solemnly asked pardon of the members of his household for any offences, he proceeded to occupy his station at the great breach. There on the following morning, after a desperate resistance, he fell fighting amidst a heap of slain, and the young sultan passed his lifeless body as he rode into the captured city.

We have thus passed in review the fortunes of the Greeks during a period of nearly eighteen centuries. We have seen how the Roman system of government and the Greek character and social institutions, mutually influencing and modifying one another, produced the characteristic features

of the Eastern empire. We have watched that empire maintaining a conflict on the one side with the invading barbarians, the Bulgarians, and the Western nations, on the other with the Persians, the Saracens, and the Turks, until to the last of these peoples it finally succumbed.

The following are the principal histories of this period:—in English, Gibbon's *Decline and Fall of the Roman Empire*, which, from its comprehensiveness and grasp of the subject, can never be superseded, and Finlay's *History of Greece*, which is the chief authority on the Byzantine empire; in French, Le Beau's *Histoire du Bas-Empire;* in German, Carl Hopf's *Geschichte Griechenlands vom Beginn des Mittelalters*, published in Ersch and Gruber's *Encyclopädie*, and reissued in vols. vi. and vii. of Brockhaus's *Griechenland* (a work of great erudition, which has cleared up many disputed questions), and Hertzberg's *Geschichte Griechenlands unter der Herrschaft der Römer*, and *Geschichte Griechenlands seit dem Absterben des antiken Lebens bis zur Gegenwart;* in Greek, Paparrhegopoulos's Ἱστορία τοῦ Ἑλληνικοῦ ἔθνους. (H. F. T.)

Section III.—Recent History.

The history of Greece from the fall of Constantinople to the present day suggests a problem of profound historic interest. From the year 1453 till the end of the 18th century almost all the occasions on which the Greek people appear on the page of the historian are occasions on which we read of them that they were butchered or sold into slavery. Records tell only of their annihilation or dispersion. Yet in the commencement of the 19th century this apparently annihilated and dispersed people can summon energy enough to resist the Turks, and although in all probability they would have failed to overcome their oppressors if they had been compelled to struggle unaided, yet the courage and self-devotion which they showed in the conflict were such as to gain for them the sympathies of Europe, and they came forth triumphant. But in reading even of their war for independence we are astonished that a remnant was left. Thousands upon thousands perished, and their victory seemed only less terrible than utter defeat. Yet the spirit of life remained. The kingdom of Greece was established, and within forty years, notwithstanding deplorable mistakes in its management, the population is doubled, and the country becomes consolidated into a constitutional realm. To trace how these events were possible and how they actually came to pass is the task of the historian of Modern Greece.

The external events in this history are necessarily few. Greece was during the most of these centuries under the sway of foreigners, and the external history of Greece is formed merely by episodes in the history of these foreigners. When Mahomet II. became master of Constantinople, he did not thereby become master of the Greek empire. The Palæologi had held only a small portion of the territory which had constituted the Greek empire. Most of the islands of the Ægean were under the rule of Italian princes who acted as independent rulers. Rhodes was governed by the knights of St. John. But especially the Venetians owned large possessions in Greece and were also powerful by sea. The external history of Greece is occupied mainly with the efforts of Mahomet II. and his successors to spread their conquests. Mahomet himself conquered the kingdoms of Trebizond, Albania, Eubœa, Greece proper, and part of the Peloponnesus. He was also successful in expeditions against several of the islands of the Ægean, but he failed in his attack on Rhodes. It was not till the end of 1522 that the knights of St. John capitulated to Suleiman I. after standing a siege in which they showed the greatest bravery, and in which the Ottomans, it is said, lost about 100,000 men. On the 1st of January the knights left the island, to go first to Crete and then to Malta. Cyprus and Crete remained still longer in the hands of the Westerns. In 1489 Catherine Cornara ceded the island of Cyprus to the Venetians, who retained possession of it till, in 1570, Piali and Lala Mustapha attacked it. Nikosia fell in September, 1570, and Famagosta in August, 1571, after a brave defence conducted by Marcantonio Bragadino. The Turks received a severe defeat at Lepanto from Don Juan d'Austria in command of the combined fleets of Spain and Italy, in which they lost 130 ships and 30,000 men. But the blow was merely temporary. The helpers of Venice were not united among themselves. Again the Turks became the rulers of the Ægean Sea, and in 1573 Venice had to conclude a humiliating treaty in which she gave up Cyprus. In the case of Crete Venice had to pay for her own severity. That island remained for a long time undisturbed in the possession of the queen of the seas, as far as the Ottomans were concerned. But internal commotions agitated it. The Sphakiots or mountaineers of the south-west of Crete—a bold, brave, and independent race of men—rebelled against the rule of the Westerns; and the Venetians had recourse to the most shameful cruelties and atrocities on all their Greek subjects in order to crush the rebellious spirit. The result was that the Greeks hated the Venetians with the bitterest hatred, and would have gladly welcomed a change to the rule of the Turks. The Venetians saw that they had gone too far, and sent a wise politician, Giacomo Foscarini, to bring matters to a better state. Many prudent reforms were inaugurated, the Sphakiots were reconciled, and all seemed to promise well. But Foscarini died before his reforms got firm hold of the people. The Sphakiots indeed from that day to this have never submitted to the Turkish yoke, but the rest of the people were far from willing subjects of the Venetians and favored an invasion by the Turks. The Turks knew their opportunity, and began an effort to possess the island, which, though the Venetians resisted with great perseverance and were backed by other Italians and by the French, ended in the treaty of 6th September, 1669, in which they ceded Crete to the Turks. This last acquisition rendered the whole of Greece subject to the Turks with the exception of the Ionian and a few other small islands, which still remained in the hands of the Venetians. The Venetians, however, did not resign their hold on Greece without a final effort to recover possession of it. For this purpose they not only levied soldiers from their own and other Italian communities, but also hired generals and soldiers from Germany. The war began in 1689. The management of it was entrusted to one of the greatest men whom Venice produced, Francesco Morosini, who was ably assisted by a Swedish general, Königsmark. The contest was carried on with great vigor until at length the Turks were driven from the Peloponnesus. The Venetians wished also to regain possession of Eubœa, but in this they were unsuccessful. The war was brought to an end by the peace of Carlowitz, which left Venice in possession of the Peloponnesus, and the islands of Ægina and Santa Maura. One incident in this war has especially attracted the attention of the civilized world. Morosini, finding his efforts successful in the Morea, resolved to advance towards Eubœa. Athens lay in his way. It was garrisoned by the Turks, who, however, on his approach quitted the lower city and, occupying the Acropolis, prepared to defend it at all hazards. They planted one of their batteries in a breach of the temple of Nike Apteros, and they placed a portion of their powder and many of their valuables in the Parthenon. The Venetians showed no respect for the most beautiful of all buildings; and one of their bombs, falling on the powder in the Parthenon, blew many of the masterpieces of art into a thousand fragments, and utterly defaced the noble building which had remained up till that time very nearly in the condition in which the original architect and sculptor had left it. The Venetians tried to introduce reforms into the Peloponnesus, and had made considerable progress when in 1715 Ali Kumurgi, at the head of a very large Ottoman army, entered the Peloponnesus. The Venetians were unprepared, and they could not easily get assistance from others. The consequence was that in a very short time Kumurgi drove them out of the whole of the peninsula. The Turks got involved at this time in war with Austria; and when peace was finally concluded at Passarowitz, Venice had to give up the Morea as well as the island of Ægina, and practically she disappears from the history of Greece except as the possessor of Santa Maura. But a great change had now begun to take place in European politics. At an early period after the capture of Constantinople the Turks came into collision with their neighbors on the north, the empires of Austria and Russia, and we find these two powers united in resisting the inroads of the Ottomans. Even so late as 1683 the Turks were so bold as to advance as far as Vienna and lay siege to it. But in the 18th century the policy of Russia attracted the attention of the rest of Europe, and caused a considerable change of attitude. Early in that century Peter the Great had declared his resolution to force his way into Constantinople, and though he was completely baulked in his aim, and had to sign an inglorious peace, (1711), the desire to have the city on the Bosphorus continued to animate the Russians. It is to Count Münnich, field-marshal

and counsellor of the Russian empress Anna, that historians attribute the suggestion that Russia should systematically stir up the Greek Christians against their Turkish masters, and from his time (1736) onward we find Russia continually scheming to rouse the Greeks to insurrection. Most famous amongst these efforts were those of the empress Catharine II., who, influenced partly by the Philhellenism of Voltaire, partly by a desire to withdraw the attention of her subjects from domestic affairs, but principally by a wish to gratify her favorite Orloff, formed the project of emancipating the Greeks from the yoke of the Turks (1769). But all the efforts made to effect this object were exceedingly inadequate. The Greeks were soon taught also that Russia, while willing to free them from the Ottoman yoke, was determined to assist none but those who would readily become Russian subjects. And the expedition to the Peloponnesus undertaken by Orloff was followed by most disastrous consequences to the Greeks. The Russians were more successful in their contests with the Turks in the north, and in 1774 compelled the sultan to accept a peace, called the peace of Kainardji, which contained several provisions bearing upon the Greeks. In some of these the sultan promised to protect the Christian religion and Christian churches, and though no special mention was made of Russia, her statesmen saw in this stipulation an opening for endless opportunities to interfere. And from this time forward Russia has claimed to be the champion of the Christians against the Turks. But the other states of Europe, especially France and England, became suspicious of the designs of Russia, and holding to the balance of power as an essential principle of European statesmanship, they determined to maintain the integrity of the Turkish empire. Austria had frequently joined with Russia in opposing the Turks, and had again and again hoped to come in for a share of the spoil when Turkey should be partitioned. But towards the end of the 18th century the increasing power and influence of Russia began to alarm her, and when the Greeks rose to assert their independence, no power more tenaciously adhered to the doctrine that the integrity of the Turkish empire was demanded by the balance of power in Europe. Thus up to the time of the establishment of the Greek kingdom the affairs of the Greeks have been mixed up with those of foreigners,—Ottomans, Venetians, Austrians, Russians, and the other European powers.

The notable fact in Greek history during these ages is the disappearance and the apparent destruction of the nation. Whoever might hold the supreme power in Greece, the Greeks were sure to be the sufferers. When the Turks spread their conquests from Constantinople on to the rest of the empire, every capture of a city was followed by the slaughter of the able-bodied men and the carrying off of the women and children to the harem or slave market. And the Western Christians were not a whit more tender than the Ottomans. The Venetians were wroth with the Greeks, because they did not acknowledge the pope, and in the island of Crete perpetrated the most abominable barbarities on the innocent population. The Turks punished the Greeks because they submitted to the Venetians, and the Venetians punished them because they submitted to the Turks. Moreover, in these times the Ægean was infested by pirates who, whether Turks or Italians or Greeks, had no mercy on the peaceful inhabitants of the mainland. Human life was disregarded, and men and women were of value only in so far as they were salable articles in the slave market. If one were to enumerate all the instances in which historians tell us of the utter destruction or transference of the Greek population, a vivid idea might be presented of how terribly hard were the sufferings of the Greek people. We have to add to this record of destruction that vast masses of the people removed to Italy or Sicily or some other place of refuge. Almost all the famous families that ruled the islands of the Ægean escaped from them when they were attacked by the Turks. The knights of St. John, for instance, left Rhodes to find a final settlement in Malta. Among the number who thus left their native land were nearly all the learned men, who sought in the West a refuge from Turkish rule, and opportunities for the pursuit of learning.

Yet notwithstanding these destructive forces the Greek people survived. To understand this phenomenon we have to examine into the mode of civil administration adopted by the Ottomans. The Ottomans were pre-eminently a warlike people. Their profession was that of arms. Their two great objects in life were to conquer and enjoy their conquests. They were brave and always ready to fight, but after battle was over they wished to enjoy the luxury and repose which they had earned by arms. They were therefore utterly disinclined to meddle with civil matters. If they got their revenues, and could enjoy their harems and slaves, it was a matter of no consequence to them how the subject races procured the means of paying the taxes, or in what way they governed themselves. The same spirit showed itself in the sultans. To them all Turks as well as Greeks were practically slaves. The sultans saw in the Turks the right hand that could bring them success in war, and in the Greeks or other subject nations the means of ministering to their wealth and enjoyment. Provided they had a sufficiently numerous and brave army and ample supplies of money, they were comparatively indifferent how or by whom local affairs were managed. This freedom from bias and this singleness of purpose enabled them to continue their power for a much longer time than they could possibly have done had they been swayed by national aims or particular ambitions. They had no hesitation in selecting for their purposes the best men they could get, and consequently many of the subject races rose to places of high eminence in the Turkish army and administration. A large proportion of the viziers of the Sublime Port have been Greeks. Many of the generals that subdued Greece were Greeks. There was thus a constant accession to the ranks of the Turks from the subject nations. Those who thus entered the Turkish service could not do so without adopting Mahometanism. It was the essential condition. But many Greeks found no difficulty in changing their faith. They saw that it was their one hope of rising to eminence. And these men reached such high positions as to arouse the jealousy of the Turks; for the sultans preferred the converts to the original Mahometans. They felt more confidence in them as instruments of their own domination. Indeed at one time there seemed a likelihood that large portions of Greece would become entirely Mahometan. They were urged to it by two opposite influences—by the high position which Mahometan converts from Greece could attain, and by the utterly wretched condition of those who remained attached to the Christian religion. We have a curious instance of the effect of the latter motive in the conduct of the Caramuratades who occupied about thirty-six villages in the valley of the Aous in Albania. The inhabitants of these villages had long been oppressed by the Mahometans, but had remained Christian until 1760. In that year matters came to a crisis. The Caramuratades could stand their distress no longer. They argued that either Christianity was not true or it ought to put them in a better position. They resolved to give it one chance more, and to try to conciliate the Divine Being by the most rigid fasts. If He did not listen to them, then they would feel assured that He did not wish them to remain Christians. The chief priest protested against the impiety of this resolution, but the Caramuratades would not listen to him. They observed Lent with the most rigorous severity, and prayed much. No improvement followed in their lot; and accordingly, on Easter day, they told the priests to retire, accused the sacred images of being indifferent to their distress, and in one body went over to the faith of Islam. A very few indeed refused to join their brethren, but they had to retire with the priests. At an earlier period, from 1620 to 1650, the Christian population of a part of Albania fell from 350,000 to 50,000; and to the present day a portion of the Albanians have remained firmly attached to Islamism, and have been the readiest tools in the hands of the Turkish Government, while the other portion have stood by the Greeks in their struggles for independence, and have done great and valuable service to the cause. In fact, so great was the inclination of the Greeks to adopt Mahometanism through the combined motives already mentioned that the sultans were alarmed lest they should have no tribute-paying people at all, and accordingly they became kindlier in their treatment of the rayahs or subject Christians, and did much to reconcile them to their government.

Another mode in which the Greeks passed over to Islamism has been already noticed. Even before the taking of Constantinople Orkhan had ordained that the children of Christians should be taken from them, should be specially trained for military service, and should enjoy such privileges and immunities that they would feel themselves spe-

cially bound to the sultan. The practice was continued and extended by Mahomet II. Every fifth Christian child had to be surrendered to the service of the sultan. All connection with his parents was cut off, and he was set apart and trained for warfare. In this way was formed the corps of the Janissaries. The Janissaries were not at first permitted to marry. Their ranks were constantly recruited from the Christian children. History speaks in the highest terms of the discipline and courage of this body of troops while it flourished. The Janissaries forgot altogether, if they ever knew, their homes and their hearths, and they were equally savage to Turk and Christian in their devotion to the sultan. This hateful sacrifice imposed upon the Christians gradually came to be regarded as an honor. The parents knew that their children were to be removed from the degradation of Christian slavery, and were to occupy the best positions that were open to Mahometans, and the Turks themselves so much envied the honor for their children that they bargained with the Greeks to take their children and give them for Janissaries instead of their own. A change took place at length in the composition of the Janissaries. They were allowed to marry; by degrees a position in the body became hereditary; and thence is dated the falling off of the corps. The tribute children were no longer required, and in the reign of Mahomet IV. (1649–1687) the tribute ceased.

In all these instances the Greeks were practically lost to their own nation. They disappeared from the nation of Greeks and Christians and became Turks and Mahometans. At the same time we cannot help supposing that by this intermixture a new element of progress, or at any rate of restlessness, was thus introduced into the dominant race.

But the Greeks attained to positions of eminence in which they were not compelled to abandon their nationality. Between the Turks and the Greeks existed irreconcilable differences. Not only was their religion different, but they differed widely in their social customs. There was no hope of amalgamating the two races. The Turks could only convert or exterminate the Christians. They did not venture to dream that they could convert all the Greeks by persuasion, and forcible conversion after the age of twelve was forbidden by the Koran. The only other alternative was extermination, and one of the sultans came to the resolution to destroy every Christian. But the Turks saw that such a policy was ruinous to themselves. Every Christian paid a poll-tax from which every Turk was exempt. The Christians cultivated the lands for the benefit of the Turks. The Christians were the drudges of the Turks. The next best thing to extermination then was to get as much out of the Christians as possible while coming as little as possible into personal contact with them. This was the plan adopted. Immediately on the conquest of Constantinople, Mahomet spread the Turkish system of administration over the whole of Greece. The Turkish warriors received lands during their life on condition of being ready to serve in war. These had captains who received the life-rent of larger portions of land, and finally pashas acted as military and civil rulers of still larger portions. All these were ready to keep the Greeks in subjection, and crush every effort at rebellion, and they guaranteed the taxes to the sultan. Turkish courts of justice were also established. But Mahomet II. did not disturb the Greek modes of civil administration which he found in force. They merely became subject to his purposes, and appeal could always be made from a Greek to an Ottoman institution. Mahomet II. especially made use of the Greek clergy as his tools for keeping the Greek people quiet and submissive in paying taxes. The Greek emperor had perished in the sack of Constantinople, and the nobles had either fallen or fled or been butchered shortly after. But the Greek Church still remained. The Greek people were devoted to their church. Their quarrels with the pope had only strengthened their attachment to it. Here was an instrument that Mahomet thought might be of great use. Accordingly he made the patriarch of Constantinople the representative of the entire Greek people. He gave him privileges and honors, but he made him responsible for the conduct of the Greeks. The Greek clergy had long before taken an active part in the administration of justice. The bishops had the decision of all questions connected with marriages and wills. They were consulted by their people not merely in spiritual but in nearly all civil matters. The sultan had hold of this clerical influence through the patriarch. He practically appointed the patriarch, the patriarch appointed the bishops. All the great officials of the church thus held their positions under the sanction of the sultan, and could be removed by him. There is no doubt that patriarch and bishops and higher clergy, thus playing the humiliating part of keeping their fellow-countrymen in due subjection to the Porte, did not and could not display very high virtues. They soon contracted all the vices which defile men who have to play a double part; they were true neither to the sultan nor to the Greeks; and they were animated generally by a mean and selfish ambition. By degrees the patriarchate came to be bought from the sultan by higher and higher prices. The patriarch made up his losses by selling the bishoprics, and simony thus became universally prevalent. Notwithstanding all these drawbacks the maintenance of the Greek Church helped to keep the Greeks together, and when a better time came, the high positions which the clergy held enabled them to accomplish much for the spread of enlightenment and the awakening of true national feeling. Even in the darkest time patriarchs appeared who were capable of the greatest sacrifices for their church and nation, and in the war of independence several of the clergy stood in the foremost rank. The inferior clergy throughout the whole time were true to their people; but as they were to a large extent uneducated, and had to maintain themselves by some handicraft, they differed in no respect from the great body of the people, to whose industry and real worth the permanence of the nation is mainly due.

Another circumstance favorable to the Greeks was that the Ottomans allowed them to retain the communal system which had existed in earlier times. By this system, which, however, did not prevail in all parts of Greece, and where it did exist was not carried out always to the same extent, all the males of full age in each district elected a man who was to take special charge of local affairs. These men went by various names, such as demogerontes, gerontes, archontes, proesti, and epitropi. The Ottomans found the system helpful. The proesti had to keep on good terms with the Turks, and were indeed frequently farmers of the taxes from the Turks. They were also often exceedingly ambitious and cruel. But they were often men of intelligence and influence; and when the war of independence broke out, some of them took a prominent part. There cannot be a doubt also that the local self-government which was thus allowed to exist helped to keep up the longing for liberty and to prepare the nation for a constitutional government.

The Greeks showed their aptitude for combination and self-government also in mercantile affairs. From an early period they had taken to mercantile pursuits, and their position was in many respects advantageous for trading. The Turks were not successful in trade, and indeed did not care to pursue it. They therefore willingly left it in the hands of the Greeks, and various events and circumstances had favored them. The Turks imposed a heavier duty on goods exported or imported by Greeks than on those possessed by Turks. The result of this regulation was that the sultan saw it to be his interest to encourage Greek rather than Turkish traders, as his revenue from the former was much greater than from the latter. Various privileges were gained by the Russians for their own traders, and the Greeks were permitted to enjoy these under the Russian flag. Then, during the war which France waged against all Europe, Turkey was for a long time neutral, and the subjects of Turkey could trade where no others could. Under these and similar conditions the Greek traders spread themselves over the whole of the Mediterranean, and many of them became very wealthy. In this prosperous state of matters various Greeks combined and formed large joint stock companies. Thus the association of Ampelakia, employed principally on cotton fabrics, embraced twenty-two villages. All the inhabitants of twenty-five years and upwards had a right to vote in the election of the five directors who managed the different departments of the company's activity. The profits were divided at the end of each year according to certain rules. Similar commercial communities existed in Philippopolis, Mademochoria, Calarryta, Soracos, Chios, and Cydonia. Most famous among such combinations were the unions among the sailors of Hydra, Spezzia, and Psara, by which those islands rose to great wealth and importance, and formed most powerful auxiliaries in the struggle for independence.

There were other positions of still greater eminence to which the Greeks rose. The Ottomans for a considerable time after the fall of Constantinople were characterized by a strong literary spirit and a desire for culture, but this spirit declined, and the pursuit of learning was left to the Greeks. But a European Government requires men of culture, if for no other purpose, at least that it may hold intercourse and enter into negotiations with the other European powers. The Ottomans felt this necessity, and accordingly in 1666 they appointed Panayiotes Nicouses dragoman or interpreter. He was succeeded in this office by Alexander Mavrocordatus, who highly distinguished himself in various political transactions of great importance. The office of dragoman became permanent; a Greek was always appointed; and thus Greeks came to have rare opportunities of influencing the sultan. Not long after the establishment of this office another was instituted, that of dragoman or interpreter to the capitan pasha or chief Turkish admiral, whose business it was to arrange all matters connected with the fleet. Still further, the Turks thought it advantageous that the northern provinces of Wallachia and Moldavia should be ruled by Greeks, and generally those who had acted as interpreters to the sultan or to the capitan pasha were appointed as waiwodes or hospodars of Wallachia. These men became practically kings of these provinces, and Greeks from all parts flocked to hold offices under them. The Greeks who received these high appointments lived, when their duties did not call them away, in the part of Constantinople called Phanarion in which the patriarchate was placed, and hence they were called "Phanariots." They increased greatly in number, and at length formed a large, powerful, and wealthy community in the city of the sultan. The character of these phanariots has not been painted in bright colors by historians, but their circumstances were strongly antagonistic to the development of a high moral tone. They had above all to gain the favor of the sultan, and to stand well with the influential Turks. They could accomplish this only through double-dealing and through extortion. They were also ambitious, and had no scruple as to the means employed in attaining the objects of their ambition. It is affirmed that the Wallachians and Moldavians detested their rule even worse than that of the Turks; but this can be accounted for satisfactorily by the consideration that nothing could be more humiliating than to be ruled by men who had the appearance of princes but were in reality slaves, without our supposing that their rule was more than ordinarily cruel and rapacious. And much has to be said in their favor. They had the strong Greek love of culture. They sent their sons to the best universities in Europe, and in this way the phanariots became men of great refinement and intelligence. Many of them take a distinguished place in the history of their country's literature. They also established schools everywhere, and vigorously supported those they found existing. The schools or rather colleges of Bucharest and Jassy rivalled that of Jannina in the number of able men they trained to guide and animate their country in its seasons of perplexity.

It was through these and similar instruments that the Greeks were being prepared during the Turkish and Venetian rule to struggle for their independence. Some of the Greek tribes had never been perfectly subject to the Ottomans, especially the Mainotes of the Peloponnesus and the Sphakiots of Crete. Many Greeks had led an independent life as pirates or as klephts. Piracy was indeed put down by the European Governments; but the klephts or brigands remained living on plunder of Greek and Turk alike, proud of their liberty, in their hill fastnesses. There were also in Albania, Thessaly, and Greece proper bodies of Christian warriors, called armatoli, who acted as bands of armed police, but whose actions came often to be confounded with those of the klephts. In regard to the other Greeks it must be affirmed that they were broken in spirit. Finlay asserts that they never once rose against their oppressors. Paparrhegopoulos tries to show that the very opposite was the case; but all he proves is that the Greeks were ever ready to take up arms against the Turks at the instigation of any foreign power. They rose up incited by France, by Spain, by the Venetians; and in later times they were continually rising through the secret instigations of Russia. But they never once rose of their own accord. The reason was that they had no means of taking combined action. The great bond of sympathy which attached the various Greeks together during the 16th and 17th centuries was their religion. But a new inspiration came with the advance of culture in the end of the 18th and the beginning of the 19th century. They began to be animated by the feeling of nationality. The French Revolution roused their minds into activity, and they were ashamed that a nation which had played such a grand part in the early civilization of mankind should be the slaves of an illiterate and barbarous horde of aliens. Circumstances favored the movement. Especially prominent amongst these was the conduct of Ali Pasha, the tyrant of Jannina. This daring and unscrupulous despot conceived the idea of cutting his connection with the sultan and assuming the absolute government of Albania. His effort showed how weak the Turkish empire was, and how loosely it held together. Stimulating also was the conduct of the Suliotes, who performed prodigies of valor in their resolution to defend their homes and their liberties. A secret society was formed to make ready for a rising of the people. The people were stimulated by patriotic songs, especially those of Rhigas of Velestino; and the agents of Russia were everywhere.

Accordingly in 1821 the war for independence broke out. It would be impossible in the limits of an article like this to give a proper account of the various conflicts between Greeks and Turks, of the quarrels among the Greeks themselves, and the windings of European diplomacy in its interference in the contest. The principal events may be shortly noted. The insurrection was begun by Prince Alexander Hypsilantes, a phanariot in the service of Russia, who had been elected head of the chief secret society (the φιλικὴ ἑταιρεία). He crossed the Pruth March 6, 1821, with a few followers, and was soon joined by several men of great bravery at the head of considerable troops. But the expedition was badly managed, and in June Hypsilantes fled to Austria, having entirely failed in his object. And in all the efforts to overthrow the power of the Turks in the northern provinces the Greeks failed, though some men fought very bravely. In the Peloponnesus the insurrection broke out also in March in several places, and most prominent among the first movers was Germanos, archbishop of Patras. Everywhere the Greeks drove the Turks before them; they were so successful that in January, 1822, the independence of Greece was proclaimed. But they soon began to quarrel among themselves. Several assemblies were held. Mavrocordatus, one of the phanariots, was appointed president. But the aspirants for honors and rewards were numberless, and they could not agree. Accordingly a civil war raged in 1823 and 1824, inspired by Colocotronis, a chief of klephts who attained great influence, and in 1824 another civil war of short duration, called the war of the Primates. During this period the Greek fleet was very active, and did good service. It was ably led by Miaonlis, a man of firm character and great skill. And he was well seconded by the intrepid Canaris,[1] whose fire ships did immense damage to the Turkish fleet, and filled the Turkish sailors with indescribable terror. For the ravages of the Greek fleet the Turks wreaked fearful vengeance on the innocent inhabitants of the lovely island of Chios (April, 1822), butchering in cold blood multitudes of its peaceful inhabitants, and carrying off others to the slave market. The savage atrocities then perpetrated caused a thrill of horror throughout the civilized world. Two years after they perpetrated similar outrages on the islands of Kasos and Psara. The sultan now invoked the aid of Mehemet Ali, pasha of Egypt, and his stepson Ibrahim landed on the Peloponnesus with a band of well-disciplined Arabs in 1824. Ibrahim carried everything before him, and the Greeks lost nearly every place that they had acquired. Some towns offered a strong resistance, and especially famous is the siege of Mesolonghi, which lasted from 27th April, 1825, to 22d April, 1826 Nothing could exceed the firmness and bravery displayed by Greek men and women during that siege; and their glorious deeds and sad fate attracted the attention of all Europe. The interest in the Greeks, which had been to some extent aroused by Lord Byron and other English Philhellenes in 1823, now became intense, and volunteers appeared from France and Germany as well as from England and America. Lord Cochrane was appointed admiral of the Greek fleet, and Sir Richard Church generalissimo of the land forces, but they did not prevent the capture of Athens by the Turks, 2d June, 1827. Most of the European Governments had remained indifferent, or had actually

[1] [Constantine (1790–1877), burned Turkish vessels and dispersed the fleets at Chios, Tenedos, and Samos, assailed Egyptian fleet at Alexandria, flag officer under D'Istria, cabinet minister under Otho, and prime minister under King George.—Am. Ed.]

discouraged the outbreak of the Greeks. Russia had disowned Hypsilantes. The monarchs of Europe were afraid that the rising of the Greeks was only another eruption of democratic feeling fostered by the French Revolution, and thought that it ought to be suppressed. But the vast masses of the people were now interested, and demanded from their Governments a more liberal treatment of Greece. Canning inaugurated in 1823, and now carried out, this new policy in England. An accident came to the aid of the Greeks. The fleets of England, France, and Russia were cruising about the coasts of the Peloponnesus, to prevent the Turkish fleet ravaging the Greek islands or mainland. Winter coming on, the admirals thought it more prudent to anchor in the Bay of Navarino, where the Turkish fleet lay. The Turks regarded their approach as prompted by hostile feelings and commenced firing on them, whereupon a general engagement ensued, in which the Turkish fleet was annihilated, 20th October, 1827. Shortly after (18th January, 1828) Capodistrias, who had been in the service of Russia, was appointed president of Greece for seven years, the French cleared the Morea of hostile Turks, and Greece was practically independent. But several years had to elapse ere affairs reached a settled condition. Capodistrias was Russian in his ideas of government, and, ruling with a high hand, gave great offence to the masses of the people; and his rule came to an untimely end by his assassination on 9th October, 1831. Anarchy followed, but at length Otho of Bavaria was made king, and the protecting powers signed a convention by which the present limits were definitely assigned to the new kingdom (1832). Henceforth Greece has existed as a recognized independent kingdom. Throughout the whole of the war of independence in Greece, the people behaved with great bravery and self-sacrifice. They showed a steady adherence to the idea of liberty. They were sometimes savage in their conduct to the Turks, and barbarities occurred which stain their history. Yet on the whole the historian has much to praise and little to blame in the great mass, especially of the agricultural population. But no single man arose during the period capable of being in all respects a worthy leader. Nor can this be wondered at. All the men who took a prominent part in the movements had received their training in schools where constitutionalism was the last doctrine that was likely to be impressed on them. Several of them had been in the service of Russia, and had full faith only in arbitrary power. Many of them were phanariots, accustomed to double dealing, ambitious and avaricious. Some of them had been brought up at the court of Ali Pasha of Jannina, and had become familiar with savage acts of reckless despotism. Others had been and indeed remained during the continuance of the war chiefs of klephts, having but little respect for human life, and habituated to scenes of cruelty and plunder. Some of them also came from the Mainotes, who owed their independence to the habitual use of arms, and who were not troubled by many scruples. It could not be expected that such men would act with great mercy or prudence in dealing with Turks who had butchered or enslaved their kinsmen and kinswomen for generations. Even amongst the foreigners who volunteered to aid the Greeks, few if any were found of supreme ability, and after the kingdom was established the Greeks were unfortunate in the strangers who came to direct them. Otho had been brought up in a despotic court, and knew no other method of ruling. He brought along with him Bavarians, to whom he entrusted the entire power, and the Greeks had the mortification of knowing that, though their kingdom was independent, no Greek had a chance of being elevated to any ministerial office of importance. Accordingly a revolution broke out in 1843; the Bavarians were dismissed, and Otho agreed to rule through responsible ministers and a representative assembly. But he failed to fulfil his promise. Discontent reached its height in 1862, when another revolution broke out and Otho had to leave Greece. The great mass of the people longed for a constitutional monarchy, and gave a striking proof of this by electing Prince Alfred king of Greece. This choice was determined by universal suffrage, and out of 241,202 Greek citizens who voted 230,016 recorded their votes in favor of the English prince. The vote meant simply that the Greek people were tired of unconstitutional princes, and hoped that they would end their troubles if they had a prince accustomed to see parliamentary government respected and enforced. The three protecting powers,—England, France, and Russia,—had however bound themselves to allow no one related to their own ruling families to become king of Greece. When the Greek people received this news, they begged England to name a king, and after several refusals England found one in Prince William of Schleswig-Holstein, son of the king of Denmark. The Greek people accepted him, and in 1863 he became king with the name of George I. Britain added the Ionian islands to his kingdom. In 1875 the ministry gave great offence to the Greek people by its unconstitutional procedure, but the king persisted in standing by it. The people, however, persevered in the use of legitimate means to oust the ministry; the king at last prudently yielded; and thus a revolution was prevented. The effort of the Greeks to extend their boundaries is the last phase of their history, and is still in progress. In 1853, when the Crimean war broke out, the Greeks sided with the Russians, and in 1854 they made inroads into Thessaly and Epirus, but English and French troops landed at the Piræus, and forcibly put an end to the Russian alliance and to Greek ideas of acquiring additional territory. In 1866 to 1869 the Cretans struggled bravely but unsuccessfully to throw off the Turkish yoke and become a part of the Greek kingdom. And recently when the Russians made war on the Turks the Greeks were eager to enter Thessaly and Epirus to aid their fellow-countrymen in asserting their freedom. But England interfered with the promise that Greece would gain more by maintaining a peaceful attitude. A clause in the Berlin Treaty affords a basis for the fulfilment of this promise; but the promise has still to be fulfilled. The Greeks themselves believe that with the extension of their boundaries there will be less occasion for intrigue, ministries will be more permanent, and the Greeks who now flock from all parts to the little kingdom of Greece for official employment will have a wider sphere and will be more contented.

The authorities for this section, some of which have been mentioned in the previous article, are very numerous. See *e. g.*, the ἱστορία of Paparrhegopoulos, vols. v. and vi., and his French work *Histoire de la civilisation Hellénique;* Finlay, vols. v. vi. and vii.; Herzberg, vols. iii. and iv.; Karl Mendelssohn Bartholdy's *Geschichte Griechenlands von der Eröberung Konstantinopels durch die Türken im Jahre 1453 bis auf unsere Tage;* Sathas, Ἑλλὰς Τουρκοκρατουμένη, and the Chroniclers in his *Bibliotheca Græca Medii Ævi;* and Gervinus, *Geschichte des neunzehnten Jahrhunderts*, vols. v. and vi. For the Greek Revolution, besides the four first mentioned, there are Gordon and (in modern Greek) Trikoupis. There are many treatises on special portions, such as those of Philemon, Perrhævos, Phrantzes, Colocotronis, Von Maurer, Prokesch-Osten, Parish, and many monographs on the history of the various islands. More recent English works are an article by Mr. Gladstone, "The Hellenic Factor in the Eastern Problem," published first in the *Contemporary Review*, and now in his *Gleanings;* Freeman's *Ottoman Power in Europe;* Sargeant's *New Greece;* and "Mr. Gladstone and the Greek Question," being iii. of *Diplomatic Sketches by an Outsider.* (J. D.)

PART III.—GREEK LANGUAGE.

The possession of a common language was always regarded by the Greeks themselves as the most significant and important of the bonds which united the scattered members of the Hellenic nationality. Wherever there was a community speaking the Greek tongue, whether in Europe, Asia, or Africa, from Olbia on the Hypanis to Cyrene in Libya, from Salamis in Cyprus to Mælaca near the Pillars of Hercules, there was a portion of the Hellenic people linked to the rest by mutual intelligibility, and sharply marked off from the jabbering and inarticulate βάρβαροι who surrounded them. The earliest written records of this speech are probably to be found in what was at the same time the most precious common possession of this great nationality, the poems that bear the name of Homer. It is possible indeed that, in the form in which they have come down to us, they are later than the fragments of the earliest elegiac and iambic poets, such as Callinus, Mimnermus, Archilochus, and Simonides of Amorgus; but it cannot be doubted that in substance they go back to an earlier date. These, however, are in a literary language,—a language which bears the most evident marks of a free combination for artistic purposes of various popular dialects, along with many reminiscences of archaic forms and usages, and not a few formations due only to false analogy. For the early history of the Greek language we are obliged to have recourse to the reconstructions of linguistic science.

Origin of the Greek Language.

The common Indo-Germanic language.

Comparative philology shows us that there was a time when the ancestors of the various nations which speak what are generally known as Indo-Germanic[1] languages lived together and had a common speech. From the extent and character of the agreement between these various languages at the time when they first become known to us from written records, it is possible to a certain extent to determine which groups remained the longest in connection with each other, and which parted off the soonest from the common stock. Unfortunately scholars are as yet by no means at one as to the results to which this method of inquiry leads us. Schleicher, *e. g.*, held that the agreement between the Aryan or Asiatic group of languages and the South-European (in which he includes not only Greek and Italian, but also Celtic) is closer and more significant than that between the latter and the North-European, *i. e.*, the Teutonic and the Letto-Slavonic group. Max Müller and Joh. Schmidt maintain that the relations of the various languages are so complicated that it is impossible to establish any "genealogical tree," or to determine the order in which they separated from each other (see Schmidt's *Die Verwandtschaftsverhältnisse der Indogermanischen Sprachen*, Weimar, 1872). But the prevailing view is still that of Lottner, Curtius, Jolly, Fick, and Scherer, that we may with confidence assume the first division to have been that between the Aryan or Asiatic (Indo-Persian) and the European groups, and that there are sufficient points of agreement between all the European languages to warrant us in assuming that there was a period of some duration during which the European peoples remained united.

The common European language.

Of these points of agreement the most important are the following :—

1. The vowel *a* is found to have "split" on European soil into the three vowels *e, a, o*,—that is to say, there are numerous instances in which the European languages agree in degrading a primitive *a* into *e* or *o* when the Asiatic tongues either retain the *a* or weaken it quite independently into *i*.

2. The Europeans agree in softening a primitive *r* into *l*, where the Asiatics have retained *r*.

3. There are a large number of new words, and apparently even some new roots, common to most, if not to all, the European languages, of which no trace is to be found among the Indo-Persians.[2]

These facts cannot be set aside by instances of agreement in inflection or syntax between Greek and Sanskrit, for example, for it is much easier to believe that at the comparatively late date at which any Teutonic language is known to us,—and much more so, at the far later date of the earliest Celtic records,—the inflections which they presumably once had in common with Greek had become to a large extent worn away and unrecognizable and the syntactic constructions modified, than to suppose that such numerous instances of agreement were wholly fortuitous.

The Græco-Italic language.

A similar course of argument fairly leads to the presumption of a common Græco-Italic nationality. The agreement in vocabulary is still closer than that between the various members of the united European group: for instance, while the general terms for agriculture are shared not only by Greeks and Italians, but also by Teutons, Celts, Slavs (though not by Indo-Persians), there are many special terms which are only found on Greek and Italian soil, the most interesting among them being perhaps the words for *wine* and *oil*. Other words, again, which are used with a more indefinite meaning by the Europeans generally are specialized and differentiated in Græco-Italic (Fick, *Vergl. Wörterb.*, ii. pp. 1-288; Curtius's *Principles*, 230b, 234, 597, etc.). Whether we may also assume (as is done, *e. g.*, by Professor E. Curtius, *History of Greece*, vol. i. p. 19) that there was a common Græco-Italic law of accentuation is very doubtful, in face of the arguments advanced by Corssen in favor of a freer law of accents in the earlier times, both in Greek and in Latin. It is much more probable that the rigidity of the Latin system, and the exquisite flexibility and harmony of the Greek, were developed quite separately from a more fluid state. But undoubtedly there is a far greater similarity in the inflectional system of Greek and Latin than can be established between either of these and any other member of the group.[3]

Stages of development in inflection.

At the time when the common Indo-European unity was first broken up, the language had reached a stage of development which may be given with some confidence as follows. The steps assumed are those which have been established by Professor Curtius in his monograph *Zur Chronologie der Indogermanischen Sprachforschung* (2d edition, Leipsic, 1873). In spite of the criticisms to which this scheme has been subjected, by far the most important of which are those by Max Müller and Ascoli, it may fairly be said to maintain its ground, and it is reasserted with full confidence in Curtius's admirable work on the Greek verb.

Roots.

We start with the period in which roots alone were employed as words. As to the origin of these roots, philology is as yet quite unable to speak with any positiveness: all that can be said is that the imitative or onomatopoetic theory has not been proved to be capable of producing all the roots which we are compelled to postulate, while, on the other hand, no theory has been generally recognized as fit to be regarded as a serious rival. It is clear, however, that we must admit an extremely early if not an absolutely primitive, distinction of roots into verbal and pronominal roots, *i. e.*, (1) such combinations of sound as were significant, and carried with them a notion which was vague and general, if not philosophically abstract, and (2) such as had no meaning in themselves, but only served to denote relations.

Roots "determined."

The second stage is that of the "determination" of roots, wherein, by the addition of different phonetic elements, they acquired a differentiated meaning—*e. g.*, when the very vague *ju*, "join," became *ju-g*, "join together," *ju-dh*, "join in battle." (It may here, however, be open to question whether the fuller forms were developed from the shorter by additions, or the shorter abstracted from the group of similar fuller forms, as Max Müller is rather inclined to hold.)

Verbs.

The third stage is that of the formation of verbs, by the close combination of a verbal root with one or more pronominal roots, to denote the character of the subject of the verb. It is in the nature of this combination that we find the distinguishing feature of the Indo-Germanic stock of languages. At the same time we find (1) the "strengthening" of the vowel of the root, by the addition of the simplest vowel-sound *a*, to denote repeated or continuous as distinct from momentary action; (2) *reduplication*, originally producing the same effect, but afterwards, in a specialized form, denoting the continued result in the present of an act done in the past; (3) the *augment*, a particle, originally demonstrative in its nature, prefixed to a verb to denote that the action expressed by the verb took place at a time removed from the present, *i. e.*, in the past. To the same stage (though possibly to a later part of it) belongs the further development of terminations, so as to mark an action as having a special reference to the subject; this produces what is in Greek conventionally called the middle voice, but what is really a reflexive formation. We may take as types of the words created during this stage such forms as *da-ta*, "give there," *i. e.*, he gives; *da-da-ta*, "he is giving;" *a-da-m*, "I gave;" *da-da-mai*, "I give with a view to myself."

Stems.

In a fourth stage we get the expansion of the root into a stem, occasioned apparently, in the first instance, by the increasing need of distinguishing the noun from the verb. The earliest method of forming a stem was by the addition of a "thematic vowel" *a* to the root, to convey the notion of a continuous action; thus from *bhar*, "carry," came *bhar-a*, "carrying." Sometimes the vowel of the root was "strengthened" along with the addition of the thematic vowel; thus *rik*, "leave;" *raika*, "leaving." Afterwards other similar formative elements (or pronominal roots) such as *ta*, *na*, *ma*, *tra*, etc., were added to produce nominal stems of many various kinds. There is no reason to suppose that these were at first strictly

[1] The numerous and forcible objections to the term "Aryan" have been often pointed out, and the word finds little favor with most philologists. For the most recent defence of it see Zimmer in Bezzenberger's *Beiträge*, vol. iii. pp. 137-158. The name "Indo-European" is apparently, but not really, more exact.

[2] See Curtius, *Ueber die Spaltung des A-Lautes*, Leipsic, 1864; Fick, *Die ehemalige Spracheinheit der Indogermanen Europas*, Göttingen, 1873; *Vergleichendes Wörterbuch der Indogermanischen Sprachen*, 3d edition, Göttingen, 1876, where the list of common European words fills vol. i. pp. 471-843. Compare *Grundzüge*, p. 93.

[3] Schleicher's doctrine as to the close relation of the Latin and the Celtic inflections is not now generally accepted.

differentiated in meaning; thus *par-nu-* is "filled" not "filling" but *su-nu-* may be taken either actively or passively, "the begetter" or "the begotten," and *tap-nu-* is "the burning" fever. Subsequently the instinct of language availed itself of variations in form to distinguish various relations, especially of gender. Again, when noun-stems came to be used, as the roots had previously been used, to form verbs by the addition of the personal terminations, this modification of the stem served to distinguish mood. Thus when the vowel *a* was added to a root from which a verb was already formed, the inflections of this extended root or stem denoted an action *intended* to be performed, and thus acquired the force of a conjunctive mood. The addition of the vowel having thus obtained this differentiating power, it was afterwards affixed with the same force to stems already provided with *a*, the contraction of *a*+*a* giving *ā*; hence, just as *han-ti* is "he kills," *han-a-ti*, "let him kill," so we get *bhara-ti*, "he is carrying," *bharā-ti*, "let him be carrying."

Compound stems.

In a fifth stage compound verbal forms make their appearance, *i.e.*, tense-stems are produced by the union of primary verb-stems with the roots of verbs which have become simply auxiliary. That this must have been at a later stage than the preceding processes is clear from the fact that verbs only gradually lose their full meaning, and sink into auxiliaries. The verbs so used are (1) *as*, originally "breathe," afterwards "be;" (2) *ja*, "go;" (3) *dha*, "do." From the composition of the first with a verb-stem we get forms like those of the compound or so-called first aorist—*e.g.*, *a-dik-sa-t*, "he pointed" (=ἐ-δεικ-σε-τ). Here we have the union of a root (in this case acting as a noun-stem) with the auxiliary verbs in the third person, preceded by the augment, *a-dik-sa-t* is to the earlier form *a-da-t* much as "tum dicens erat" is to "tum dans." These formations belong to the earliest stratum of this period, inasmuch as the stem appears in its simplest form. For a like reason we must assign to the same stratum the compounds of *ja* with the simple stem. This auxiliary is used to denote relations which were at first somewhat indefinite but were afterwards more precisely differentiated. There is (1) the present of *duration*: *e.g.*, *svid-jā-mi*, "I am sweating;" (2) the *passive* force thus derived, as in Sanskrit *ja* is a sign of the passive: *e.g.*, *bódh-a-ti*, "he knows," *bodh-jā-tē*, "he is known;" (3) the tendency to do a thing, *i.e.*, the *optative* mood: as in *as-jā-m*, the primitive form of *siēm* (*sim*) and εἰην. There is also to be noted, as belonging to this stage, the very important present of duration from the root *as*, *i.e.*, *as-já-mi*, which acquired for itself, and when affixed to roots or stems gave to them, the force of a future. With regard to the root *dha*, the widely varying force which its compounds have in the different cognate languages prevents us from determining with certainty the manner in which it was originally employed in composition (*cf.* Curtius, *Das Verbum*, ii. 352). To a second stratum of the same period must be assigned those compound verbal formations in which the stem is not a pure root, but has already been developed into a stem which has the character of a noun. If we compare, *e.g.*, *bhāra-jā-mi* (=φορε-jω-μι), "I am bearing," with *svid-jā-mi*, we find in the first a nominal theme employed for composition and inflection, in the second a simple root. It is of much importance to notice that here too the verbal formation must have preceded the formation of cases. Had the accusative *bhāra-m* been in use, it would have been impossible not to employ it in connection with a verb-form like *jā-mi*, just as the Romans said *venum dare*, *datum iri*, and the like, and as Sanskrit forms the periphrastic perfect of the tenth conjugation, by uniting the auxiliary verb with the accusative — *e.g.*, *k'órajām k'ákâra*, *bodhajām babhûva*, etc. We are led to the same conclusion by considering forms like *a-dik-sa-nt*, by which the absence of plural inflection is not less clearly indicated than the lack of case-inflections by *bhāra-jā-mi*. It has been urged, *e.g.*, by Professor Max Müller, that this argument is a weak one, because our ancestors must have felt the need for clearly distinguishing the plural from the singular, and the nominative from the accusative, before the need for denoting the differences between the persons. To this it may be replied (1) that the argument from what *must* have been is one of the most dangerous that can possibly be used in philology; conclusions *a priori* have again and again been disproved by a more complete acquaintance with the facts of the history of language; (2) that, as a fact, incompletely developed languages do find it more easy to do without distinct marks of the cases than to dispense with personal inflections, and that this is confirmed by languages like English and French, which have returned to an uninflected state more completely in the case of nouns than in that of verbs; (3) that in the inflection of nouns the sign of the plural is added to the case-suffix and not *vice versa* (*e.g.*, λύκους = λυκον-ς = *varka-m-s*), so that the use of the sign of case must have preceded that of the sign of number, although the latter might have seemed to us the more indispensable. Professor Müller's argument that composition might have taken place in times subsequent to nominal inflection, because the stem-forms show themselves in certain cases of declension, and therefore might have remained present in the consciousness of those using the language, breaks down upon the essential distinction between the nature of the composition of the verbal forms in primitive times and of the construction of compound verbs within the historical period. We may therefore safely follow Curtius in holding it as at least highly probable that verbs were already inflected according to person, tense, mood, and voice at a time when nouns were still in the state either of simple roots (*e.g.*, *vāk*) or nominal themes (*bhara*, *akva*, *sunu*, *pati*, and the like). The needs of language at this stage were probably helped out (as at present in uninflected languages) by the position of the words, by the stress of the voice, and by a free use of pronominal roots, which may have been already acquiring somewhat of a prepositional force. But one of the most important means of expression was undoubtedly composition. The form which the elements of compounds take, rarely (and apparently never in any early word) appearing with any case-inflection of the first element (as in οὐδενόσωρα, διτρεφής, ἀμφορεαφόρος), but presenting themselves simply as stems (λογο-γράφο-ς, etc.), shows that at any rate the mould in which they were cast, the analogy on which later compounds were freely fashioned, was constructed at a time when nouns were not inflected. The various relations which the factors of the compounds bear to each other point to the same fact. We find in Greek, according to the very clear and careful statement of Curtius (*Grammar*, § 359, *cf. Elucidations*, pp. 172–178) three kinds of compounds: (1) *determinative*, in which the second factor is the principal, which, without altering its meaning, has it defined by the first, *e.g.*, ἀκρόπολις = ἄκρα πόλις, (2) *attributive*, where the first factor defines the second, but so as to alter its meaning, the two combining to form a new idea; *e.g.*, μακρό-χειρ = μακρὰς χεῖρας ἔχων, (3) *objective*, in which one of the two words is grammatically governed by the other, so that in paraphrasing one of the two must be put in an oblique case; *e.g.*, ἡνί-οχο-ς = τὰ ἡνιά ἔχων, φιλό-μουσο-ς = ὁ τὰς Μούσας φιλῶν, ἀξιό-λογο-ς = λόγου ἄξιος, θεο-βλαβής = ὑπὸ θεοῦ βεβλαμμένος, χειρο-ποίητο-ς = χερσὶ ποιητός. (Similarly Max Müller, *Sanskrit Grammar*, § 513, gives six classes of Tatpurusha compounds, according as the first element stands in an accusative, instrumental, dative, ablative, genitive, or locative relation to the second, with numerous examples.) Curtius justly calls attention to the epithet πατροφονῆα as applied in the *Odyssey* to Ægisthеus in relation to Orestes, "one who had slain his father." It is evident that composition, used as freely as forms like these indicate, could have taken very largely the place of case-inflections.

Compounds.

The origin of the cases, which marks a sixth stage, presents much more difficulty than the origin of verbal flection. But one broad division may at once be made. The vocative, nominative, and accusative are connected together much more closely than the remaining cases; they coincide in the neuter gender, and no one of them ever interchanges with or becomes equivalent to any one of the other group. On the other hand, in Sanskrit the ablative often coincides with the genitive, and the locative (in the dual) with the genitive or dative, while in Greek the instrumental is replaced by the dative, in Latin by the ablative; dative and genitive coincide in the Greek dual, dative and ablative in the Latin plural, and the locative always in Latin coincides in form with genitive, dative, or ablative. The vocative may be regarded as a relic of the preceding uninflected stage. The nominative and accusative are closely connected with theme-formation, and seem to have been but a new development of the same principle. From a root *svap*, "sleep," came, as has been seen, at an early stage *svap-na*, "sleeping;" from *kar*, "make," came *kar-ta*, "made." It was only an extension of the same method when the pronominal *sa* and *ma* were added to the themes thus formed. Nominal inflection was created as

Cases.

soon as it came to be recognized that the last additions were movable, and that the same stem might, according to circumstances, appear with one or the other or with neither. The fact that *-m* is found as the suffix of the nominative in some pronouns (*e. g.*, Sanskrit *aha-m* = ἐγώ-ν, *tva-m* = τυνή, etc.) seems to point to a time when this was used as a determinative for nominative and accusative alike; but it soon became specialized as a characteristic of the latter. There is reason to believe that this process was facilitated, if not occasioned, by the use of the *m*-suffix to denote gender, or more strictly the absence of gender, in neuter nouns. It was only natural that the same suffix which distinguished the theme as a living being should be applied to mark it out as the subject or source of an action, while, conversely, that which denoted the absence of life should be used to mark the object. It is no improbable conjecture which finds in this accusative character of the sign of the neuter the explanation of the ordinary Greek idiom which constructs a neuter plural substantive with a singular verb; τὰ ζῷα τρέχει, "the animals are running." Further, the wide and varied usage of the accusative case in Greek appears to point to a time when it was the only oblique case. At a later period the second group of cases made its appearance; this includes at least the genitive, ablative, dative, locative, instrumental, and sociative. Whether we are also to regard the various terminations which appear in some adverbs, which cannot be referred to any one of these, as originally case-suffixes is a question not easy to determine, and one which is, after all, rather one of terminology than of any real importance. The theory of the purely local force of the cases, attractive as it is at first sight from its simplicity, and its apparent conformity with the sound theory which bids us, in dealing with language, proceed from the concrete to the abstract, and not *vice versa*, breaks down when we come to apply it in detail. For the genitive, at any rate, it is much safer to postulate an original adjectival force, a view borne out both by striking similarity of formation in some instances (*cf.*, *e. g.*, δημο-σιο, the earlier form of the Homeric δήμοιο, the Attic δήμου, and δημό-σιο-ς, "belonging to the people") and by numerous analogies from various languages. It has even been conjectured, though perhaps on inadequate grounds, that the genitive had originally the final *s*, which was dropped only when the sense of its origin became obscured. In the ablative we have apparently a use of the pronominal element *-ta* corresponding to that of *-sa* in the genitive, and originally in the nominative, the *a* being afterwards dropped, so that *vāk-a-s* = *vocis* is to *vāk-a-t* = *voce(d)* as *ja-s* = *is* is to *ja-t* = *i-d*. The syntactic force of the ablative may often be represented as adjectival; and the differentiation of the two cases may well be a product of later times. The earliest forms of the other cases, the formation of which has not hitherto been satisfactorily explained, will be pointed out below.

Second group of cases.

Adverbs and prepositions.

In the seventh period assumed by Curtius we have the *petrifaction* of some forms of particular themes with case-suffixes, which were no longer declined throughout, and thus gave rise to adverbs and prepositions. The adverbial force was undoubtedly the earlier, as we can see from indications in the Homeric poems; the prepositional force came later, first perhaps in connection with verbs, and afterwards as governing cases.

Infinitives.

To the same period probably belongs the singularly interesting form of petrified cases presented by infinitives. These have long been recognized as cases of verbal nouns (*nomina actionis*) no longer inflected throughout. The agreement of the cognate languages in the use of this device for extending the range of language seems to be a sufficient indication that it had been introduced before the original unity broke up. At the same time the great variety of the forms actually selected by different languages as the basis of this construction is a clear proof that no well defined system of infinitives had then been brought into use.

Reconstruction of the Indo-Germanic languages.

Such were the stages by which, according to our greatest living authority, that language grew which was destined to be the mother, not only of Greek and Latin, but of almost all the tongues in which human culture has found an utterance. It is by no means impossible to reconstruct it, at least in outline, as it must have been spoken before the original unity broke up. This task has been attempted, so far as its phonetic laws and inflectional forms are concerned, by Schleicher in his well-known *Compendium der vergleichenden Grammatik der Indogermanischen Sprachen* (3d edition, Weimar, 1871). and its vocabulary has been reconstructed by Fick in his *Vergleichendes Wörterbuch* already referred to. Schleicher indeed ventured to narrate a brief story in this primitive language (Kuhn's *Beiträge*, vol. v. pp. 206 *sqq.*).[1] On particular points he may well have been mistaken. The tendency of modern philology is to admit within the period of the united national life a fuller development than that assumed by Schleicher. Several scholars, working along different lines of research and entirely independently, have established the great probability of a bifurcation of the gutturals; and it is by no means certain that the vowel system was not already becoming more rich and varied. We have probably to admit that dialectic differences already existed, such as could hardly have failed to arise, even before the nation broke up completely, so soon as it attained any considerable magnitude. And above all it must never be forgotten that we are dealing with the products of a period to which chronological limits cannot well be fixed, but which language gives us strong reasons to believe must have been at least as long as that to which the data of other branches of anthropology appear to point. It is impossible to be sure that all the elements which are introduced were ever strictly contemporaneous. Our review of the history of the language thus far is enough to show that one form may have begun to show traces of phonetic decay at a time when another form was not yet created. Hence M. Bréal (*Mélanges*, p. 376) does well to warn us against the common error of philologists in endeavoring to get more out of the reconstructed "primitive speech" than the facts on which it is based will warrant. But used with discretion it affords a highly convenient means for stating the results to which the comparison of languages brings us.

For our present purpose it will be well to mark one intermediate stage between the source of the Greek language thus revealed to us and the language itself as given in its earliest records, by noting the common Græco-Italic modifications of the primitive speech.

Indo-Germanic sounds.

The original sounds of Indo-Germanic speech may be conveniently tabulated thus:

	Consonants.						Vowels.	
	Momentary.			Continuous.				
	Unaspirated.		Aspirated.	Spirant.		Nasal.		
	Surd.	Sonant.	Sonant.	Surd.	Sonant.			
Guttural	*k*	*g*	*gh*	...	...	...	*a*	
Palatal	...	...	...	...	*j* (*y*)	...	*i*	*ai*
Lingual	...	...	...	...	...	*r*	...	
Dental	*t*	*d*	*dh*	*s*	...	*n*	...	
Labial	*p*	*b*(?)	*bh*	...	*v* (*w*)	*m*	*u*	*au*

Changes in time of Græco-Italic unity.

That the later surd aspirates (*kh*, *th*, *ph*) were developed from the sonant by the influence of the aspiration seems to have been clearly proved by the very careful researches of Curtius. The fact that while Greek has surds (χ, θ, φ) the Latin representatives of the same are initially the pure aspirate (*h*) or the spirant *f* and medially the corresponding sonants (*b*, *d*, *g*) is enough to show that they had not lost their sonant character in Græco-Italic times.

On the whole the mutes must have remained unchanged. The numerous modifications of the *k* found in Greek (κ, γ, π, τ) are not to be traced in Latin, and although *p* often replaces it in Oscan and Umbrian, the fact that it rarely if ever does in Latin proves that the guttural was unchanged at the time of the separation except in the way of generating a parasitic *w* (*v*) or *y* (*j*).

In the same way Latin shows no trace of the change of *g* to β, though it has the parasitic *v* which sometimes causes the loss of the *g*; thus βίος and *vivus* point to a Græco-Italic *gvigva-s*. It is doubtful whether the primitive language ever used *b* unaccompanied by the aspiration; but Greek and Latin furnish us with sufficient words agreeing in this respect—Fick quotes 25—to make it clear that this letter was so used before the separation.

If Schleicher is right in denying *l* to the primitive lan-

[1] Mr. J. P. Postgate has published a similar composition (*Academy*, June 14, 1879), rewritten by Mr. T. C. Snow (*ib.*, June 28) on the principles of Brugman and De Saussure.

guage—and this seems very doubtful in face of the facts collected by Curtius (*Principles*, ii. 174)—there can be no doubt that this was abundantly developed by the European unity; and there seems to be no single instance of an *r* retained in Latin where Greek has λ, while *villus* as compared with ἔριον is the only case of the converse. The spirants undoubtedly remained in their full vigor.

But while the Græco-Italic consonants are on the whole the same as those of the primitive tongue, there is a highly important and significant change in the vowel-system. The original *a*, retained for the most part in Sanskrit, and modified in Zend only under conditions which make it plain that this is not a phenomenon of very ancient date there, has in Europe undergone a change in two directions. The very valuable paper by Curtius previously mentioned contains five tables, from which it clearly appears that *a*

(1) is retained in 106 Greek and Latin words;
(2) becomes *e* (*i*) in 102;
(3) becomes *o* (*u*) in 56;
(4) (*a*) is retained in Greek, becoming *e* (*i*) in Latin in 21;
(*b*) ditto, becoming *o* (*u*) in Latin in 18;
(*c*) remains in Latin, but becomes ε in Greek in 18;
(*d*) ditto, becoming o in Greek in 11;

while there are

(*e*) 19 words in which Greek ε (ι) answers to Latin *o* (*u*), and
(*f*) 10 in which Greek *o* answers to Latin *e* (*i*).

Hence it is abundantly plain that the "thinning" of the primitive *a* to *e* and its "dulling" to *o* must have taken place in the great majority of instances during the Græco-Italic period. The instances of agreement are three times as numerous as those of disagreement, and most of the latter are to be ascribed to the operation of well-known phonetic tendencies distinctive of the two stocks after their separation. It is worth noticing as to the other members of the European stock that, while there is a striking agreement in the cases of the retention of the *a* or of its weakening into *e*, this is not found with the third process, the dulling of *a* into *o*; it is therefore legitimate to assume that the first was common to the European family, while the second was specifically Græco-Italic. Thus the numeral *octo*, the roots *gno*, "know," *mor*, "die," *od*, "smell," *ok* (*op*), "see," and the words *ovi-s*, *poti-s*, *porko-s*, *ovo-m*, are all Græco-Italic but not European.

Inflection of nouns.

The inflection of nouns was complete before the time of the separation of languages. We have no reason to believe that any new case-form was developed either in the European unity or in any individual nation after this date. The changes are wholly in the direction of loss. The cases which can be shown to have existed, and the terminations by which they were denoted, were as follows:—

	Singular.	Plural.	Dual.
Nominative.....	*-s*	*(s)a-s*	*-(s)ā(s).*
Accusative	*-am*	*am-s*	"
Ablative	*-at*	*bhjam-s*	*bhjām-s.*
Genitive	*-as (asja)*	*(s)ām-s*	*-aus(?).*
Locative	*-i*	*sva(s)*	"
Dative.....	*-ai*	*-bhjam-s*	*bhjām-s.*
Instrumental (i.)....	*-ā*		"
Instrumental (ii.)... (Sociative)	*-bhi*	*-bhi-s*	"
Vocative.....	(no sign).		

In some cases these were modified according to the termination of the stem to which they were suffixed; and the stems themselves suffered phonetic adaptation to the termination. Otherwise there was no distinction of declension, except that the fuller form of the genitive was used for the most part in the case of *a*-stems.

Græco-Italic changes.

If we examine the changes which may be assumed for the Græco-Italic period we find (1) the first instrumental case is retained only in a few Greek and (possibly) Latin adverbs, so that this may be supposed to have dropped out of ordinary flection; (2) the ablative is retained in Latin, and hence it was a Græco-Italic case, though it appears in historic Greek only in adverbs (καλῶς, ὡς, etc.); (3) the loss of the dual in Latin makes it impossible for us to determine exactly the form of its inflections at this period, probably they had already become worn down to something like the form in which we find them in Greek; (4) the existence of a final *s* in the nom. plur. of *o*-stems in some Italian dialects (Old Latin *equis*, Oscan *-os*, Umbrian *-ās*, Oscan fem. *-as*, Umbrian *-as*, *-ar*) shows that the analogy of the pronominal declension had not yet established exclusively the *-oi*, *-ai* terminations, though these were doubtless already in use.

In the flection of adjective pronouns there is an agreement in the nom. plur. (*cf.* τοί, ταί, *is-ti*, *is-tæ*) which may be a Græco-Italic development, the origin of the termination being obscure.

In the declension of the personal pronouns, it is to be noticed that the complete distinction of the stems used in the first and second persons plural (*ἀμμε-*, *ἠμε-*. *ὑμμε-*, *ὑμε-*, as compared with *nos*, *vos*) proves that the parallel forms *asma-*, *nas*, and *jusma-*, *vas* to which Sanskrit points as concurrently existing, were still used side by side.

The comparison of adjectives was made by the employment of the same stem-suffixes (*jans* or *tara*, and *ta*, *tama*, etc.), though a different selection became the normal one in Greek and in Latin.

The inflection of verbs underwent far greater changes than that of nouns, after the separation, but mainly in the way of a fuller development. In Latin, however, we must assume a very extensive replacing of earlier formations by those of later origin; for of many inflections which are shown to have been Græco-Italic by the coincidence of Greek and Sanskrit, there are few if any traces to be found in Latin. The following principles of verbal flection, the chief stages of whose development we have noticed above, had been established in the parent language:—

1. Stems were inflected by the use of suffixes denoting the three persons of the three numbers—singular, dual, and plural.
2. Themes variously expanded were used instead of roots for stems, *e. g.*, *bhara-ti* by the side of *as-ti*. Greek and Latin agree essentially in the methods used for forming present themes.
3. Middle or reflexive inflections were developed by the side of those of the active voice. In Latin this system appears to have lost its significance by the gradual wear and tear of inflections, and to have been replaced by one based on a wholly different principle.
4. A distinction grew up between primary inflections, used for present and future tenses, and secondary inflections, used for past tenses, where the increased length given to the word by the use of the augment caused the lightening of the termination, usually by the loss of the final vowel.
5. To form the conjunctive and optative moods *a* and *ja* (*i*) were added to the tense-stems before inflection.
6. A past tense was formed by the use of the augment and the secondary terminations. This became differentiated afterwards in Greek into (1) past imperfect, (2), simple aorist, according as the theme was or was not used without modification for the present tense. In Latin this tense was as a rule dropped in favor of the compounded past imperfect or perfect, but Curtius has discovered some traces of it still in use.
7. A compound aorist was formed by the help of the verbal root *as*. This is also replaced in Latin by a tense of later creation—the perfect; but its occurrence in Sanskrit establishes it as Græco-Italic.
8. A future was formed by the combination of the roots *as* and *ja*. Of this, again, there are but slight traces in Latin, the ordinary future being either a later compound with the root *bhu*, or an optative in origin; but the agreement of Sanskrit and Greek establishes it for this period.
9. Participles or verbal adjectives were formed by the use of the suffixes *ant*, *vant* for the active and *mana* (*meno*), *ta* for the reflexive respectively.
10. The dative or (possibly) locative case of a neuter verbal substantive was used as an infinitive. It is certain that Latin in all cases adopted a substantive with the suffix *as* (giving *-asai* = *erē*), while Greek in some instances employed one with the suffix *man* or *an* (giving *-μεναι*, *-εναι*, and perhaps in the accusative form *μεν*); it is not clear whether the more common Greek termination *-ειν* is closely connected with the Latin *-ere* (λέγειν = λεγε(σ)εν = legese = legere) as Curtius is inclined to think, or is of distinct origin.

The researches of Curtius on the Græco-Italic vowel-system enable us to determine with some confidence the phonetic character assumed by these inflections. We may give as the common possession, not *bharami*, etc., but

bherōmi, bheresi, bhereti,
bheromes, bheretes, bheronti;

not *akvos*, etc., but

ekvos, ekvom, ekvōd, ekvois, ekvoi, ekvōi, ekve, etc.

Phonetic laws distinctive of Greek.

It was at this stage of inflectional development, and with a stock of roots and words which can still be ascertained with some approach to completeness, that the Greek language started on its separate career and commenced its independent history. The shape which it has assumed when it first becomes known to us from literary and epigraphic records is due to the action of its characteristic laws, some purely phonetic, and some due rather to the intellectual tendencies of those who used it. Of the phonetic laws four are especially distinctive:—

1. *Loss of Spirants.*—This is most extensive and important in its results: *j* (*y*) has entirely disappeared from the written language, and its existence is only to be detected from isolated traces in Homer, and perhaps in some inscriptions where Ϝ is probably used to denote it; *v* (*w*) in the form of Ϝ is found on some of the older inscriptions, and its introduction into the text of Homer is often required by the metre; but it is unknown to the ordinary written language; *s* remains when final, and when in immediate contact with mutes, and also when it has assimilated to itself another consonant; but before vowels it passes into the rough breathing, and between vowels it is as a rule entirely dropped. Instances of the effect of this loss of the spirants abound; as an example we may take the primitive *navasja*, which becomes νεϜοσjο, νεοιο, νεοο, and so νέου.
2. *Softening of the Gutturals by Labialism.*—It has been calculated that not less than one-sixth of the roots originally containing *k* or *g* present π or β in Greek. Hence the reduplicated past tense (1st sing.) from *vak*, "speak," *avavakam*, in Greek becomes εϜεϜεπον, the Homeric ἔειπον, Attic εἶπον.
3. *Lightening of the Endings.*—Greek allows no consonants to end a word except ς, ν, and ρ, and shows a marked preference for vowel endings. Hence we often find one or more consonants dropped at the end. This gives a liquid flow to the language in which it has few rivals.
4. *Rich Development of the Vowel System.*—In this again Greek is almost unrivalled. While Latin shared with it the original splitting of the *a*, by its tendency to the loss of the diphthongs this language soon impaired the variety and expressiveness of its vocalization, while Greek retained the full range undiminished. This was an advantage not merely for the euphony of the language, it added greatly to its expressiveness. Curtius has shown by many examples (*Comparative Philology and Classical Scholarship*, p. 33 *ff.*) how easily distinctions in meaning were given by this variety of vowels, which are expressed far more clumsily in other languages.

We may notice here also the wide influences of *zetacism*. This is not limited to Greek, as Schleicher showed in the essay which first set forth its importance properly; but it is more operative in Greek than in any language owing to the more complete disappearance of the *j*, which coalesces with some other consonant, usually a *d*, original, modified, or parasitic, to produce it. Thus *sad-ja-mai* became ἕζομαι, *varg-ja-mi*, ῥέζω, etc.

New creation of verbal forms.

While these laws act naturally, and, so to say, mechanically, we must ascribe to the intellectual character of the Greeks another marked feature of this language, the enormous development given to their verbal system. Six wholly new tenses were created after the separation from the Italian stock,—the future perfect, the compound pluperfect, two passive aorists, and two future passives. Besides, the whole system was worked out with wonderful completeness; so that while an ordinary Latin verb has 143 possible inflections, a corresponding Greek verb has no less than 507. In some instances we can see the creative process still at work, as, *e.g.*, in the case of the perfects in -κα, which are all but unknown to Homer.

The Historic Stage of Greek.[1]

Divisions of the Greek race.

The legend of the sons of Hellen, as we find it in Apollodorus, is of course entirely destitute of historical authority, but it serves as an indication of what the Greeks felt to be a natural division of their race; and from this point of view it is largely confirmed by language. The story runs that Hellen left his kingdom to Æolus his eldest son, while he sent forth Dorus and Xuthus, the father of Ion, to make conquests in different lands. We see from this that the Æolic dialect was regarded as the oldest representative of Hellenic speech, that the Dorian came next to it, and that the Ionian, out of which the Attic subsequently sprung, was regarded as belonging properly to a later period. On the whole this view is not misleading; but it requires some qualification. In the first place this division is more satisfactory for literature than for history; the names Æolic, Doric, Ionic, and Attic cover well enough the written literature of Greece, but are hardly comprehensive enough for all the spoken dialects. These were literally innumerable,—we are told that the tiny island of Peparethus had three clearly distinct,—and they shaded off one into another by slight gradations. The influence of mixed populations is often seen to tell upon their language; and sometimes race distinctions do not tally with those of dialect; thus the Æolians of the Peloponnesus adopted a dialect essentially Dorian, while the Dorians of Halicarnassus spoke Ionian. It is often a matter of dispute under which head a particular dialect shall be placed, and whatever division may be made, connecting links are sure to be found between members of different groups.

Æolic.

Æolic.—This is usually subdivided into four chief dialects:—(1) Lesbian, (2) Thessalian and (?) Macedonian, (3) Bœotian, (4) Elean and Arcadian. It has been maintained by some high authorities, *e. g.*, by Kirchhoff, that Lesbian alone ought to be considered Æolic, and that not only Elean and Arcadian, which Ahrens admits come nearer to Doric, but even Bœotian and Thessalian ought to be ranked as Doric. On the other hand, Professor E. Curtius denies to Æolic the character of a dialect, and holds that it is rather a name for those remains, preserved in different localities, of the more ancient form of the language, and that everything which was not Doric or Ionic was called by the ancients Æolic. We shall find, however, that some of the distinctive features of the Lesbian dialect, which has the fullest right to be called Æolic, were certainly not primitive, but of later origin, so that we can hardly accept this view. The extent to which various dialects admit of being grouped together will be best examined after a survey of their special characteristics.

Lesbio-Æolic.

Lesbio-Æolic.—The sources for this dialect are (1) inscriptions, and (2) the statements of grammarians, based mainly upon quotations from Alcæus and Sappho. Of the former, there are only three of great importance,—one found at Mitylene, recording the return of some exiles in the time of Alexander the Great (*Corpus Inscrip. Græc.*, No. 2166); another found at Pordoselena, an island close to Lesbos, of a few years later (*ib.*, 2166c); and a third, of the same date as the first, found at Eresus and edited by Conze and Sauppe. The poets are of great value, because they appear to have written in the pure dialect of their country, and not to have framed a conventional language for themselves. The 28th and 29th idylls of Theocritus, called by the scholiasts Æolic, are naturally a more suspicious source.

The grammarians with one accord lay stress upon the tendency to barytone pronunciation as a mark of Æolism. The word is accented on the last syllable: for σοφός, θυμός, Ἀχιλλεύς, βαρύς, and the like, the Lesbians said σόφος, θῦμος, Ἀχίλλευς, βάρυς. This tendency has often been adduced, along with the loss of the dual, to prove a closer connection of Æolic than of any other Greek dialect with Latin; it is rather a striking proof of the danger of drawing such deductions from phenomena of purely independent origin (*cf.* Schrader in Curtius's *Studien*, x. 259). The grammarians also tell us that Æolic did not use the rough breathing. The inscriptions date from a time when the aspirate was not written; and the MSS. are not sufficiently trustworthy to give us much help. But there are instances enough in which a tenuis preceding a syllable which in ordinary Greek begins with the rough breathing appears in Æolic as an aspirate—Ahrens quotes nine, besides the article and the demonstrative and relative—to show that aspiration was not unknown. It is to be noticed that in all these instances the rough breathing represents a primitive *s* or *j*. The same authorities assert that Æolic was distinguished by its retention of the digamma, and hence this letter is called by Quintilian and Priscian "Æolium digammon;" but inscriptions show that, though more common in Æolic than in Ionic, it was much less faithfully retained in the former than among the Bœotians and Dorians. Before ρ it was commonly hardened into β, between vowels vocalized into υ. Of the distinctively Æolic phonetic laws, the following deserve special notice. When in other dialects ζ has originated in δj, it usually appears as σδ; βρισδα = ῥίζα. Liquids are very frequently doubled, usually as a result of assimilation, *e. g.*, νν = νσ or σν, as εγέννατο, κτέννας, μῆννος (*cf. mensis*), ἔμμι, ἄργεννος; νν = νj, as κέννος, κλίννω (so φθέρρω); νν = νϜ, as γόννος = γοννός. Σσ is retained,

[1] In dealing with this part of the subject no attempt has been made to record the ordinary forms of inflection as given in grammars, a knowledge of which is assumed. For the Greek alphabet reference may be made to the article ALPHABET, vol. i., especially pp. 535-537. Much which is closely connected with the history of the language finds its place more properly under the head of Literature.

where primitive, while Attic often drops it: μέσσος, ἔσσονται, ἴσσος. Π assimilates a following μ instead of being assimilated by it: ὄππατα = ὄμματα (ὀπ-ματα), γρόππατα = γράμματα (γραφ-ματα). Before σ, ν generally passes into ι, forming a diphthong with a preceding vowel: τάλαις, Att. τάλας for ταλαν-ς; παῖς, Att. πᾶς for παντ-ς; so πρεποίσαις = πρεποντ-jαν-ς, σόφαις, Att. σοφάς for σοφάν-ς, λέγοισι, Att. λέγουσι.

Of the vowels, α is sometimes retained, when it has been "dulled" in Attic, e. g., ὅτα (= ὅτε), ὑπά = ὑπό; but more commonly it passes into ο, especially when in contact with liquids, e. g., στρότος, ἔφθορ-θαι, ὀμνάσθην (= ἀναμνησθῆναι)—this may be regarded as a characteristic mark of Æolism; ο often becomes ν, e. g., ὕσδος = ὄζος; so ἀπυδόμεναι; ᾱ is retained as in Ionic, when Ionic has η, but η has its proper place where it has originated in a lengthened ε, e. g., μάτηρ, τὰμ πόλιν, στάλλαν (= στήλην). For ει and ου η and ω are commonly used: συμφέρην, χήρ, κῆνος, ὦρανος, κῶρος. The ι of diphthongs is often omitted; ἀλάθεα = ἀλήθεια; λαχόην for λαχοίην (*cf.* the popular Attic ποεῖν). In contraction αο becomes α, Κρονίδα; εο ευ, βέλευς; οο ω, ἀνθρώπω. The apparent diæresis of diphthongs is sometimes due to a retention of the uncontracted form; sometimes, as in ὄϊδα in Alcæus, ἄϊ in inscriptions, it is real.

In noun-inflection, besides the changes produced by these phonetic laws, we may notice the loss of the dual, and also a tendency to metaphrastic forms, especially the accusative in ν from consonantal stems.

In verb-inflection, there is a 2d sing. in -σθα, ἔχεισθα, but not the Doric 1st plur. in -μες; the 3d plur. ends in -ισι (as noticed above;) and contracted verbs commonly follow the earlier conjugation in -μι, φίλημι, δοκίμωμι (the grammarians add, but probably incorrectly, γέλαιμι).

The general character of Æolic was much less hard and vigorous than that of Doric; it was distinguished by a quick tripping utterance, as contrasted with the Doric slow deliberateness; the verse of the Æolic poet abounds in dactyls and anapæsts. To the Athenians the language of Lesbos seemed somewhat outlandish, so that, though it was doubtless an exaggeration, it was not an absurd one, for Plato (*Protag.*, 341c) to represent Prodicus as saying of Pittacus ἅτε Λέσβιος ὢν καὶ ἐν φωνῇ βαρβάρῳ τεθραμμένος.

Thessalian. The *Thessalian* dialect is known only by a few inscriptions, the most important of which were discovered by Leake and Rangabé. It forms a kind of link between Lesbian and Bœotian, doubling liquids, changing α into ο, and dropping the ι of diphthongs with the former, but agreeing with the latter in the use of an infinitive in -μεν. It is also characterized by the use of ου for ω; e. g., Ἀπλοῦν for Ἀπόλλων, ὀνάλουμα = ἀνάλωμα: *cf.*, ἀπὸ τᾶς τοῦν ταγοῦν γνούμας; and the genitive sing. ends in -οι (for οιο) instead of -ου; e. g., Ἀντιγενείοι λέξαντος, Αἰσχυλὶς Σατυροι. The general character of the dialect confirms the tradition that the earlier common home of the Lesbians and the Bœotians was in Thessaly.

Bœotian. The *Bœotian* dialect is known mainly from inscriptions. The scanty fragments of Corinna have come down to us mixed with Ionic forms; and the specimens of the Bœotian dialect given by Aristophanes in the *Acharnians* and Eubulus in his *Antiopa* are still more corrupted by an intermixture of Attic. The Bœotians differed from the Lesbians in many not unimportant points. (1)They had no tendency to throw the accent back. (2) They liked the rough breathing. (3) They retained an earlier τ, or changed it into θ, where the Lesbians had σ. (4) A Lesbian σδ (= ζ) appears in Bœotian as δδ. (5) The Lesbian doubling of liquids and change of νς to ις are unknown in Bœotian. (6) In inflection Bœotian retains -αο and -αων, which Lesbian contracts. (7) The Bœotian genitives are ἐμοῦς, τεοῦς, ἐοῦς, the Lesbian ἔμεθεν, σέθεν, ἔθεν. Further, Bœotian changes ε to ι before vowels, υ to ου, η to ει, ει to ι, and οι to ν, all which changes are unknown to Lesbian; *cf.*, e. g., Bœot. θιός, κούνες, οὐμές, ἀνέθεικε, ποείτας, βασιλίος, τῦ δάμο, Fυκιά, etc. As against these numerous differences there are but few points of resemblance, except such as would be shared by all the Dorian dialects. A few peculiar words shared by both are noticed by Beerman (Curt., *Stud.*, ix. p. 85), and he lays stress upon their agreement in -μεν (1 plur.) as contrasted with the Doric -μες, on the feminine terminations -ις and -ω (Ἄλεξις, Σάπφω, Μαντώ, etc.), and on the common use of patronymic adjectives instead of the genitive of the father's name. But it may fairly be said that these would not have been regarded as sufficient indications of a close connection, unless the traditional evidence in its favor had been so strong. We must assume that the Lesbian emigrants changed their language more rapidly than those who had moved less far from their earlier home.

Elean. The *Elean* dialect is represented by Strabo (viii. p. 333) as being also Æolic. This tradition is decidedly rejected by Ahrens, and is very doubtful. The most recent discussion of the question (by Schrader in Curtius's *Studien*, x. 267 *sqq.*) advocates the theory that the Eleans separated from the rest of the Greeks at a time antecedent to the distinction between Æolic and Doric. This practically coincides with the view of Ahrens that, while it has many points of contact with Doric, and especially with Laconian, it is really a distinct dialect, and is confirmed by the inscriptions, of which the most important are the ancient bronze plate brought back from Olympia by Sir W. Gell (*C. I. G.* 11) recording a treaty between the Eleans and the Heræans, and the recently discovered inscription of Damocrates, edited by Kirchhoff (*Archæol. Zeit.*, 1876). It agrees with Lesbian in the nom. sing. masc. in α, τελέστα, and the acc. plur. masc. in οις (-οιρ) for ον-ς. It resembles the northern Doric in the use of εν with the acc., in the apocope of περί to παρ, and in a heteroclite dat. plur. in -οις (ἀγώνοιρ), and Laconian in a complete retention of the digamma, (changed in the later inscriptions to β), in the change of final ς into ρ (e. g., τοῖρ, ἄλλοιρ, προξένοιρ, βοικίαρ = Fοικίας), and in the change of a medial ς into the rough breathing (ποήἁσσαι = ποιήσασθαι). The last two, and also the use of β for F, are much less usual in the early than in the later inscriptions; and the same is the case with Laconian; hence the phenomena point rather to a later action of one dialect upon the other than to a close original connection. Much light may be expected to be cast upon the Elean dialect by the researches at Olympia, which are bringing to light almost every week forms of great philological interest.

Arcadian. The *Arcadian* dialect rests almost wholly upon inscriptions, of which the most important is one found at Piali near Tegea in 1859, edited by Bergk, and afterwards by Michaelis, with valuable notes by Curtius. The very careful examination of this dialect by Schrader (Curtius's *Studien*, x. 273–280) shows that it has more points in common with Doric than with Æolic,—indeed that there is no single point in which it agrees with all the dialects of the latter, where it does not also agree with the former. Its agreement with Lesbian especially is only on minute points, which seem to be of independent origin. Hence its Æolic character may be definitely given up. Among the more interesting phenomena which it presents, we may notice -αν for the gen. sing. masc. of *a*-nouns, -οι as the dative (or possibly locative) sing. of *o*-nouns, ἰν used for εἰς and ἐν, -τοι as the inflection of the 3d sing. middle (e. g., γίνητοι, δέατοι) and -ημενος as the ending of the participle of verbs in -έω (ἀδικήμενος; *cf.* καδαλημένῳ = καταδηλουμένῳ in the Elean treaty; Lesb. καλήμενος, etc.).

Cyprian. The *Cyprian* dialect may be mentioned here; for the results of its examination entirely confirm the statements of Herodotus (vii. 90) and Pausanias (viii. 5, 2) that Arcadians were among the colonists of Cyprus This was first asserted by Bergk on the strength of a few glosses; but recently the inscriptions have been deciphered by Dr. Birch, followed with more complete success by Brandis, Schmidt, and Deecke and Siegismund. They are not written in Greek characters, but in an alphabet of their own, which is syllabic in its character, *i. e.*, each sign represents a consonant followed by a vowel. Of these signs there are 56 as yet identified; there is no distinction between tenues, medials, and aspirates, nor is there any mark of rough or smooth breathing; the signs therefore stand for *a, e, i, o, y, ka, ke, ki, ko, ky, pa*, etc., *ta*, etc., *ma*, etc., *na*, etc., *ra*, etc., *la*, etc., *sa*, etc., and *va*, etc. The number is made up by *ja, je, ji* (*jo* and *jy* not having yet been discovered), *sse, za*, and *zo*. If a word ends in a consonant, the sign of that consonant when followed by *e* is used; but an article or a preposition is often treated as coalescing with its noun. When two consonants come together, the first is denoted by the sign of that syllable which it makes either with the vowel attached to the second consonant (*e. g., po-to-li-ne* = πτόλιν) or with the preceding vowel (*e. g., a-ra-ky-ro* = ἀργύρῳ). A nasal is always omitted before an explosive (*a-to-ro-po-se* = ἄνθρωπος). Cyprian agrees with Arcadian in the genitive in -αν, in ἀπύ for ἀπό (sometimes followed in both by the dative), in the preposition ἰν (often with acc.), and in many less important points.

Doric. — The Dorian dialect was divided by Ahrens, following the Greek grammarians, into two main groups—(1) the severer Doric, (2) the milder, the one being more closely connected with Æolic, the other with Ionic. To the former belonged the speech of Laconia, Crete, Cyrene, and the Greek colonies in Italy; to the latter the language of Argolis, Messenia, Megara, and northern Greece, and the colonies of Asia Minor and Sicily. The basis of this distinction is the use of ω and η in the severer as against ου and ει in the milder dialect. But the division can hardly be maintained in practice, and hence it is abandoned by most modern scholars. The northern Doric, for instance, which is ascribed by Ahrens to the second division, has been shown by Merzdorf (*Sprachwissensch. Abhandl.*, etc., Leipsic, 1874, pp. 23–42) to form a bridge between Æolic and Doric. Again, while we find ου in use at Thera, at Cyrene, a colony of Thera, ω is retained; hence this cannot point to a deep division. We may notice first the authorities for the particular dialects, and then the characteristics of Doric generally.

Doric.

Sources for the various subdialects.

The *Laconian* dialect is known from few and unimportant inscriptions, from the fragments of Alcman, which, however, are in a language much modified for poetic purposes, and from the specimens in the *Lysistrata* of Aristophanes and in other Attic comedies. There are also a large number of La-

conian glosses in Hesychius, and Thucydides (v. 77) gives a treaty in the Spartan dialect. Our knowledge is largely supplemented by the famous tables of Heraclea, a colony of Tarentum, which itself was founded by Sparta. These were found in the bed of the river Cavone in 1732 and 1735, and are now partly in the Musoo Borbonico at Naples and partly in the British Museum.

From *Crete* there are numerous important inscriptions, chiefly treaties between various towns. It is curious that some of the most valuable of these were found in the ruins of the splendid temple of Dionysus in the island of Teos; this temple enjoyed the rights of an asylum, and the inscriptions are mainly treaties acknowledging these rights on the part of various Cretan cities. They contain some highly interesting archaisms of form.

For *Thera* there is an important inscription containing the will of a wealthy lady Epicteta (*C. I. G.*, 2448); for its more famous colony, Cyrene, there are only brief and fragmentary records.

The *Argolic* dialect appears on a very ancient helmet found at Olympia (*C. I. G.*, 29) and on an inscription very recently dug up at the same place, as well as on several others of less importance.

From *Messenia* there is a long and very interesting inscription found at Andania, dealing with the cultus of certain deities; it is of comparatively late date (probably 93 B. C.) and in a much modified Doric, but it contains some striking forms.

The *Corinthian* dialect is learnt mainly from inscriptions at its colonies of Corcyra and Syracuse, both of which cities supply some very ancient and valuable records. In the same way the Doric of *Megara* is preserved most fully on Byzantine inscriptions. For this we have also the Megarian in the *Acharnians* of Aristophanes.

For the *Locrian* dialect Ahrens had but few and fragmentary inscriptions and no literary evidence; recently a bronze tablet containing a treaty between Chaleion and Œantheia (of the 4th century B. C.) has been dug up at the latter place; and also a tablet containing the regulations for founding a colony at Naupactus (*cf.* Curt., *Stud.*, ii. 441–449, iii. 205–279). These throw much new light on the dialect, and enable us to set it down with confidence as a link between Doric and Æolic.

General Doric characteristics.

The general character of the Doric dialect was that of a slow, deliberate, and emphatic speech; it is the speech of the warrior and the ruler, not of the orator or merchant. The πλατειασμός, which the ancient authorities ascribe to the Dorians, is not distinctive of them, but was shared by the Bœotians and other Æolians; it is to be regarded rather as a mark of an earlier stage of the language, which was retained like many other similar characteristics by the Dorians much more extensively than by contemporary Ionians. It is quite the exception for any Doric characteristic to be of recent origin. A natural hypothesis finds in the full and broad sounds of the dialect of these "men of the mountain-forests" signs of the chest strengthened by mountain air and mountain life. To pass to details:—

In accentuation Doric shows no inclination to the barytone pronunciation of Lesbos; on the contrary, it has more oxytone forms even than Attic. In many words the Doric accent is of especial interest as bearing valuable testimony to the origin of the inflections; we find not only ἀγγέλοι, ἀνθρώποι, and τυπτομένοι, but also ἐλέγον, ἐλύσαν, παίδες, πτώκας and ἀμπέλος (acc. plur.), —these forms all pointing back to a time when the final syllable was long, and thus demanding from philology an account of this length.

In vowels a short α is often retained where Attic has ε (ἰαρός, τράφω, τράχω,) or ο (Ϝεικατι = εἴκοσι): υ in Laconian became ου, but probably only as an indication that the earlier pronunciation of the vowel was retained, when in ordinary Greek it had sunk into ϊ. Wherever η in Ionic has come from an earlier ᾱ, Doric retains ᾱ, but where it has originated in ε, η is retained as in Lesbio-Æolic (πατήρ, Bœot. πατείρ); it is also retained in augments (ἠρχόμαν), and as a contraction for αε (ἐνίκη). On the other hand αο and αω contract into α (Ἀτρείδα, γελᾶν). The contractions of εο, εω vary much in different dialects. The severer Doric gives η for ει and ω for ου: ἦς for εἷς, ἦμεν for ἔσμεν, ἄγωσα, Μῶσα, ἐγϜηληθίωντι = ἐξειληθῶσι, βωλά (Lesb. βόλλα), Κῶρος, etc. A noteworthy phenomenon is presented by the shortening of long final syllables, almost exclusively where the length is due to compensatory lengthening in the place of a lost consonant (δημότᾶς, κατὰ τὸς νόμος, πράξᾶς, πός [= ποδ-ς], λέγες, τίκτεν, τεκέν); of all forms of the dialect the Cretan especially favored this.

Of the consonants, the digamma was retained longer by the Doric than by any other dialect, but we find it gradually disappearing. It is used in the old Laconian, Argolic, Corinthian, and Corcyræan inscriptions, but not in the Cretan, with the exception of the proper name Ϝάξιοι; on the Heraclean tables it is very common, but there are some strange exceptions, as οἰκιά, ἐργάξομαι, and ἀφέργω; some have held that it is there wrongly inserted in Ϝεξ, but this is really a valuable confirmation of the labial spirant to which other languages also bear witness. The digamma is often changed to β (as in Elean), but never before ρ, as in Æolic; whether it ever actually passed into γ, or whether the numerous forms which give this in the place of an earlier digamma are all due to the mistakes of copyists, is a question still under discussion (Curtius's *Princ.*, ii. 229 *ff*). Τ is constantly retained, where the Ionians have weakened it into σ, especially in τι: φατί = φησί; so τύπτοντι = τύπτουσι, τίθεντι = τέθεισι; *cf.* πλάτιος, πλούτιος, δῶτις, Σελινούντιοι.

Laconian peculiarities.

Three changes characteristic of Laconian came in at a comparatively late date; for they do not appear in the Heraclean tables, and consequently they must be later than the foundation of Tarentum. (1) Θ becomes σ; this is very common in the Spartan of the *Lysistrata*; *e. g.*, σέλει, σιγῆν (= θιγεῖν), σιός (= θεός); *cf.* τῶ σιῶ σύματος (Thuc. v. 77), σεῖος, ἀνήρ (Ar., *Eth. Nic.*, vii. 1). (2) Final ς becomes ρ; this is still later, and does not appear in Aristophanes, but is very common in the more recent inscriptions. (3) Medial σ between vowels becomes '; this is found in Aristophanes (Μῶά, πᾶά, etc.) and in later inscriptions (Ποοϊδᾶνι), but not in Alcman.

The traditional change of γ into δ is denied by Ahrens and Curtius, who altogether reject, with very good reason, the asserted identity of δᾶ and γῆ. The appearance of ξ in the future and compound aorist of verbs in -ζω (*e. g.* δοκιμάξοντι, ἐμέριξαν, etc. in the *Tabb. Heracl.*, μυσίξαι in Aristoph., *Lysist.*) has been rightly explained by Curtius (*Princ.*, ii. 248) as a hardening of the original spirant *y* (*j*) before the σ, the only possible alternative to its complete loss, which we find in the ordinary Greek δοκιμάσω. The change of ζ into σδ, ascribed by the grammarians to Doric, is more properly Lesbian, and is unknown to pure Doric; here ζ is as a rule retained, but in the Laconian dialect when initial it becomes δ (δωμός = ζωμός), when medial δδ (μυσίδδω = μυθίζω, ποτόδδει = προσόζει).

A double σ is retained where this is the more ancient form, changed in ordinary Greek into σ; thus the Heraclean tables give ὅσσος, μέσσος, ἔσσονται, etc. The σσ often found in Dorian inscriptions (and sometimes in the earlier Attic also), where there is no historical explanation of its presence, seems to be an attempt to represent the sound of the earlier sibilant *san*, which was retained by the side of *sigma*. For the earlier guttural *koppa*, the distinctive sign ϙ is found in old inscriptions, almost, but not quite exclusively before ο, *e. g.*, ϙορινθόθεν, ὄρϙος.

We may notice finally a free use of assimilation especially in Laconian (πούμμα = πυγμή, κάρρων = κρείσσων, *i. e.*, καρτίων, ἀκκόρ = ἀσκός), and on the other hand the retention of νς by the Argives and Cretans (τόνς, μόνσα, ἐνς, τιθένς, Τίρυνς, etc.).

The characteristic Dorian inflections are almost entirely such as are due to these phonetic laws, or to the tendency to metaphrastic or heteroclite formations, already noticed.

Ionic.—The *Ionic* dialect is commonly divided into three stages,—the Old Ionic or Epic dialect, the New Ionic, represented most completely by Herodotus and Hippocrates, and the Attic. This division is not satisfactory; for, in the first place, the Epic is a mixed dialect or more properly a *style*, and cannot be taken as a faithful representative of a spoken language; and, in the second place, Attic is not a later stage of the New Ionic, but in many respects remains faithful to forms in which even the Old Ionic has departed from the earlier usage. The three *sub-dialects*, however, agree on the whole much more closely than any one of them does with either Æolic or Doric, and they may therefore be grouped together. We know from an express statement of Herodotus (i. 142) that there were many subordinate varieties of the ordinary Ionic; he mentions four within a comparatively narrow extent; but neither the extant inscriptions nor the statements of grammarians enable us to distinguish these with any precision. It is probable that the differences lay rather in slight shades of pronunciation than in any extensive variations, and that, on the whole, the varieties closely resembled each other. As the general character of Doric is due, at least in a measure, to the hardy mountain life of the Dorians, so the Ionic type was determined by the easier and more effeminate life of the Ionians. All harshness is carefully avoided; the spirants, especially the Ϝ, were dropped here earlier and more completely than in any other dialect; the α is more extensively changed into ε and ο; aspiration is frequently lost or transposed so as to be easier to pronounce; τ, especially before ι, regularly passes into σ; gutturals are replaced by dentals or labials. The vowel-system is especially rich and free; sometimes an easy flow is given by the avoidance of contraction; sometimes again a full coloring is produced by the variety of the diphthongs. The varied literary activity of the Ionians in different directions gave a manifold development to their language, which makes it especially well adapted to poetry, and adds not a little of poetical charm even to their prose.

Epic Dialect.—The language of the Homeric poems is doubtless based upon the popular spoken dialect of the district in the midst of which they grew up. But as every scholar would now admit that they were constructed out of a large mass of previously existing material, however widely opinions may differ as to the person or school to which they owe their present form,

and as much of this material must have dated from a great antiquity, it need not surprise us to find in the midst of a dialect, which is of a much more recent type than Æolic or Doric, traces of archaisms, earlier in some respects than anything to be found elsewhere. It is one of the greatest services which comparative philology has done for the interpretation of these poems, that it has enabled us to recognize as relics of an older language much which had been previously set down as poetic license, or held to be inexplicable.

One of the most interesting of these relics is the effect produced by the earlier existence of a spirant, no longer written, upon the quantity of a preceding syllable. As late as the time of I. Bekker all such cases were unhesitatingly ascribed to the digamma; and this accounts for many instances; but in others the cognate languages point to *σ* or *j*: *e. g.*, we find not only *φίλα Fείματα δύσω, οὕτω δὴ Fοἶκονδε*, and hundreds of similar cases (La Roche gives 84 Homeric words with the digamma), some of very common occurrence, but also *θεὸς (j)ὥς, Fοίκαδε (j)ι(j)εμένων, ἔτι γὰρ (σ)έχον ἕλκεα λυγρά, νίέι σῷ (σ)επόμην, εἰς ἅλα (σ)ἁλτο*, and many other instances. On the other hand, the occasional neglect of the digamma, even in words for which it is most certainly established, points, not necessarily, as some have argued, to a later origin of those lines in which this occurs, but to a fluctuating usage, akin to though much more extensive than our own poetic use of forms like *loveth* and *loves*, *formèd* and *form'd*, *my* and *mine*. In the form in which the poems now appear, it is often of much importance to remember that they must have been transcribed at a comparatively late date from the earlier into the later Ionic alphabet (see ALPHABET, vol. i. p. 536), and that doubtless many words were inaccurately represented. The limits of this sketch do not admit of a statement of the characteristic epic forms. They will be found given with very full references in the introduction to La Roche's school edition of the *Iliad* (Berlin, 1870), and with admirable clearness and scientific exactness in the sketch of Homeric grammar prefixed by Mr. D. B. Monro to his edition of the First Book of the *Iliad* (Oxford, 1879).

New Ionic.

The *New Ionic* dialect is found first in the writings of the iambic elegiac poets, Archilochus, Callinus, and Mimnermus (where the digamma has already entirely disappeared), and is known more completely from Herodotus and Hippocrates. We are told that the language of the former was varied (*ποικίλη*) as compared with the pure (*καθαρή*) Ionic of preceding logographers; this seems to refer to the occasional introduction of epic forms and expressions, which give a delightful poetic tinge to his language (*cf.* Quintil., ix. 4, 18, *Tum ipsa διάλεκτος habet eam iucunditatem, ut latentes etiam numeros complexa videatur*) and not to any dialectic variations. Besides the general tendencies of Ionic mentioned above we may notice the retention of the earlier *κ* for *π* in interrogative and relative words (*κοῖος, ὁκόσος*, etc.), the interchange of *ει* and *ου* with the simple vowels (*εἴρομαι, κεινός, ξεῖνος*, but *μέζων, δέξω, τάχεα*; and *μοῦνος, οὔνομα, τὸ οὖρος, νοῦσος*), the contraction of *οη* into *ω* (*βῶσαι, ἐβώθεε, ἐννώσας*), the use of *ηι* for *ει* (*βασιληίη, μαντήϊον*), the Ionic crasis in *ὠνήρ, ὦλλοι*, etc., the entire absence of the appended *ν*, the gen. plur. in *-εων* for Homer's *-άων*, Att. *-ῶν*, and the use of *-αται, -ατο* for *-νται* and *-ντο* wherever these are added directly to the tense-stems (*cf. ἐσκευάδαται, ἄπίκαται, βεβλέαται, τιθέαται, ἀγοίατο*, etc.). The dialect of Herodotus has been most fully discussed by Brodow (*Quæstionum criticarum de dialecto Herod. libri duo*, 1846); there are some excellent remarks upon it by Mr. Woods in an introduction to his edition of Book i., pp. 40–45. The text of Hippocrates is in too unsettled a state, and the genuineness of many of the treatises ascribed to him too doubtful, to make it possible for us to build much upon his authority. From inscriptions but little can be gained. See Erman in Curtius's *Studien*, vol. v., pp. 250 *ff.*

Attic.

The *Attic* dialect may be regarded as on the whole a slightly modified representative of the Ionic spoken before the foundation of the Ionic colonies. It is not so much a daughter of Ionic as its mother, as Bergk justly calls it. In Ionic the tendency to soften the language which had already commenced before the separation went on its way unrestrained in the luxurious life of the Asiatic cities.[1] In Attica, possibly owing to the free admission of non-Ionic citizens by Solon and Cleisthenes, this tendency was checked, and there are even some signs of a reaction in the direction of the earlier and more vigorous speech. There is a celebrated inscription found at Sigeum in the Troad (*C. I. G.*, 3), the antiquity of which, though attacked by Boeckh, has been established by Kirchhoff; this is in two parts,—the upper in Ionic dialect, the lower (which is probably a little later, but also belonging to the time of Pisistratus) in Attic, and we can already see the reaction at work. The Attic dialect thus adapted itself admirably to the character of the Athenian people, which knew better than any other Hellenic community how to unite energy and dignity with grace and refinement, to preserve the *σεμνότης* of the Dorian without sacrificing the *χάρις* of the Ionian. The Attic of the inscriptions may be most conveniently divided according as these are written in the old alphabet of sixteen letters or in the so-called Ionic alphabet of twenty-four. The latter was introduced for public documents in the archonship of Euclides (403 B. C.); the inscriptions written before that date have been collected and edited by Kirchhoff in the first volume of the new Berlin *Corpus Inscriptionum Græcarum*, and their linguistic peculiarities well commented upon by Cauer in Curtius's *Studien*, vol. viii., pp. 223–301 and 399–442. The Attic of literature is divided into the Old and the New, the point of division being earlier than the archonship of Euclides, and coinciding more nearly with the beginning of the Peloponnesian War (431 B. C.). The division is, however, not strictly a chronological one, for, while Thucydides and the tragedians adhere to the older forms, contemporary comic writers adopt the later ones; in Plato both are found side by side; but in the orators the change to the new is fully established. The difference is not deeply marked, and lies for the most part in minute details. In some cases these seem to point to the adoption in literature of popular forms which had always been current, and which were really older than the forms that (probably owing to the influence of the Ionic poets and historians) had become fashionable with older writers. Thus the *ττ* which in New Attic supplants *σσ* cannot possibly have come from this weaker sound,[2] they are both independent modifications of an earlier *κj* or *τj*; and the inscriptions show clearly (*cf.* Cauer, p. 284 *sq.*) that *σσ* was never used except under Ionic influence. In other cases there are undoubtedly indications of the weakening of sound which marks the ordinary course of language: *e. g.*, *σύν* for *ξύν*, *ρρ* for *ρσ*; the same is probable in the instances where a simple vowel represents an earlier diphthong, as in *ἀεί, ἀετός, ἐλάα*, and *ποεῖν*, and in the tendency to allow *ee* (*η*) to sink into *ei* (*ει*), *e. g.*, *βασιλεῖς, κλεῖθρον, λύει, εἶκαζον*, and the duals *σκέλει, ζεύγει* for *σκέλη, ζεύγη*. It is less easy to account for the change of *ἤν* (*ἐάν*) to *ἄν*.

Qualities of the Greek language.

In the New Attic the Greek language may be said to have reached its zenith of grace, expressiveness, and symmetry; and hence this is the proper place for a few remarks on the qualities which have confessedly made the Greek language quite unrivalled as a means for the expression of human thought.

In the first place we may notice its purity and consequent transparency. The Greeks felt themselves to be sharply marked off from the barbarians around them, and in consequence rarely allowed their language to be contaminated by foreign influences. Latin teems with borrowed words, often ill-adapted to the genius of the language; Greek has very few, and these almost invariably Hellenized in form. Hence the etymologist feels himself to have a far firmer footing in Greek than on Italian soil. Hence too the organic structure of Greek retains its regularity, and the orthography is well established and rarely fluctuating. Then there is the phonetic harmony of the language. Dissonance was everywhere avoided; there is no undue predominance of consonants, as in Latin and still more strikingly in Etruscan. The endings of the words are light, no final consonants being endured, except the liquids *ν* and *ρ* and the spirant *ς*. The brightest of the vowels, *a, e, o*, are far more common than the harder and thinner *i* and *u*, Greek here again contrasting sharply with Latin. The abundance of diphthongs—practically lost in the modern pronunciation of Greek—gives a rich variety of sound, besides supplying admirable means for the differentiation of meanings. The careful observation of accent, by the side of and quite distinct from the due marking of quantity, lent a varied modulation to the rhythm, which the rapid utterance of the Athenians especially prevented from ever becoming wearisome. The range of different forms at the disposal of poets and the freedom allowed in the order of words permitted the writer to choose the rhythmical effect most conducive to the harmony of his period. With regard again to the *expressiveness* of the language, the completeness of the verbal inflection enabled various shades of meaning to be expressed with unrivalled precision and terseness. It is perhaps impossible to estimate with any approach to accuracy the extent of the vocabulary of a language known to us only from a literature which, in some of its most important branches, has come down to us in a sadly fragmentary state; but some approximation may be made from the fact that Herodian is said to have determined the accent of 60,000 words. But the free power of word-formation and composition to which this marvellous richness was largely due was no mechanical process. It sprang from the lively fancy of the most poetic of nations,—a fancy which shows itself alike in the significant individual names borne by every Greek citizen, which contrast so sharply with the obscure, trivial, and stereotyped hereditary labels of the Romans, and in the characteristic and often sportive appellations of plants and animals. Nor can we omit that which was according to Aristotle the despair of the barbarian of old, as it is of the modern schoolboy, the ex-

[1] The tablets of Styra, engraved not later than 480 B. C. (Kirchhoff, *Zur Geschichte der Griech. Alph.*, p. 139 *sq.*), give an interesting example of Ionic of a less complete development.

[2] On this question, however, the arguments of Ascoli deserve careful consideration. They have considerably modified the judgment of Curtius in the fifth edition of the *Grundzüge*, *cf.* pp. 666 *ff.*

quisitely exact and delicate use of the particles. Of all the qualities which make Greek really untranslatable, even into German, the only one of modern languages which approaches it in this respect, perhaps the most characteristic is the abundance of these tiny atoms of speech, not one of which can be neglected with impunity, while it is impossible to reproduce them all except at an expenditure of our means of expression which ruins the lightness and grace of the sentence. The history of the development of the period, that device in which the symmetry of form is inseparably wedded to the artistic balance of thought,—a device which is found in no language which has not derived it directly or mediately from Greece,—belongs to the region of literature rather than language. But many a construction, for which formal syntax finds it hard to discover a name and a classification, can only be understood aright if we look upon it as the utterance of a national life unrivalled in its bold and vivid freshness, delighting in variety, and shaping at its will a language still fluid and plastic.

Pronunciation of Greek.

With regard to the *pronunciation* of Greek, the best modern scholars are at one in regarding the modern pronunciation, advocated at the revival of learning by Reuchlin, as wholly misleading for an earlier period. On the other hand, the current pronunciation in England is hardly more correct than the conventional pronunciation of Latin; and even the Continental pronunciation, as established by Erasmus, needs to be modified on many points. The vowels and consonants present no difficulty: ᾰ, ᾱ, η, ε, ι, ῐ, ω, ο were undoubtedly pronounced as the corresponding vowels are now in French, German, or Italian; υ and ῠ were the French û and ŭ, *i. e.*, very nearly the German *ue*. The consonants may be pronounced as in English, γ being however always hard, and ζ being *dz*, while, as noticed already, the aspirates φ, θ, χ = *p-h*, *t-h*, *c-h*. It is much more difficult to determine the pronunciation of the diphthongs. Undoubtedly they were originally strictly diphthongal, *i. e.*, the two vowels were each pronounced, but ran rapidly one into the other; *cf.* παΐς and the Homeric πάϊς, οἷς and ὄϊς. But at an early period the diphthongal pronunciation was lost, and in modern Greek the sound ι is given alike to αι, ει, and οι. This cannot be correct for the Attic period; it probably began to creep in in the time of the Diadochi; οι at this date began to pass into *ü*, and much later sank into *i*; ου had always the force of our *oo*, and is used even when the syllable is short: *e. g.*, in Bœot. κούνες it was pronounced as *u* in "put." It is altogether erroneous to pronounce υ in diphthongs as *v*, as is done in modern Greek; νι was doubtless pronounced much as *wee*, but with more stress laid on the first element.

History of later Greek.

The dialects long continued to exist in the mouths of the common people; but the influence of extended commercial intercourse, and especially of the commanding position which Athens had gained as the centre of education and the home of science, literature, and philosophy, gave an increasing predominance to one, the Attic dialect. The Ionic was the first to disappear; there are but few traces of this after the Peloponnesian War; the Æolic and the Doric are found, but always in diminishing extent, as late as the time of the Roman emperors. But Attic lost in purity as it gained in range; new words and constructions crept in especially from the increasing influence of the East; until at last the grammarians gave the distinctive name of ἡ κοινὴ διάλεκτος to the language popularly current. The rise of the Alexandrian school of critics gave a new stimulus to the study of literary Attic; on the other hand the vulgar speech continued its own course of free combination and assimilation from various quarters. Thus in the Roman times we have three main divisions of Greek:—(1) the revived Attic of the schools, the purity of which was jealously guarded by grammarians such as Phrynichus; (2) the common (κοινή) literary language, employed by such writers as Polybius and Plutarch; and (3) the popular spoken language, which much more freely absorbed foreign elements than the κοινή, and which may be described as Hellenistic. This is the basis of the diction of the Septuagint and the New Testament. Of course the dividing lines cannot be sharply drawn. Of the authors belonging to this period some, like Lucian, endeavored to approach as closely as possible to the standard of pure Attic; others, like Babrius, came nearer to the popular diction. The peculiarities of this stage of the language consist rather in new words and new inflections than in extensive syntactical changes. The former are too numerous to state here (*cf.* Winer's *Grammar*, part ii. pp. 69–128, ed. Moulton); of the latter we may notice—

1. A negligent use of the moods with particles: *e. g.*, ὅταν with a past indicative, εἰ with the conjunctive, ἵνα with the present indicative.
2. A construction of verbs with cases unknown in Attic: *e. g.*, γεύεσθαι with accusative, προσκυνεῖν and προσφωνεῖν with dative, etc.
3. The extension of the genitive of the infinitive (τοῦ ποιεῖν) beyond its original and natural limits.
4. The use of the conjunctive for the optative after past tenses, and the gradual disuse of the latter mood, which has wholly disappeared in modern Greek. (*Ib.*, p. 38.)

Under the Greek empire, the language of literature was still based upon an artificial and often a lamentably unsuccessful imitation of Attic, and an interesting parallel might be worked out in detail between the Greek and the Latin writers of this period. But, just as in the Western empire, the popular dialect went on its way, for the most part unrecognized in literature, but constantly exerting its effect upon the written language, and from time to time coming to the surface. The first writer who boldly adopted the popular dialect was Theodorus Ptochoprodromus, a monk of Constantinople who lived under the emperor Manuel Comnenus (1143–1180); his language, though with some traces of the more ancient forms, is essentially modern Greek. To the same period belongs Simon Sethos, a chronicler, the first prose writer of the modern language. In the 14th century we have the romance in verse, *Belthandros and Chrysantza*, a work highly spoken of for imaginative power and free command of the language in its new form. The poems of Gorgilas (cent. xv.), Chortakes and Kornaros (cent. xvii.), and Rhegas (cent. xviii.) suffice to show that the popular language never entirely ceased to be used as an organ of literary utterance. An epoch in the history of modern Greek is marked by the long and fruitful activity of the illustrious scholar and patriot Coraes (1748–1833). He made it his object to purify the popular dialect, not by an artificial resuscitation of the ancient Attic, but by a strenuous endeavor to preserve and to render current all classical forms not wholly extinct, and to replace foreign and barbarous words by genuine Greek ones, often freshly coined for the purpose. Greece now can number poets, historians, scholars, and orators who bring forth from their native language no feeble echoes of the immortal notes with which its prime was made musical for every age.

Authorities.

Authorities.—For all that concerns the formation and history of the Greek language the writings of Professor G. Curtius of Leipsic are unrivalled in sound sobriety of judgment and full mastery of all the results of modern philological science, which owes to him some of its most important advances. The chief are *Grundzüge der Griechischen Etymologie* (5th edition, Leipsic, 1879, translated into English by A. S. Wilkins and E. B. England, 2 vols. 1875–6); *Das Verbum der Griechischen Sprache* (vol. i. 2d edition, 1877, vol. ii. 1876; English translation in one volume, 1880); a *School Grammar* (8th English edition, 1876) and *Elucidations* of the same (2d English edition, 1876). The fullest storehouse of the facts of inflection and of syntax is Kühner's *Ausführliche Grammatik* (2d edition, 1871). For the Greek dialects Ahren's *De Græcæ Linguæ Dialectis* (2 vols. 1839, 1843) remains the best work; but recent discoveries have made it necessary to supplement it in many places; indispensable material for this is furnished by the series of monographs in Curtius's *Studien zur Griechischen und Lateinischen Grammatik* (10 vols. Leipsic, 1868–78) and in many scattered programmes and dissertations. Mr. Merry's *Specimens of Greek Dialects* (Clarendon Press, 1875) contains admirably clear and useful introductions for junior students. Bergk's *Griechische Literaturgeschichte* contains much that is useful, but needs to be used with caution. For modern Greek the standard works are Sophocles's *Glossary of Later and Byzantine Greek* (Boston, 1870), and Mullach's *Grammatik der Griechischen Vulgärsprache* (Berlin, 1856). (A. S. W.)

PART IV.—GREEK LITERATURE.

The history of Greek literature has had three great stages:—the Old Literature, from the earliest times to 529 A. D., when the edict of Justinian closed the schools of pagan philosophy; the Byzantine Literature, from 529 A. D. to the taking of Constantinople by the Turks in 1453; and the Modern Literature, which may be said to have begun with the satirical poetry of Theodorus Prodromus in the 12th century.

SECTION I.—THE OLD GREEK LITERATURE.

The Old Literature, to 529 A. D., falls into three periods. I. *The Early Literature*, to about 475 B. C. Epic, elegiac, iambic, and lyric poetry; the beginnings of literary prose. II. *The Attic Literature*, 475–300 B. C. Tragic and comic drama; historical, oratorical, and philosophical prose. III *The Literature of the Decadence*, 300 B. C. to 529 A. D.,—which may again be divided into (1) the Alexandrian period, 300–146 B. C., and (2) the Græco-Roman period, 146 B. C. to 529 A. D.

It is not the purpose of the present article to enter into details regarding particular works or the lives of their authors. These will be found in the separate articles devoted to the principal Greek writers. The object of the following pages will be to sketch the literary development as a whole, to show how its successive periods were related to each other, and to mark the dominant characteristics of each.

I. *The Early Literature.*

A process of natural growth may be traced through all the best work of the Greek genius. The Greeks were not literary imitators of foreign models; the forms of poetry and prose in which they attained to such unequalled excellence were first developed by themselves. Their literature had its roots in their political and social life; it is the spontaneous expression of that life in youth, maturity, and decay; and the order in which its several fruits are produced is not the result of accident or caprice. The series of its seasons is as much the result of natural laws as the sequence of spring, summer, and autumn. Further, the old Greek literature has a striking completeness, due to the fact that each great branch of the Hellenic race bore a characteristic part in its development. Ionians, Æolians, Dorians, in turn contributed their share. Each dialect corresponded to a certain aspect of Hellenic life and character. Each found its appropriate work.

The dialects.

The Ionians on the coast of Asia Minor—a lively and genial people, delighting in adventure, and keenly sensitive to everything bright and joyous—created artistic epic poetry out of the lays in which Æolic minstrels sang of the old Achæan wars. And among the Ionians arose elegiac poetry, the first variation on the epic type. These found a fitting instrument in the harmonious Ionic dialect, the flexible utterance of a quick and versatile intelligence. The Æolians of Lesbos next created the lyric of personal passion, in which the traits of their race—its chivalrous pride, its bold but sensuous fancy—found a fitting voice in the fiery strength and tenderness of Æolic speech. The Dorians of the Peloponnesus, Sicily, and Magna Græcia then perfected the choral lyric for festivals and religious worship; and here again an earnest faith, a strong pride in Dorian usage and renown, had an apt interpreter in the massive and sonorous Doric. Finally, the Attic branch of the Ionian stock produced the drama, blending elements of all the other kinds, and developed an artistic literary prose in history, oratory, and philosophy. It is in the Attic literature that the Greek mind receives its most complete interpretation.

A natural affinity was felt to exist between each dialect and that species of composition for which it had been specially used. Hence the dialect of the Ionian epic poets would be adopted with more or less thoroughness even by epic or elegiac poets who were not Ionians. Thus the Æolian Hesiod uses it in epos, the Dorian Theognis in elegy, though not without alloy. Similarly, the Dorian Theocritus wrote love-songs in Æolic. The Attic Tyrtæus used Doric forms for his marching songs. All the faculties and tones of the language were thus gradually brought out by the co-operation of the dialects. Old Greek literature has an essential unity—the unity of a living organism; and this unity comprehends a number of distinct types, each of which is complete in its own kind.

Pre-Homeric poetry.

Extant Greek literature begins with the Homeric poems. These are works of art which imply a long period of antecedent poetical cultivation. Of the pre-Homeric poetry we have no remains, and very little knowledge. Such glimpses as we get of it connect it with two different stages in the religion of the prehistoric Hellenes. The first of these stages is that in which the agencies of forms of external nature were personified indeed, yet with the consciousness that the personal names were only symbols. Some very ancient Greek songs of which mention is made may have belonged to this stage—as the songs of Linus, Ialemus, and Hylas. Linus, the fair youth killed by dogs, seems to be the spring passing away before Sirius. Such songs have been aptly called "songs of the seasons." The second stage is that in which the Hellenes have now definitively personified the powers which they worship. Apollo, Demeter, Dionysus, Cybele, have now become to them beings with clearly conceived attributes. To this second stage belong the hymns connected with the names of the legendary bards such as Orpheus, Musæus, Eumolpus, who are themselves associated with the worship of the Pierian Muses and the Attic ritual of Demeter. The seats of this early sacred poetry are not only "Thracian"—*i. e.*, on the borders of northern Greece—but also "Phrygian" and "Cretan." It belongs, that is, presumably to an age when the ancestors of the Hellenes had left the Indo-European home in central Asia, but had not yet taken full possession of the lands which were afterwards Hellenic. Some of their tribes were still in Asia; others were settling in the islands of the Ægean; others were passing through the lands on its northern sea board. If there was a period when the Greeks possessed no poetry but hymns forming part of a religious ritual, it may be conjectured that it was not of long duration. Already in the *Iliad* a secular character belongs to the marriage hymn and to the dirge for the dead, which in ancient India were chanted by the priest. The bent of the Greeks was to claim poetry and music as public joys; they would not long have suffered them to remain sacerdotal mysteries. And among the earliest themes on which the lay artist in poetry was employed were probably war-ballads, sung by minstrels in the houses of the chiefs whose ancestors they celebrated.

Songs of the seasons.

Hymns.

Such war-ballads were the materials from which the earliest epic poetry of Greece was constructed. By an "epic" poem the Greeks meant a narrative of heroic action in hexameter verse. The term *epe* meant at first simply "verses;" it acquired its special meaning only when *mele*, lyric songs set to music, came to be distinguished from *epe*, verses not set to music, but merely recited. Epic poetry is the only kind of extant Greek poetry which is older than about 700 B. C. The early epos of Greece is represented by the *Iliad* and the *Odyssey*, Hesiod, and the Homeric hymns; also by some fragments of the "Cyclic" poets.

Epos.

The Iliad and the Odyssey.

After the Dorian conquest of the Peloponnesus, the Æolian emigrants who settled in the north-west of Asia Minor brought with them the war-like legends of their chiefs, the Achæan princes of old. These legends lived in the ballads of the Æolic minstrels, and from them passed southward into Ionia, where the Ionian poets gradually shaped them into higher artistic forms. Among the seven places which claimed to be the birthplace of Homer, that which has the best title is Smyrna. Homer himself is called "son of Meles"—the stream which flowed through old Smyrna, on the border between Æolia and Ionia. The tradition is significant in regard to the origin and character of the *Iliad*, for in the *Iliad* we have Achæan ballads worked up by Ionian art. A preponderance of evidence is in favor of the view that the *Odyssey* also, at least in its earliest form, was composed on the Ionian coast of Asia Minor. According to the Spartan account, Lycurgus was the first to bring to Greece a complete copy of the Homeric poems, which he had obtained from the Creophylidæ, a clan or guild of poets in Samos. A better authenticated tradition connects Athens with early attempts to preserve the chief poetical treasure of the nation. Pisistratus is said to have charged some learned men with the task of collecting all "the poems of Homer;" but it is difficult to decide how much was comprehended under this last phrase, or whether the province of the commission went beyond the mere task of collecting. Nor can it be determined what exactly it was that Solon and Hipparchus respectively did for the Homeric poems. Solon, it has been thought, enacted that the poems should be recited from an authorized text (ἐξ ὑποβολῆς); Hipparchus, that they should be recited in a regular order (ἐξ ὑπολήψεως). At any rate, we know that in the 6th century B. C. a recitation of the poems of Homer was one of the established competitions at the Panathenæa, held once in four years. The reciter was called a *rhapsodist*,—properly one who weaves a long, smoothly-flowing chant, then an epic poet who chants his own or another's poem. The rhapsodist did not, like the early minstrel, use the accompaniment of the harp; he gave the verses in a flowing recitative, bearing in his hand a branch of laurel, the symbol of Apollo's inspiration. In the 5th century B. C. we find that various Greek cities had their own editions (αἱ πολιτικαὶ ἐκδόσεις) of the poems for recitation at their festivals. Among these were the editions of Massilia, of Chios, and of Argos. There were also editions bearing the name of the individual editor (αἱ κατ' ἀνδρα),—the best known being that which Aristotle prepared for Alexander. The recension of the poems by Aristarchus (156 B. C.) became the standard one, and is probably that on which the existing text is based. The oldest Homeric MS. extant, Venetus A of the *Iliad*, is of the 10th century; the first printed edition of Homer was that edited by the Byzantine Demetrius Chalcondyles (Florence, 1488). The first Aldine edition appeared twelve years later.

The Homeric question.

The ancient Greeks were almost unanimous in believing the *Iliad* and the *Odyssey* to be the work of one man, Homer, to whom they also as-

cribed some extant hymns, and probably much more besides. Aristotle and Aristarchus seem to have put Homer's date about 1044 B. C., Herodotus about 850 B. C. It was not till about 170 B. C. that the grammarians Hellanicus and Xenon put forward the view that Homer was the author of the *Iliad*, but not of the *Odyssey*. Those who followed them in assigning different authors to the two poems were called the Separaters (or *Chorizontes*). Aristarchus combated "the paradox of Xenon," and it does not seem to have had much acceptance in antiquity. Vico, a Neapolitan (1668–1744), seems to have been the first modern to suggest the composite authorship and oral tradition of the Homeric poems; but this was a pure conjecture in support of his theory that the names of ancient lawgivers and poets are often mere symbols. F. A. Wolf, in the *Prolegomena* to his edition (1795), was the founder of a scientific scepticism. The *Iliad*, he said (for he recognized the comparative unity and consistency of the *Odyssey*), was pieced together from many small unwritten poems by various hands, and was first committed to writing in the time of Pisistratus. This view was in harmony with the tone of German criticism at the time; it was welcomed as a new testimony to the superiority of popular poetry, springing from fresh natural sources, to elaborate works of art; and it at once found enthusiastic adherents. For the course of Homeric controversy since Wolf the reader is referred to the article HOMER. The general result has been, not to prove any precise theory of authorship, but rather to establish certain general propositions, and so far to limit the question. It is now generally admitted that the *Iliad* and the *Odyssey*, whatever their absolute or relative ages, must at least be regarded as belonging to the maturity of a poetical school in Ionia, which had gradually created an epic style. Next, it can no longer be doubted that the *Iliad* contains elements of various age and origin; the form and the matter alike show this, though we cannot with certainty point to any one group of these elements as the original nucleus around which our *Iliad* grew. Comparing the *Odyssey* with the *Iliad*, we perceive greater unity of design and of coloring, and indications of a somewhat later time; but not even here can we affirm that the poem as we have it, is the work of one man.

Cyclic poems.

The Ionian school of epos produced a number of poems founded on the legends of the Trojan war, and intended as introductions or continuations to the *Iliad* and the *Odyssey*. The grammarian Proclus (140 A. D.) has preserved the names and subjects of some of these; but the fragments are very scanty. The *Nostoi* or *Homeward Voyages*, by Agias of Trœzen, filled up the gap of ten years between the *Iliad* and the *Odyssey*; the *Lay of Telegonus*, by Eugammon of Cyrene, continued the story of the *Odyssey* to the death of Odysseus by the hand of Telegonus, the son whom Circe bore to him. Similarly the *Cyprian Lays*, by Stasinus of Cyprus, was introductory to the *Iliad*; the *Æthiopis* and the *Sack of Troy*, by Arctinus of Miletus, and the *Little Iliad*, by Lesches of Mitylene, were supplementary to it. These and many other names of lost epics—some taken also from the Theban myths—serve to show how prolific was that epic school of which only two great examples remain. The name of *epic cycle* was properly applied to a prose compilation of abstracts from these epics, pieced together in the order of the events. The compilers were called "cyclic" writers; and the term has now been transferred to the epic poets whom they used.

Hesiodic epos.

The epic poetry of Ionia celebrated the great deeds of heroes in the old wars. But in Greece proper there arose another school of epos, which busied itself with religious lore and ethical precepts especially in relation to the rural life of Bœotia. This school is represented by the name of Hesiod. The legend spoke of him as vanquishing Homer in a poetical contest at Chalcis in Eubœa; and it expresses the fact that, to the old Greek mind, these two names stood for two contrasted epic types. Nothing is certainly known of his date, except that it must have been subsequent to the maturity of Ionian epos. He is conjecturally placed about 850–800 B. C.; but some would refer him to the early part of the 7th century B. C. His home was at Ascra, a village in a valley under Helicon, whither his father had migrated from Cyme in Æolis on the coast of Asia Minor. In Hesiod's *Works and Days* we have the earliest example of a didactic poem. The seasons and the labors of the Bœotian farmer's year are followed by a list of the days which are lucky or unlucky for work. The *Theogony*, or "Origin of the Gods," describes first how the visible order of nature arose out of chaos: next, how the gods were born. Though it never possessed the character of a sacred book, it remained a standard authority on the genealogies of the gods. So far as a corrupt and confused text warrants a judgment, the poet was piecing together—not always intelligently—the fragments of a very old cosmogonic system, using for this purpose both the hymns preserved in the temples and the myths which lived in folklore. The epic lay in 480 lines called the *Shield of Heracles*—partly imitated from the 18th book of the *Iliad*—is the work of an author or authors later than Hesiod. In the Hesiodic poetry, as represented by the *Works and Days* and the *Theogony*, we see the influence of the temple at Delphi. Hesiod recognizes the existence of *daimones*—spirits of the departed who haunt the earth as the invisible guardians of justice; and he connects the office of the poet with that of the prophet. The poet is one whom the gods have authorized to impress doctrine and practical duties on men. A religious purpose was essentially characteristic of the Hesiodic school. Its poets treated the old legends as relics of a sacred history, and not merely, in the Ionian manner, as subjects of idealizing art. Such titles as the *Maxims of Cheiron* and the *Lay of Melampus*, the seer—lost poems of the Hesiodic school—illustrate its ethical and its mystic tendencies.

The Homeric Hymns.

The *Homeric Hymns* form a collection of thirty-three pieces, some of them very short, in hexameter verse. Their traditional title is—*Hymns* or *Preludes of Homer and the Homeridæ*. The second of the alternative designations is the true one. The pieces are not "hymns" used in formal worship, but "preludes" or prefatory addresses (*προοίμια*) with which the rhapsodists ushered in their recitations of epic poetry. The "prelude" might be addressed to the presiding god of the festival, or to any local deity whom the reciter wished to honor. The pieces range in date perhaps from 750 to 500 B. C., and it is probable that the collection was formed in Attica, for the use of rhapsodists. The style is that of the Ionian or Homeric epos; but there are also several traces of the Hesiodic or Bœotian school. The five principal "hymns" are those (1) to the Delian Apollo, i. 1–177; (2) to the Pythian Apollo, i. 178 to end; (3) to Hermes, ii.; (4) to Aphrodite, iii.; and (5) to Demeter, v. The hymn to the Delian Apollo, quoted by Thucydides (iii. 104) as Homer's, is of peculiar interest on account of the lines describing the Ionian festival at Delos. Two celebrated pieces of a sportive kind passed under Homer's name. The *Margites*—a comic poem on one "who knew many things but knew them all badly"—is regarded by Aristotle as the earliest germ of comedy, and was possibly as old as 700 B. C. Only a few lines remain. The *Battle of the Frogs and Mice* probably belongs to the decline of Greek literature, perhaps to the 2d century B. C. About 300 verses of it are extant.

Transition from epos to elegy.

In the *Iliad* and the *Odyssey* the personal opinions or sympathies of the poet may sometimes be conjectured, but they are not declared, or even hinted. Hesiod, indeed, sometimes gives us a glimpse of his own troubles or views. Yet Hesiod is, on the whole, essentially a prophet. The message which he delivers is not from himself; the truths which he imparts have not been discovered by his own search. He is the mouthpiece of the Delphian Apollo. Personal opinion and feeling may tinge his utterance, but they do not determine its general complexion. The egotism is a single thread; it is not the basis of the texture. Epic poetry was in Greece the foundation of all other poetry; for many centuries no other kind was generally cultivated, no other could speak to the whole people. Politically, the age was monarchical or aristocratic; intellectually, it was too simple for the analysis of thought or emotion. Kings and princes loved to hear of the great deeds of their ancestors; common men loved to hear of them too, for they had no other interest. The mind of Greece found no subject of contemplation so attractive as the warlike past of the race, or so useful as that lore which experience and tradition had bequeathed. But in the course of the 8th century B. C. the rule of hereditary princes began to disappear. Monarchy gave place to oligarchy, and this—often after the intermediate phase of a tyranny—to democracy. Such a change was necessarily favorable to the growth of reflection. The private citizen is no longe:

a mere cipher, the Homeric τις, a unit in the dim multitude of the king-ruled folk; he gains more power of independent action, his mental horizon is widened, his life becomes fuller and more interesting. He begins to feel the need of expressing the thoughts and feelings that are stirred in him. But as yet a prose literature does not exist; the new thoughts, like the old heroic stories, must still be told in verse. The forms of verse created by this need were the Elegiac and the Iambic.

Elegy. The elegiac metre is, in form, a simple variation on the epic metre, obtained by docking the second of two hexameters so as to make it a verse of five feet or measures. But the poetical capabilities of the elegiac couplet are of a wholly different kind from those of heroic verse. *Elegos* seems to be the Greek form of a name given by the Carians and Lydians to a lament for the dead. This was accompanied by the soft music of the Lydian flute, which continued to be associated with Greek elegy. The non-Hellenic origin of elegy is indicated by this very fact. The flute was to the Greeks an Asiatic instrument—string instruments were those which they made their own—and it would hardly have been wedded by them to a species of poetry which had arisen among themselves. The early elegiac poetry of Greece was by no means confined to mourning for the dead. War, love, politics, proverbial philosophy, were in turn its themes; it dealt, in fact, with the chief interest of the poet and his friends, whatever that might be at the time. It is the direct expression of the poet's own thoughts, addressed to a sympathizing society. This is its first characteristic. The second is that, even when most pathetic or most spirited, it still preserves, on the whole, the tone of conversation or of narrative. Greek elegy stops short of lyric passion. English elegy, whether funereal as in Dryden and Pope, or reflective as in Gray, is usually true to the same normal type. Roman elegy is not equally true to it, but sometimes tends to trench on the lyric province. For Roman elegy is mainly amatory or sentimental; and its masters imitated, as a rule, not the early Greek elegists, not Tyrtæus or Theognis, but the later Alexandrian elegists, such as Callimachus or Philetas. Catullus introduced the metre to Latin literature, and used it with more fidelity than his followers to its genuine Greek inspiration.

Iambic verse. Elegy, as we have seen, was the first slight deviation from epos. But almost at the same time another species arose which had nothing in common with epos, either in form or in spirit. This was the iambic. The word *iambos* (*iapto*, to dart or shoot) was used in reference to the licensed raillery at the festivals of Demeter; it was the maiden Iambe, the myth said, who drew the first smile from the mourning goddess. The iambic metre was at first used for satire; and it was in this strain that it was chiefly employed by its earliest master of note, Archilochus of Paros (670 B.C.). But it was adapted to the expression generally of any pointed thought. Thus it was suitable to fables. Elegiac and iambic poetry both belong to the borderland between epic and lyric. While, however, elegy stands nearer to epos, iambic stands nearer to the lyric. Iambic poetry can express the personal feeling of the poet with greater intensity than elegy does; on the other hand, it has not the lyric flexibility, self-abandonment, or glow. As we see in the case of Solon, iambic verse could serve for the expression of that deeper thought, that more inward self-communing, for which the elegiac form would have been inappropriate.

But these two forms of poetry, both Ionian, the elegiac and the iambic, belong essentially to the same stage of the literature. They stand between the Ionian epos and the lyric poetry of the Æolians and Dorians. The earliest of the Greek elegists, Callinus and Tyrtæus, use elegy to rouse a warlike spirit in sinking hearts. Archilochus too wrote warlike elegy, but used it also in other strains, as in lament for the dead. The elegy of Mimnermus is the plaintive farewell of an ease-loving Ionian to the days of Ionian freedom. In Solon elegy takes a higher range; it becomes political and ethical. Theognis represents the maturer union of politics with a proverbial philosophy. Xenophanes gives a philosophic strain to elegy. With Simonides of Ceos it reverts, in an exquisite form, to its earliest destination, and becomes the vehicle of epitaph on those who fell in the Persian wars. Iambic verse was used by Simonides of Amorgus, as by Archilochus, for satire,—but satire directed against classes rather than persons. Solon's iambics so far preserve the old associations of the metre that they represent the polemical or controversial side of his political poetry. Hipponax of Ephesus was another iambic satirist—using the "scazon" or "limping" verse, produced by substituting a spondee for an iambus in the last place. But it was not until the rise of he Attic drama that the full capabilities of iambic verse were seen.

Lyric poetry. The lyric poetry of early Greece may be regarded as the final form of that effort at self-expression which in the elegiac and iambic is still incomplete. The lyric expression is deeper and more impassioned. Its intimate union with music and with the rhythmical movement of the dance gives to it more of an ideal character. At the same time the continuity of the music permits pauses to the voice,—pauses necessary as reliefs after a climax. Before lyric poetry could be effective, it was necessary that some progress should have been made in the art of music. The instrument used by the Greeks to accompany the voice was the four-stringed lyre, and the first great epoch in Greek music was when Terpander of Lesbos (660 B.C.), by adding three strings, gave the lyre the compass of the octave. Further improvements are ascribed to Olympus and Thaletas. By 500 B.C. Greek music had probably acquired all the powers of expression which the lyric poet could demand. The period of Greek lyric poetry may be roughly defined as from 670 to 440 B.C. Two different parts in its development were taken by the Æolians and the Dorians.

Æolian school. The lyric poetry of the Æolians—especially of Lesbos—was essentially the utterance of personal feeling, and was usually intended for a single voice, not for a chorus. Lesbos in the 7th century B.C. had attained some naval and commercial importance. But the strife of oligarchy and democracy was active; the Lesbian nobles were often driven by revolution to exchange their luxurious home-life for the hardships of exile. It is such a life of contrasts and excitements, working on a sensuous and fiery temperament, that is reflected in the fragments of Alcæus. In these glimpses of war and love, of anxiety for the storm-tossed state and of careless festivity, there is much of the cavalier spirit; if Archilochus is in certain aspects a Greek Byron, Alcæus might be compared to Lovelace. The other great representative of the Æolian lyric is Sappho, the only woman of Greek race who is known to have possessed poetical genius of the first order. Intensity and melody are the characteristics of the fragments that remain to us. Probably no poet ever surpassed Sappho as an interpreter of passion in exquisitely subtle harmonies of form and sound. Anacreon of Teos, in Ionia, may be classed with the Æolian lyrists in so far as the matter and form of his work resembled theirs, though the dialect in which he wrote was mainly the Ionian. A few fragments remain from his hymns to the gods, from love-poems and festive songs. The collection of sixty short pieces which passes current under his name dates only from the 10th century. The short poems which it comprises are of various age and authorship,—all of them probably of the Christian era. They have not the pure style, the flexible grace, or the sweetness of the classical fragments; but the verses, though somewhat mechanical, are often pretty.

Dorian school. The Dorian lyric poetry, in contrast with the Æolian, had more of a public than of a personal character, and was for the most part choral. Hymns or choruses for the public worship of the gods, and odes to be sung at festivals on occasions of public interest, were its characteristic forms. Its central inspiration was the pride of the Dorians in the Dorian past, in their traditions of worship, government, and social usage. The history of the Dorian lyric poetry does not present us with vivid expressions of personal character, like those of Alcæus and Sappho, but rather with a series of artists whose names are associated with improvements of form. Thus Alcman (660 B.C.) is said to have introduced the balanced movement of strophe and antistrophe. Stesichorus, of Himera in Sicily, added the epode, sung by the chorus while stationary after these movements; Arion gave a finished form to the choral hymn ("dithyramb") in honor of Dionysus and organized the "cyclic" or circular chorus which sang it at the altar.

Simonides and Pindar. The culmination of the lyric poetry is marked by two great names, Simonides and Pindar. Simonides was an Ionian of the island of Ceos, but his lyrics belonged by form to the choral

Dorian school. Many of his subjects were taken from the events of the Persian wars: his epitaphs on those who fell at Thermopylæ and Salamis were celebrated. In him the lyric art of the Dorians is interpreted by Ionian genius, and Athens—where part of his life was passed—is the point at which they meet. Simonides is the first Greek lyrist whose significance is not merely Æolian or Dorian but Panhellenic. The same character belongs even more completely to his younger contemporary. Pindar was born in Bœotia of a Dorian stock; thus, as Ionian and Dorian elements meet in Simonides, so Dorian and Æolian elements meet in Pindar. Simonides was perhaps the most tender and most exquisite of the lyric poets. Pindar was the boldest, the most fervid, and the most sublime. His extant fragments represent almost every branch of the lyric art. But he is known to us mainly by forty-four *Epinicia*, or odes of victory, for the Olympian, Pythian, Nemean, and Isthmian festivals. The general characteristic of the treatment is that the particular victory is made the occasion of introducing heroic legends connected with the family or city of the victor, and of inculcating the moral lessons which they teach. No Greek lyric poetry can be completely appreciated apart from the music, now lost, to which it was set. Pindar's odes were, further, essentially occasional poems; they abound in allusions of which the effect is partly or wholly lost on us; and the glories which they celebrate belong to a life which we can but imperfectly realize. Of all the great Greek poets, Pindar is perhaps the one to whom it is hardest for us to do justice; yet we can at least recognize his splendor of imagination, his strong rapidity, and his soaring flight.

II. *The Attic Literature.*

The Ionians of Asia Minor, the Æolians, and the Dorians had now performed their special parts in the development of Greek literature. Epic poetry had interpreted the heroic legends of warlike deeds done by Zeus-nourished kings and chiefs. Then, as the individual life became more and more refined,[1] elegiac and iambic poetry had become the social expression of that life in all its varied interests and feelings. Lastly, lyric poetry had arisen to satisfy a two-fold need—to be the more intense utterance of personal emotion, or to give choral voice, at stirring moments, to the faith or fame, the triumph or the sorrow, of a city or a race. A new form of poetry was now to be created, with elements borrowed from all the rest. And this was to be achieved by the people of Attica, in whose character and language the distinctive traits of an Ionian descent were tempered with some of the best qualities of the Dorian stock.

Origin of drama.

The drama arose from the festivals of Dionysus, the god of wine, which were held at intervals from the beginning of winter to the beginning of spring. A troop of rustic worshippers would gather around the altar of the god, and sing a hymn in his honor, telling of his victories or sufferings in his progress over the earth. "Tragedy" meant the "goat-song," a goat being sacrificed to Dionysus before the hymn was sung. "Comedy," "the village-song," is the same hymn regarded as an occasion for rustic jest. Then the leader of the chorus would assume the part of a messenger from Dionysus, or even that of the god himself, and recite an adventure to the worshippers, who made choral response. The next step was to arrange a dialogue between the leader (*coryphæus*) and one chosen member of the chorus, hence called "the answerer" (*hypocrites*, afterwards the ordinary word for "actor"). This last improvement is ascribed to the Attic Thespis (about 536 B.C.). The elements of drama were now ready. The choral hymn to Dionysus (the "dithyramb") had received an artistic form from the Dorians; dialogue, though only between the leader of the chorus and a single actor, had been introduced in Attica. Phrynichus, an Athenian, celebrated in this manner some events of the Persian wars; but in his "drama" there was still only one actor.

Tragedy.

Æschylus.

Æschylus (born 525 B.C.) became the real founder of tragedy by introducing a second actor, and thus rendering the dialogue independent of the chorus. At the same time the choral song—hitherto the principal part of the performance—became subordinate to the dialogue; and drama was mature. Æschylus is also said to have made various improvements of detail in costume and the like; and it was early in his career that the theatre of Dionysus under the acropolis was commenced—the first permanent home of Greek drama, in place of the temporary wooden platforms which had hitherto been used. The system of the "trilogy" and the "tetralogy" is further ascribed to Æschylus,—the "trilogy" being properly a series of three tragedies connected in subject, such as the *Agamemnon*, *Choephori*, *Eumenides*, which together form the *Oresteia*, or Story of Orestes. The "tetralogy" is such a triad with a "satyric drama" added—that is, a drama in which "satyrs," the grotesque woodland beings who attended on Dionysus, formed the chorus, as in the earlier dithyramb from which drama sprang. The *Cyclops* of Euripides is a satyric drama. In the seven tragedies which alone remain of the seventy which Æschylus is said to have composed, the forms of kings and heroes have a grandeur which is truly Homeric; there is a spirit of Panhellenic patriotism such as the Persian wars in which he fought might well quicken in a soldier-poet; and, pervading all, there is a strain of speculative thought which seeks to reconcile the apparent conflicts between the gods of heaven and of the underworld by the doctrine that both alike, constrained by necessity, are working out the law of righteousness. Sophocles, who was born thirty years after Æschylus (495 B.C.), is the most perfect artist of the ancient drama. No one before or after him gave to Greek tragedy so high a degree of ideal beauty, or appreciated so finely the possibilities and the limitations of its sphere. He excels especially in drawing character; his *Antigone*, his *Ajax*, his *Œdipus*—indeed, all the chief persons of his dramas—are typical studies in the great primary emotions of human nature. He gave a freer scope to tragic dialogue by adding a third actor; and in one of his later plays, the *Œdipus at Colonus*, a fourth actor is required. From the time when he won the tragic prize against Æschylus in 468 to his death in 405 B.C. he was the favorite dramatist of Athens; and for us he is not only a great dramatist, but also the most spiritual representative of the age of Pericles. The distinctive interest of Euripides is of another kind. He was only fifteen years younger than Sophocles; but when he entered on his poetical career, the old inspirations of tragedy were already failing. Euripides marks a period of transition in the tragic art, and is, in fact, the mediator between the classical and the romantic drama. The myths and traditions with which the elder dramatists had dealt no longer commanded an unquestioning faith. Euripides himself was imbued with the new intellectual scepticism of the day; and the speculative views which were conflicting in his own mind are reflected in his plays. He had much picturesque and pathetic power; he was a master of expression; and he shows ingenuity in devising fresh resources for tragedy—especially in his management of the choral songs. Æschylus is Panhellenic, Sophocles is Athenian, Euripides is cosmopolitan. He stands nearer to the modern world than either of his predecessors; and though with him Attic tragedy loses its highest beauty, it acquires new elements of familiar human interest.

Sophocles.

Euripides.

In Attica, as in England, a period of rather less than fifty years sufficed for the complete development of the tragic art. The two distinctive characteristics of Athenian drama are its originality and its abundance. The Greeks of Attica were not the only inventors of drama, but they were the first people who made drama a complete work of art. And the great tragic poets of Attica were remarkably prolific. Æschylus was the reputed author of 70 tragedies, Sophocles of 113, Euripides of 92; and there were others whose productiveness was equally great.

Comedy represented the lighter side, as tragedy the graver side, of the Dionysiac worship; it was the joy of spring following the gloom of winter. The process of growth was nearly the same as in tragedy; but the Dorians, not the Ionians of Attica, were the first who added dialogue to the comic chorus. Susarion, a Dorian of Megara, exhibited about 580 B.C. pieces of the kind known as "Megarian farces." The more artistic form of comedy seems, however, to have been developed in Attica. The greatest names before Aristophanes are those of Cratinus and Eupolis; but from about 470 B.C. there seems to have been a continuous succession of comic dramatists. Aristophanes came forward as a comic poet in 427 B.C., and retained his popularity for about forty years. He presents a perhaps unique union of bold fancy, exquisite humor, critical acumen, and lyrical power. His eleven extant comedies may be divided into three groups, according as the license of political satire becomes

Comedy.

Aristophanes.

[1] The word "refined" is not found in the original, and is inserted here in the absence of some such word necessary to complete the sentence. AMER. PUB.

more and more restricted. In the *Acharnians*, *Knights*, *Clouds*, *Wasps*, and *Peace* (425–421) the poet uses unrestrained freedom. In the *Birds*, *Lysistrata*, *Thesmophoriazusæ*, and *Frogs* (414–405) a greater reserve may be perceived. Lastly, in the *Ecclesiazusæ* and the *Plutus* (392–388) personal satire is almost wholly avoided. The same general tendency continued. The so-called "Middle Comedy" (390–320) represents the transition from the Old Comedy, or political satire, to satire of a literary or social nature. The "New Comedy" (320–250) resembled the modern "comedy of manners." These successive periods cannot be sharply or precisely marked off. The change which gradually passed over the comic drama was simply the reflection of the change which passed over the political and social life of Athens. The Old Comedy, as we see it in the earlier plays of Aristophanes, was probably the most powerful engine of public criticism that has ever existed in any community. Unsparing personality was its essence. The comic poet used this recognized right on an occasion at once festive and sacred, in a society where every man of any note was known by name and sight to the rest. The same thousands who heard a policy or a character denounced or lauded in the theatre might be required to pass sentence on it in the popular assembly or in the courts of law.

Literary prose.

The development of Greek poetry had been completed before a prose literature had begun to exist. The earliest name in extant Greek prose literature is that of Herodotus; and, when he wrote, the Attic drama had already passed its prime. There had been, indeed, writers of prose before Herodotus; but there had not been, in the proper sense of the term, a prose literature. The causes of this comparatively late origin of Greek literary prose are independent of the question as to the time at which the art of writing began to be generally used for literary purposes. Epic poetry exercised for a very long period a sovereign spell over the Greek mind. In it was deposited all that the race possessed of history, theology, philosophy, oratory. Even after an age of reflection had begun, elegiac poetry, the first offshoot of epic, was, with iambic verse, the vehicle of much which among other races would have been committed to prose. The basis of Greek culture was essentially poetical. A political cause worked in the same direction. In the Eastern monarchies the king was the centre of all, and the royal records afforded the elements of history from a remote date. The Greek nation was broken up into small states, each busied with its own affairs and its own men. It was the collision between the Greek and the barbarian world which first provided a national subject for a Greek historian. The work of Herodotus, in its relation to Greek prose, is so far analogous to the *Iliad* in its relation to Greek poetry, that it is the earliest work of art, and that it bears a Panhellenic stamp.

Early prose writers.

The sense and the degree in which Herodotus was original may be inferred from what is known of earlier prose writers. For about a century before Herodotus there had been a series of writers in philosophy, mythology, geography, and history. The earliest, or among the earliest, of the philosophical writers were Pherecydes of Syros (550 B. C.) and the Ionian Anaximenes and Anaximander. The Ionian writers, especially called *logographi*, "narrators in prose" (as distinguished from *epopoii*, makers of verse), were those who compiled the myths, especially in genealogies, or who described foreign countries, their physical features, usages, and traditions. Hecatæus of Miletus (500 B. C.) is the best-known representative of the *logographi* in both these branches. Hellanicus of Mitylene (450 B. C.), among whose works was a history of Attica, appears to have made a nearer approach to the character of a systematic historian.

Herodotus.

Herodotus was born in 484 B. C.; and his history was probably not completed before the beginning of the Peloponnesian War (431 B. C.). His subject is the struggle between Greece and Asia, which he deduces from the legendary rape of the Argive Io by Phœnicians, and traces down to the final victory of the Greeks over the invading host of Xerxes. His literary kinship with the historical or geographical writers who had preceded him is seen mainly in two things. First, though he draws a line between the mythological and the historical age, he still holds that myths, as such, are worthy to be reported, and that in certain cases it is part of his duty to report them. Secondly, he follows the example of such writers as Hecatæus in describing the natural and social features of countries. He seeks to combine the part of the geographer or intelligent traveller with his proper part as historian. But when we turn from these minor traits to the larger aspects of his work, Herodotus stands forth as an artist whose conception and whose method were his own. His history has an epic unity. Various as are the subordinate parts, the action narrated is one, great and complete; and the unity is due to this that Herodotus refers all events of human history to the principle of divine Nemesis. If Sophocles had told the story of Œdipus in the *Œdipus Tyrannus* alone, and had not added to it the *Œdipus at Colonus*, it would have been comparable to the story of Xerxes as told by Herodotus. Great as an artist, great too in the largeness of his historical conception, Herodotus fails chiefly by lack of insight into political cause and effect, and by a general silence in regard to the history of political institutions. Both his strength and his weakness are seen most clearly when he is contrasted with that other historian who was strictly his contemporary, and who yet seems divided from him by centuries.

Thucydides.

Thucydides was only thirteen years younger than Herodotus; but the intellectual space between the men is so great that they seem to belong to different ages. Herodotus is the first artist in historical writing; Thucydides is the first thinker. Herodotus interweaves two threads of causation—human agency, represented by the good or bad qualities of men, and divine agency, represented by the vigilance of the gods on behalf of justice. Thucydides concentrates his attention on the human agency (without, however, denying the other), and strives to trace its exact course. The subject of Thucydides is the Peloponnesian War. In resolving to write its history, he was moved, he says, by these considerations. It was probably the greatest movement which had ever affected Hellas collectively. It was possible for him as a contemporary to record it with approximate accuracy. And this record was likely to have a general value, over and above its particular interest as a record, seeing that the political future was likely to resemble the political past. This is what Thucydides means when he calls his work "a possession for ever." The speeches which he ascribes to the persons of the history are, as regards form, his own essays in rhetoric of the school to which Antiphon belongs. As regards matter, they are always so far dramatic that the thoughts and sentiments are such as he conceived possible for the supposed speaker. Thucydides abstains, as a rule, from moral comment; but he tells his story as no one could have told it who did not profoundly feel its tragic force; and his general claim to the merit of impartiality is not invalidated by the possible exceptions—difficult to estimate—in the cases of Cleon and Hyperbolus.

Xenophon.

Strong as is the contrast between Herodotus and Thucydides, their works have yet a character which distinguish both alike from the historical work of Xenophon in the *Anabasis* and the *Hellenica*. Herodotus gives us a vivid drama with the unity of an epic. Thucydides takes a great chapter of contemporary history and traces the causes which are at work throughout it, so as to give the whole a scientific unity. Xenophon has not the grasp either of the dramatist or of the philosopher. His work does not possess the higher unity either of art or of science. The true distinction of Xenophon consists in his thorough combination of the practical with the literary character. He was an accomplished soldier, who had done and seen much. He was also a good writer, who could make a story both clear and lively. But the several parts of the story are not grouped around any central idea, such as a divine Nemesis is for Herodotus, or such as Thucydides finds in the nature of political man. The seven books of the *Hellenica* form a supplement to the history of Thucydides, beginning in 411 and going down to 362 B. C. The chief blot on the *Hellenica* is the author's partiality to Sparta, and in particular to Agesilaus. Some of the greatest achievements of Epaminondas and Pelopidas are passed over in silence. On the whole, Xenophon is perhaps seen at his best in his narrative of the *Retreat of the Ten Thousand*—a subject which exactly suits him. The *Cyropædia* is a romance of little historical worth, but with many good passages. *The Recollections of Socrates*, on the other hand, derive their principal value from being uniformly matter-of-fact. In his minor pieces on various subjects Xenophon appears as the earliest essayist. It may be noted that one of the essays erroneously ascribed to him—that *On*

the Athenian Polity—is probably the oldest specimen in existence of literary Attic prose.

Oratory. The steps by which an Attic prose style was developed, and the principal forms which it assumed, can be traced most clearly in the Attic orators. Every Athenian citizen who aspired to take part in the affairs of the city, or even to be qualified for self-defence before a law-court, required to have some degree of skill in public speaking; and an Athenian audience looked upon public debate, whether political or forensic, as a competitive trial of proficiency in a fine art. Hence the speaker, no less than the writer, was necessarily a student of finished expression; and oratory had a more direct influence on the general structure of literary prose than has ever perhaps been the case elsewhere. A systematic rhetoric took its rise in Sicily, where Corax of Syracuse (466 B. C.) devised his *Art of Words* to assist those who were pleading before the law-courts; and it was brought to Athens by his disciple Tisias. The teaching of the Sophists, again, directed attention, though in a superficial and imperfect way, to the elements of grammar and logic; and Gorgias of Leontini—whose declamation, however turgid, must have been striking—gave an impulse at Athens to the taste for elaborate rhetorical brilliancy.

The Attic orators. Antiphon represents the earliest, and what has been called the grand, style of Attic prose; its chief characteristics are a grave, dignified movement, a frequent emphasis on verbal contrasts, and a certain austere elevation. The interest of Andocides is mainly historical; but he has graphic power. Lysias, the representative of the "plain style," breaks through the rigid mannerism of the elder school, and uses the language of daily life with an ease and grace which, though the result of study, do not betray their art. He is, in his own way, the canon of an Attic style; and his speeches written for others exhibit also a high degree of dramatic skill. Isocrates, whose manner may be regarded as intermediate between that of Antiphon and that of Lysias, wrote for readers rather than for hearers. The type of literary prose which he founded is distinguished by ample periods, by studied smoothness, and by the temperate use of rhetorical ornament. From the middle of the 4th century B. C. the Isocratic style of prose became general in Greek literature. From the school of Rhodes, in which it became more florid, it passed to Cicero, and through him it has helped to shape the literary prose of the modern world. The speeches of Isæus in will-cases are interesting,—apart from their bearing on Attic life,—because in them we see, as Dionysius says, "the seeds and the beginnings" of that technical mastery in rhetorical argument which Demosthenes carries to perfection. Isæus has also in a degree some of the qualities of Lysias.

Demosthenes. Demosthenes excels all other masters of Greek prose not only in power but in variety; his political speeches, his orations in public or private causes, show his consummate and versatile command over all the resources of the language. In him the development of Attic prose is completed, and the best elements in each of its earlier phases are united. The modern world can more easily appreciate Demosthenes as a great natural orator than as an elaborate artist. But, in order to apprehend his place in the history of Attic prose, we must remember that the ancients felt him to be both; and that he was even reproached by detractors with excessive study of effect. Æschines is the most theatrical of the Greek orators; he is vehement, and often brilliant, but seldom persuasive. Hyperides was, after Demosthenes, probably the most effective; he had much of the grace of Lysias, but also a wit, a fire, and a pathos which were his own. The one oration of Lycurgus which remains to us is earnest and stately, reminding us both of Antiphon and of Isocrates. Dinarchus was merely a bad imitator of Demosthenes. There seems more reason to regret that Demades is not represented by larger fragments. The decline of Attic oratory may be dated from Demetrius of Phalerum (318 B. C.), the pupil of Aristotle. Cicero names him as the first who impaired the vigor of the earlier eloquence, "preferring his own sweetness to the weight and dignity of his predecessors."

Philosophical prose—Plato and Aristotle. The place of Plato in the history of Greek literature is as unique as his place in the history of Greek thought. The literary genius shown in the dialogues is many-sided: it includes dramatic power, remarkable skill in parody, a subtle faculty of satire, and, generally, a command over the finer tones of language. In passages of continuous exposition, where the argument rises into the higher regions of discussion, Plato's prose takes a more decidedly poetical coloring—never florid or sentimental, however, but lofty and austere. In Plato's later works—such, for instance, as the *Laws*, *Timæus*, *Critias*—we can perceive that his style did not remain unaffected by the smooth literary prose which contemporary writers had developed. Aristotle's influence on the form of Attic prose literature would probably have been considerable if his *Rhetoric* had been published while Attic oratory had still a vigorous life before it. But in this, as in other departments of mental effort, it was Aristotle's lot to set in order what the Greek intellect had done in that creative period which had now come to an end. His own chief contribution to the original achievements of the race was the most fitting one that could have been made by him in whose lifetime they were closed. He bequeathed an instrument by which analysis could be carried further, he founded a science of reasoning, and left those who followed him to apply it in all those provinces of knowledge which he had mapped out. Theophrastus, his pupil and his successor in the Lyceum, opens the new age of research and scientific classification with his extant works on botany, but is better known to modern readers by his lively *Characters*, the prototypes of such sketches in our own literature as those of Hall, Overbury, and Earle.

III. *The Literature of the Decadence.*

Character of the creative age in Greek literature. The period of decadence in Greek literature begins with the extinction of free political life in the Greek cities. So long as the Greek commonwealths were independent and vigorous, Greek life rested on the identity of the man with the citizen. The city was the highest unit of social organization; the whole training and character of the man were viewed relatively to his membership of the city. The market-place, the assembly, the theatre, were places of frequent meeting, where the sense of citizenship was quickened, where common standards of opinion or feeling were formed. Poetry, music, sculpture, literature, art, in all their forms, were matters of public interest. Every citizen had some degree of acquaintance with them, and was in some measure capable of judging them. The poet and the musician, the historian and the sculptor, did not live a life of studious seclusion or engrossing professional work. They were, as a rule, in full sympathy with the practical interests of their time. Their art, whatever its form might be, was the concentrated and ennobled expression of their political existence. Æschylus breathed into tragedy the inspiration of one who had himself fought the great fight of national liberation. Sophocles was the colleague of Pericles in a high military command. Thucydides describes the operations of the Peloponnesian War with the practical knowledge of one who had been in charge of a fleet. Ictinus and Phidias gave shape in stone, not to mere visions of the studio, but to the more glorious, because more real and vivid, perceptions which had been quickened in them by a living communion with the Athenian spirit, by a daily contemplation of Athenian greatness, in the theatre where tragic poets idealized the legends of the past, in the ecclesia where every citizen had his vote on the policy of the state, or in that free and gracious society, full of beauty, yet exempt from vexatious constraint, which belonged to the age of Pericles. The tribunal which judged these works of literature or art was such as was best fitted to preserve the favorable conditions under which they arose. Criticism was not in the hands of a literary clique or of a social caste. The influence of jealousy or malevolence, and the more fatal influence of affectation, had little power to affect the verdict. The verdict was pronounced by the whole body of the citizens. The success or failure of a tragedy was decided, not by the minor circumstance that it gained the first or second prize, but by the collective opinion of the citizens assembled in the theatre of Dionysus. A work of architecture or sculpture was approved or condemned, not by the sentence of a few whom the multitude blindly followed, but by the general judgment of some twenty thousand persons, each of whom was in some degree qualified by education and by habit to form an independent estimate. The artist worked for all his fellow-citizens, and knew that he would be judged by all. The soul of his work was the fresh and living inspiration of nature; it was the ennobled expression

of his own life; and the public opinion before which it came was free, intelligent, and sincere.

The transition to Hellenism.

Philip of Macedon did not take away the municipal independence of the Greek cities, but he dealt a death-blow to the old political life. The Athenian poet, historian, artist, might still do good work, but he could never again have that which used to be the very mainspring of all such activity,—the daily experience and consciousness of participation in the affairs of an independent state. He could no longer breathe the invigorating air of constitutional freedom, or of the social intercourse to which that freedom lent dignity as well as grace. Then came Alexander's conquests; Greek civilization was diffused over Asia and the East by means of Greek colonies in which Asiatic and Greek elements were mingled. The life of such settlements, under the monarchies into which Alexander's empire broke up, could not be animated by the spirit of the Greek commonwealths in the old days of political freedom. But the externals of Greek life were there,—the temples, the statues, the theatres, the porticos. Ceremonies and festivals were conducted in the Greek manner. In private life Greek usages prevailed. Greek was the language most used; Greek books were in demand. The mixture of races would always in some measure distinguish even the outward life of such a community from that of a pure Greek state; and the facility with which Greek civilization was adopted would vary in different places. Syria, for example, was rapidly and completely Hellenized. Judæa resisted the process to the last. In Egypt a Greek aristocracy of office, birth, and intellect existed side by side with a distinct native life. But, viewed in its broadest aspect, this new civilization may be called Hellenism. As *hellenizo* means "to do like Hellene," Hellenism means the adoption of Hellenic ways; and it is properly applied to a civilization, generally Hellenic in external things, pervading people not necessarily or exclusively Hellenic by race. What the Hellenic literature was to Hellas, that the Hellenistic literature was to Hellenism. The literature of Hellenism has the Hellenic form without the Hellenic soul. The literature of Hellas was creative; the literature of Hellenism is derivative.

The Alexandrian period.

1. Alexandria was the centre of Greek intellectual activity from Alexander to Augustus. Its "Museum" or college, and its library, both founded by the first Ptolemy (Soter), gave it such attractions for learned men as no other city could rival. The labors of research or arrangement are those which characterize the Alexandrian period. Even in

Poetry.

its poetry spontaneous motive was replaced by erudite skill, as in the hymns, epigrams, and elegies of Callimachus, in the enigmatic verses of Lycophron, in the highly finished epic of Apollonius Rhodius, and in the versified lore, astronomical or medical, of Aratus and Nicander. The pastoral poetry of the age—Dorian by origin—was the most pleasing; for this, if it is to please at all, must have its spring in the contemplation of nature. Theocritus is not exempt from the artificialism of the Hellenizing literature; but his true sense of natural beauty entitles him to a place in the first rank of pastoral poets. Bion of Ionia and Moschus of Syracuse also charm by the music and often by the pathos of their bucolic verse. But it is not for its poetry of any kind that this period of Greek literature is memorable. Its true work was in erudition and science. Aristarchus (156 B.C.), the greatest in a long line of Alexandrian critics, set the example of a more thorough method in revising and interpreting the ancient texts, and may in this sense be said to have become the founder of scientific scholarship. The critical studies of Alexandria, carried on by the followers of Aristarchus, gradually formed the basis for a science of grammar. Translation was another province of work which employed the learned of Alexandria,—where the Septuagint version of the Old Testament was begun, probably about 300–250 B.C. Chronology was treated scientifically by Eratosthenes, and was combined with history by Manetho in his chronicles of Egypt, and by Berosus in his chronicles of Chaldæa. Euclid was at Alexandria in the reign of Ptolemy Soter. The general results of the Alexandrian period might perhaps be stated thus. Alexandria produced a few eminent men of science, some learned poets (in a few cases, of great literary merit), and many able scholars. The preservation of the best Greek literature was due chiefly to the unremitting care of the Alexandrian critics, whose appreciation of it partly compensated for the decay of the old Greek perceptions in literature and art, and who did their utmost to hand it down in a form as free as possible from the errors of copyists. On the whole, the patronage of letters by the Ptolemies had probably as large a measure of success as was possible under the existing conditions; and it was afforded at a time when there was special danger that a true literary tradition might die out of the world.

Erudition and science.

Summary.

2. The Græco-Roman period in the literature of Hellenism may be dated from the Roman subjugation of Greece. "Greece made a captive of the rough conqueror," but it did not follow from this intellectual conquest that Athens became once more the intellectual centre of the world. Under the empire, indeed, the university of Athens long enjoyed a pre-eminent reputation. But Rome gradually became the point to which the greatest workers in every kind were drawn. Greek literature had already made a home there before the close of the 2d century B.C. Sulla brought a Greek library from Athens to Rome. Such men as Cicero and Atticus were indefatigable collectors and readers of Greek books. The power of speaking and writing the Greek language became an indispensable accomplishment for highly educated Romans. The library planned by Julius Cæsar and founded by Augustus had two principal departments, one for Latin, the other for Greek works. Tiberius, Vespasian, Domitian, and Trajan contributed to enlarge the collection. Rome became more and more the rival of Alexandria, not only as possessing great libraries, but also as a seat of learning at which Greek men of letters found appreciation and encouragement. Greek poetry, especially in its higher forms, rhetoric and literary criticism, history and philosophy, were all cultivated by Greek writers at Rome.

The Græco-Roman period.

The first part of the Græco-Roman period may be defined as extending from 146 B.C. to the close of the Roman republic. At its commencement stands the name of one who had more real affinity than any of his contemporaries with the great writers of old Athens, and who, at the same time, saw most clearly how the empire of the world was passing to Rome. The subject of Polybius was the history of Roman conquest from 264 to 146 B.C. His style, plain and straightforward, is free from the florid rhetoric of the time. But the distinction of Polybius is that he is the last Greek writer who in some measure retains the spirit of the old citizen-life. He chose his subject, not because it gave scope to learning or literary skill, but with a motive akin to that which prompted the history of Thucydides—namely, because, as a Greek citizen, he felt intensely the political importance of those wars which had given Rome the mastery of the world. The chief historical work which the following century produced—the *Universal History* of Diodorus Siculus—resembled that of Polybius in recognizing Rome as the political centre of the earth, as the point on which all earlier series of events converged. In all else Diodorus represents the new age in which the Greek historian had no longer the practical knowledge and insight of a traveller, a soldier, or a statesman, but only the diligence, and usually the dulness, of a laborious compiler.

First part: 146–30 B.C.

Second part: 30 B.C.–529 A.D.

The Greek literature of the Roman empire, from Augustus to Justinian, was enormously prolific. The area over which the Greek language was diffused—either as a medium of intercourse or as an established branch of the higher education—was co-extensive with the empire itself. An immense store of materials had now been accumulated, on which critics, commentators, compilers, imitators, were employed with incessant industry. In very many of its forms, the work of composition or adaptation had been reduced to a mechanical knack. If there is any one characteristic which broadly distinguishes the Greek literature of these five centuries, it is the absence of originality either in form or in matter. Lucian is, in his way, a rare exception; and his great popularity—he is the only Greek writer of this period, except Plutarch, who has been widely popular—illustrates the flatness of the arid level above which he stands out. The sustained abundance of literary production under the empire was partly due to the fact that there was no open political career. Never, probably, was literature so important as a resource for educated men, and the habit of reciting before friendly or obsequious audiences swelled

the number of writers whose taste had been cultivated to a point just short of perceiving that they ought not to write.

Departments of prose literature.

In the manifold prose work of this period, four principal departments may be distinguished. (1) *History*, with *Biography*, and *Geography*. It would exceed the limits of the present summary to notice in detail the works which belong to this and to the other provinces; but it may be useful, for purposes of reference and classification, to give some chief names in each. History is represented by Dionysius of Halicarnassus,—also memorable for his criticisms on the orators and his effort to revive a true standard of Attic prose,—by Josephus, Arrian, Appian, and Herodian. In biography, the foremost names are Plutarch, Diogenes Laertius, and Philostratus; in geography, Strabo and Pausanias. (2) *Erudition* and *Science*. The learned labors of the Alexandrian schools were continued in all their various fields. Under this head may be mentioned such works as the lexicon of Julius Pollux; the commentaries of Galen on Plato and on Hippocrates; the learned miscellanies of Athenæus, Ælian, and Stobæus; and the *Stratagems* of Polyænus. (3) *Rhetoric* and *Belles Lettres*. The most popular writers on the theory of rhetoric were Hermogenes, Aphthonius, and Cassius Longinus—the last the reputed author of the essay *On Sublimity*. Among the most renowned teachers of rhetoric—now distinctively called "Sophists," or rhetoricians—were Dion Chrysostom, Ælius Aristides, Themistius, Himerius, Libanius, and Herodes Atticus. Akin to the rhetorical exercises were various forms of ornamental or imaginative prose—dialogues, letters, essays, or novels. Lucian, in his dialogues, exhibits more of the classical style and of the classical spirit than any writer of the later age; he has also a remarkable affinity with the tone of modern satire, as in Swift or Voltaire. His Attic prose, though necessarily artificial, was at least the best that had been written for four centuries. The emperor Julian was the author both of orations and of satirical pieces. The chief of the Greek novelists are Xenophon of Ephesus and Longus, representing a purely Greek type of romance, and Heliodorus, —with his imitators Achilles Tatius and Chariton,—representing a school influenced by Oriental fiction. There were also many Christian romances in Greek, usually of a religious tendency. Alciphron's fictitious *Letters*—founded largely on the New Comedy of Athens—represent the same kind of industry which produced the letters of Phalaris and many similar collections. (4) *Philosophy* is represented chiefly by Epictetus and Marcus Aurelius, in both of whom the Stoic element is the prevailing one; by the Neoplatonists, such as Plotinus, Porphyry, Iamblichus; and by Proclus, of that eclectic school which arose at Athens in the 5th century A.D.

Verse.

The Greek poetry of this period presents no work of high merit. Babrius versified the Æsopic *Fables;* Oppian wrote didactic poems on fishing and hunting; Nonnus and Quintus Smyrnæus made elaborate essays in epic verse; and the Orphic lore inspired some poems and hymns of a mystic character. The so-called *Sibylline Oracles*, in hexameter verse, range in date from about 170 B.C. to 700 A.D., and are partly the expression of the Jewish longings for the restoration of Israel, partly predictions of the triumph of Christianity. By far the most pleasing compositions in verse which have come to us from this age are some of the short poems in the Greek Anthology, which includes some pieces as early as the beginning of the 5th century B.C., and some as late as the 6th century of the Christian era.

The Anthology.

The 4th century may be said to mark the beginning of the last stage in the decay of literary Hellenism. From that point the decline was rapid and nearly continuous. The attitude of the church towards it was no longer that which had been held by Clement of Alexandria, by Justin Martyr, or by Origen. There was now a Christian Greek literature, and a Christian Greek eloquence of extraordinary power. The laity became more and more estranged from the Greek literature—however intrinsically pure and noble—of the pagan past. At the same time the Greek language—which had maintained its purity in Italian seats—was becoming corrupted in the new Greek Rome of the East. In 529 A.D. Justinian put forth an edict by which the schools of heathen philosophy were formally closed. The act had at least a symbolical meaning. It is necessary to guard against the supposition that such assumed landmarks in political or literary history always mark a definite transition from one order of things to another. But it is practically convenient, or necessary, to use such landmarks. And, in this case, if a line is to be drawn at any one point between the Old and the Byzantine literature, it may be said that the edict of Justinian was the official record of the fact that the old literature of Greece was dead. Then came the Byzantine age, with its massive but formless erudition, its commentaries, annals, and lexicons, represented by such works as those of Eustathius, Photius, and Suidas. The golden time of the Byzantine literature was from about 850 to 1200 A.D. Just as this was drawing to an end, a poetry—at first satirical—arose in the popular dialect, which had now decidedly diverged from the literary; and thus the link was made which connects the Byzantine period with the Greek literature of to-day. The Greek language has never died, and the continuity of Greek literature has never been broken.

See *History of the Literature of Ancient Greece*, by K. O. Müller, continued by J. W. Donaldson; *Critical History of the Language and Literature of Ancient Greece*, by William Mure; *Histoire de la Littérature Grecque*, by Émile Burnouf (1869); *Griechische Literaturgeschichte*, by Theodor Bergk (1872); *Grundriss der griechischen Litteratur*, by G. Bernhardy (1872–1876); *Griechische Literaturgeschichte*, by R. Nicolai (1873–1876); *Primer of Greek Literature*, in Macmillan's Series, by R. C. Jebb. (R. C. J.)

Section II.—The Byzantine Literature.

The literature of the Byzantine period, from the death of Justinian to the capture of Constantinople by the Turks, is singularly destitute of interest for the general reader. There is not a single work of intense human passion. Not one man appeared gifted with anything like genius. The most notable books are books of history written by those who were themselves actors in the scenes, or at the least were contemporaries or nearly contemporaries of the events recorded. There is always a sense of reality about such works, however hazy our general conception of the times may be. Of these historians a full account is given in the article Byzantine Historians. Some of these writers discussed other subjects. Remarkable amongst these is Constantine VII., Porphyrogenitus, who wrote or caused to be written a whole series of books, treating of the administration of the empire, the ceremonies of the court, war, and jurisprudence. He got up a cyclopædia of history and politics, of agricultural science, of the veterinary art, and of medicine, and ordered the preparation of an epitome of Aristotle's work on animals, of a collection of Greek epigrams, and a collection of the histories of saints. Constantine's works do not give so much an insight into what he could do as into what he wished to do. Some of the historians were really men of wide culture. Nicephorus Gregoras (born 1295) received a liberal education in rhetoric, astronomy, and other subjects, and his literary activity ranged over the entire field of human knowledge. Others again combined the study of rhetoric or philosophy with that of history. Pachymeres, for instance, wrote declamations of a pedantic and frigid nature on historical subjects, blending imagination with what he gathered from history.

History.

The character of the Byzantine period is seen in the kind of poetry that it produced. There were some good epigram writers in the reign of Justinian, but after his time the anthology received very few additions. The first versifier of importance that we meet in the progress of time is Georgius of Pisidia, who was deacon of the church of St. Sophia in the reign of the emperor Heraclius (610–641). His muse celebrates various wars in iambic verse, such as the war against the Persians, the Avaric war, and the exploits of Heraclius. He also wrote several Christian pieces. Leo VI., called the Wise, who was emperor from 886 to 912, versified astronomical and ecclesiastical subjects, and wrote some prose works besides, most of which, if not all, deserve to lie in oblivion. Theodosius, deacon in the church of St. Sophia towards the end of the 10th century, used the iambic trimeter to narrate the capture of Crete, a work which derives all its value from the historical matter contained in it. Theodorus Prodromus is perhaps of all the Byzantine writers the one that comes nearest to the rank of a poet, yet even this approach is made only in some of his poems in the popular dialect, which have a strong satiric turn and a vein of humor. His more ambitious efforts have no claim to the title of poetry.

Poetry.

The subjects are of wide range and various form—epistles, congratulatory addresses, historical and didactic poems. Some of them are in a dramatic form, such as the *Catamyomachia*, recently edited by Hercher in the *Teubner Bibliotheca*, in which besides the ordinary characters Prodromus introduces a chorus and semi-chorus, and the *κῆρυξ* and *ἄγγελος* so common in ancient plays. His largest poem is a romance called *τὰ κατὰ Ῥοδάνθην καὶ Δοσικλέα*, consisting of nine books in iambic trimeter. It is entirely destitute of originality, and overladen with rhetorical and unpoetic passages. It is given by Hercher in his *Scriptores Erotici*. Prodromus flourished in the reign of Manuel I., Comnenus (1143–1180). Another Byzantine, Nicetas Eugenianus, apparently of the same age, wrote a fictitious poem, *τὰ κατὰ Δρόσιλλαν καὶ Χαρικλέα*, which bears traces on every page of a close connection with the similar work of Prodromus. Constantine Manasses also lived during the reign of Manuel I., Comnenus, and wrote a fiction in the versus politicus, characterized by absurdity and poverty of thought and expression. Both of these romances are given in Hercher's *Scriptores Erotici*. Verse was during this period used for the most prosaic purposes. Michael Psellus the younger, about 1018 A.D., employed it to give a synopsis of laws, Tzetzes to give an exposition of history. The work of Tzetzes is now called *Chiliades*, from its being divided into books of a thousand lines. It is written in the versus politicus, and is a very heterogeneous mixture of fact and fiction, but occasionally contains references to customs and incidents which are not handed down to us elsewhere. Another critic, Joannes Pediasimus, wrote iambic verses, *περὶ γυναικὸς κακῆς καὶ ἀγαθῆς ἢ Πόθος*. Such were the subjects which the Byzantine muse treated, and as we have given a rather full catalogue of the poetical works produced in the Byzantine period in the ancient language, nothing requires to be said of the sterile nature of the poets and their poetry.

Drama. Dramatic poetry was also neglected, but enough was produced to keep up the continuity in the tradition of the drama. Sathas has tried to show that dramas were acted up to the latest period of the Byzantine empire, and though the notices are not numerous nor very conclusive, he seems to us to have proved his point (K. N. *Σάθα ἱστορικὸν δοκίμιον περὶ τοῦ θεατροῦ καὶ τῆς Μουσικῆς τῶν Βυζαντίνων*, Venice, 1878). We have already seen that Prodromus composed dramas. The most voluminous writer in this department is Manuel Philes of Ephesus, who flourished from about 1280 to 1330, and who himself probably acted on the stage. His dramas are occupied with the exhibition of the great deeds of his patrons, or resemble in some respects our Moralities, making characters of the various virtues.

Hymns. The Byzantine period produced a considerable number of hymn writers. Among them may be mentioned Germanus, who was patriarch of Constantinople in the reign of Leo the Isaurian; Theodorus Studites, a theologian of some mark (759–826); the emperors Constantine Porphyrogenitus and Leo the king; and Photius, patriarch of Constantinople. The hymn writers who stand highest are Cosmas, who flourished in the 8th century, and whom W. Christ calls "princeps melodorum Græcorum;" Joannes Damascenus, a contemporary of Cosmas; and Theophanes *ὁ Γραπτός*, who lived nearly a hundred years after Cosmas (see *Anthologia Græca Carminum Christianorum adornaverunt W. Christ et M. Paranikas*, Leipsic, 1871).

Anthology. The Byzantines occupied themselves with collections of poems, but the works of Cephalas and Planudes Maximus of this nature have already been discussed in the article ANTHOLOGY.

Prose writings. When we pass from poetry to prose we meet with the same want of creative power. The Byzantines collect the writings of others and annotate, but they give us no original works. They performed two services to literature. They handed down the forms of literary expression, and by their indefatigable energy in excerpting and embodying in their own works the works of others, they have preserved for us many valuable documents of antiquity, or at least portions of them. During the Byzantine period there were also various phases of literary life. After the death of Justinian literary activity became gradually less, until in the time of the Iconoclasts intellectual culture was repressed, manuscripts were destroyed, and literature fell into disrepute and neglect. A revival took place under the Macedonian dynasty, but when the Latin empire was established in Constantinople, a relapse into semi-barbarism again took place. Under the Palæologi the literary spirit once more came to life. Amidst these changes it was impossible for a vigorous creative literature to flourish, and the bright periods are mainly characterized by efforts to destroy the effects of the previous dark era by gathering together all kinds of information. Hence arose the compilations of Porphyrogenitus that have been already mentioned, and similar attempts were made at similar periods.

Several of the Byzantines attained to high eminence in the cultivation of science, but sometimes their exertions took a fruitless direction, especially when they aimed at discovering the method of converting the baser metals into gold. It is in the study of grammar, in the production of lexicons, and the annotation of the classical writers that their best men have gained for themselves a name. The works of the writers on these subjects are of no interest to the common reader, but they furnish the scholar with many attractive problems. Who were the authors from whom the Byzantines borrowed? How far are their works interpolated? How far are the original authorities mutilated? These and such like inquiries crop up in connection with almost every one of these writings. The writers who are best known as contributing to our knowledge of the ancients are Tzetzes, Eustathius, Moschopulus, Thomas Magister, Joannes Pediasimus, and Demetrius Triclinius. Tzetzes (probably the same word as Cæcius) lived in Constantinople about the year 1180. His *Chiliades* have been already mentioned. He wrote notes on Homer, Hesiod, and Æschylus, but he was especially copious on Aristophanes.

Commentaries. Eustathius is well known to scholars for an elaborate commentary on Homer. He was brought up in Constantinople, and in 1160 became archbishop of Thessalonica and in 1174 archbishop of Myra in Lycia. Besides his labors on Homer he wrote many theological and several historical works. Manuel Moschopulus belonged to the 13th century. He wrote many works on different points of grammar, and scholia on Pindar, the Tragedians, and Theocritus. Thomas Magister of Thessalonica flourished in the reign of Andronicus II. (1283–1332), and composed articles on ancient literary history, and scholia on Æschylus and other Greek writers. Joannes Pediasimus, who lived towards the end of the 14th century, is best known by his scholia on Hesiod; and Triclinius, who taught grammar in Constantinople at the same period, wrote scholia on Hesiod, Pindar, and the Tragedians. Nothing can exceed the stupidity of these writers and their fellow scholiasts of the Byzantine era. They misunderstand the acute remarks of their Alexandrian predecessors or bury them in verbiage. They are utterly uncritical in their discussion of historical questions; they are continually going wrong in their grammatical expositions; and they are passionately fond of nonsense. Perhaps nowhere, to take one instance, in the whole of literature could wilder etymologies be found in greater numbers than in the scholia on the *Plutus* of Aristophanes. Yet these men thought highly of their work, and Triclinius tells us, in regard to a trivial book which he wrote on metres, that he accomplished the task only through divine inspiration. Notwithstanding this, they have preserved for us within the quantities of rubbish many valuable facts and expositions derived from earlier writers.

Grammar. Ignatius, deacon in the reign of Michael II. (820–829), Gregorius, archbishop of Corinth in the second half of the 12th century, Holobolus, in the reign of Michael VIII., and Joannes Glycas, patriarch of Constantinople in 1316, are the principal writers on grammar. Of these Gregorius is best known, for his work on the Greek dialects, though full of mistakes, has deservedly attracted the attention of scholars.

Lexicons. Of the writers of lexicons Suidas is the best known. He flourished in the 10th century. His work contains not only explanations of words but biographies of men. It is an undigested mass of statements which are often contradictory, but is of great value, for he has incorporated facts and expositions from early writers possessed of accurate knowledge. A full account of Suidas, and a discussion of all the questions connected with him, are given by Bernhardy in the prolegomena to his edition of the *Lexicon*. The *Etymologicum Magnum* is another important work of the Byzantine period, having been compiled in the 11th century. The appellation *mag-*

num or *μέγα* does not belong to it originally, but was added by Musurus, its first editor, or Calliergis, its first printer. Gaisford in his edition has discussed this and other matters concerning the *Etymologicum*. A much smaller work by Philemon is a *Technological Dictionary*, written in the second half of the 12th century. Among the lexicon-writers is Photius, who was patriarch of Constantinople, and died in an Armenian convent about the year 891. Photius was a man of marked individuality, and his history is mixed up with that of his country. A more detailed account of him will therefore be found in a separate article. Porson prepared an edition of the *Lexicon*, which was published after his death by Dobree. The Leipsic edition contains a review by Blomfield (*Edin. Rev.*, xlii., 1813) of Hermann's edition of Photius, in which the English reader will find a full discussion of the sources and value of the *Lexicon*. Photius also prepared a work generally called *Photii Bibliotheca*, containing extracts and notices of 280 books which he read while acting as ambassador in Syria. The nature of this work awaits more minute investigation than it has yet received; but there can scarcely be a doubt that some of the articles are the productions of a dishonest man, or of a late interpolator, or of both. His *Letters*, recently edited by Valettas, are of great importance for a knowledge of the times.

Music and metre.

Several scholars of the Byzantine period wrote on the music and metres of the ancients. Their works abound in errors, but they preserve fragments of earlier writers which are interesting and valuable. The work of Psellus the younger, called *Σύνταγμα εἰς τὰς τέσσαρας μαθηματικὰς ἐπιστήμας*, contains large fragments of Aristoxenus (Westphal, *Fragmente der Rhythmiker*, supplement to the first volume of his *Metrik*); and Manuel Bryennius (about the year 1330) wrote three books on harmonics, which contain among other things an exposition of the later Byzantine musical system (see Westphal, *Metrik*, vol. i. p. 319).

Rhetoric.

Of the rhetoricians only a very few deserve mention. Joannes Doxopater, who flourished in the reign of Alexius I., Comnenus (1081–1118), wrote several works of a rhetorical nature, which are to be found in Walz's *Rhetores Græci*. All that can be said of them is that they prove that he was a man of culture and refinement, and did not deserve the neglect and poverty which fell to his lot. A cluster of rhetoricians appeared in the reigns of Michael VIII. and Andronicus II., of whom the principal were Georgius of Cyprus, Nicephorus Chumnus, and Theodorus of Hyrtace. The emperor Manuel II., Palæologus, wrote several works of the nature of essays, and a large number of letters, several of which were addressed to Demetrius Cydones of Thessalonica, the author of a treatise on the *Contempt of Death* which has attracted some attention.

Philosophy.

The study of philosophy was, generally speaking, neglected, but there were some who acquired renown as philosophers. Foremost amongst these was Michael Psellus the younger. He was born about the year 1018, and died shortly after the year 1105, after a chequered career. He was called by the men of his own age "Chief of Philosophers." His works range over the entire field of human learning. He wrote on the sciences, mathematical, physical, medical, on grammar and metres and music, on the doctrines of Plato and Aristotle, on psychology and dialectic; and very recently Sathas has edited a work of his called *A Century of Byzantine History*, which entitles him to a place among historians, a series of his letters which throw much light on the life of the Byzantines, and various discourses, panegyric and funereal. He lost the favor of the court and was supplanted by Joannes Italus, who also succeeded to the title of "Chief of Philosophers." Several of his scholars attained distinction as authors, or rather compilers, of commentaries on the Greek philosophers.

Theology.

The theologians were to a large extent philosophers. The most famous among them was John of Damascus, who lived in the reign of Leo the Isaurian (718–741). He wrote on a great variety of subjects, theological and philosophical. The work by which he is best known is his *Sacra Parallela*, in which he has collected numerous passages from the writings of the fathers on such topics as repentance, faith, etc. The work is valuable as containing fragments of works which are not now extant. Alzog calls Damascenus the last of the Greek theologians. In subsequent times few appear worthy of attention, and it may suffice here to mention Nicephorus Callistus, "the Ecclesiastical Thucydides," who lived in the 14th century. He compiled an *Ecclesiastical History* from Eusebius, Socrates, Sozomenus, and the other earlier ecclesiastical historians, endeavoring at the same time to make his style more elegant than that of his predecessors.

Fiction.

We find almost no attempt at light literature in prose during the Byzantine period. Only one work has come down to us of this nature, *The Loves of Hysmine and Hysminias*, by Eustathius the Macrembolite. Hilberg, the last editor of the work, has tried to show with some success that Eustathius lived some time between 852 and 988. The work is full of imitations, and displays no inventive power.

A very full account is given of most of the writers here mentioned, with lists of their works edited and unedited, in the later volumes of the *Bibliotheca Græca* of Johannes Albertus Fabricius, edited by Harles, Hamburg, in 12 vols., 1790–1809; see also Cave, *Scriptorum Ecclesiasticorum Historia Literaria*; Gibbon, *Decline and Fall of the Roman Empire*; Müller and Donaldson's *History of Greek Literature*, 1858; Dr. R. Nicolai, *Griechische Literaturgeschichte*, vol. iii., 1876. Many of the works of the Byzantine writers are found only in *ἀνέκδοτα*, especially those of Villoison, Boissonade, Cramer, Bekker, and Sathas, and often these editors investigate the history of the writers. Sathas has thrown much new light on the life of Psellus.

(J. D.)

Section III.—Modern Greek Literature.

Peculiar nature of modern Greek literature.

In narrating the history of modern Greek literature several difficulties of a peculiar nature present themselves which do not emerge in an account of the literature of previous periods. The literature is no longer homogeneous, and we have to answer for ourselves the question whether we are to record the literary efforts made by Greeks or the literary efforts made in Greek. If we adopt the first course, we have to take notice of books written in Italian, French, German, and English, as well as in Greek, for the Greeks like the Jews were, during the three centuries of Turkish domination, a dispersed people. They found refuge far away from their native land; they spoke the languages of strange peoples, and, when they published books, frequently used these languages. Few, however, forgot their native tongue, and there are consequently very few authors who, however copiously they may have written in the languages of the countries in which they settled, did not leave at least one work written in Greek. Even since the kingdom of Greece has been established, many of her most distinguished men have written some of their best works in French, German, or English, in order to obtain a wider audience than they could expect if they had used modern Greek. We have to divide even those who used Greek into two classes,—those who used the ancient language and those who used the modern, though many have used both forms. The ancient language was still the literary language at the time of the capture of Constantinople, and the use of it as a vehicle of literature has been handed down in unbroken tradition to the present day. This has been specially the case with ecclesiastical writers. The church service is in ancient Greek. The New Testament is still read in the original language in Greek churches. The learned priests were familiar with the ancient language, and in learned treatises felt bound by a firmly impressed tradition to use only the language which the great fathers of the church had used. Cultivated Greeks in all lands still continued to make verses in imitation of the ancients. A change took place when Greece revived in the 19th century. All the great writers felt that it was pedantic to adopt many of the old forms of inflection and construction,—that, in one word, the ancient language was not fitted to be the vehicle of modern civilization. They therefore resolved to adapt it, to omit what might fetter the full and free expression of modern thought, but to retain at the same time the body and substance of the language. And hence arose a form of the language which is practically identical with the ancient, but transfused with modern ideas, and fitted for the clear and rapid expression of modern literature. The influence of the ancient language on the modern is manifest in every part of it. And it could not be otherwise. Education is spread over every corner of free Greece. But in education the Greek child does not learn the grammar

Works in the ancient language.

of the modern language but of the ancient. He often reads ancient books, and every cultivated Greek becomes as familiar with Xenophon and Plutarch as an Englishman is with Shakespeare and Milton. Before entering on the history of modern Greek literature, it is necessary to trace the modern language through its various stages. Historians of the Greek language acknowledge that alongside of the literary language there existed a conversational, which must have varied in different localities. We have the clearest traces of this language in the New Testament, as noticed under GREEK LANGUAGE, p. 121, and some ecclesiastical writers of a later date bear equally unmistakable indications of it. The *Pastor of Hermas* is specially marked by such features, and the form of it given in the *Codex Sinaiticus* is as far advanced towards the modern as we find in several works of the 12th century written in the popular language. Very distinct approximations to the modern forms are also to be found in some of the apocryphal gospels, and in the *Testaments of the Twelve Patriarchs*, but especially in the *Apocryphal Acts* and *Apocalypses* published by Tischendorf. All these writings tend to show that it is impossible to fix on any period when the modern language may be said to be definitely formed. It grew out of the conversational language of earlier times. Till very recently some poems of Theodorus Prodromus (often called Ptochoprodromus) were supposed to be the earliest distinct specimens of the modern language; but recent researches among the libraries have brought to light the fact that between the 10th and 15th centuries various works were produced in the modern form of the language. These researches are not yet concluded, and any results that are attained must be deemed merely provisional.

The modern language.

The work which is now regarded as the earliest specimen of the new form is the *Exploits of Basilios Digenis Acritas*, written according to Legrand in the second half of the 10th century. The writer of this work unquestionably knew classical Greek well, and most of the lines would be perfectly intelligible to every scholar. But now and then words and constructions purely modern intervene. Yet there is a wide and marked difference between the language of this poem and that of the two poems of Prodromus, belonging to the 12th century, published by Corais; or the three more recently discovered by E. Miller, and published by him in his *Mélanges*, and subsequently by Legrand. In every line of these the scholar comes upon forms which are quite strange.

Earliest modern Greek works.

The difference will be best appreciated if we quote some lines from each of the writers. We take a passage from the *Digenis*, which contains more than the usual number of modern peculiarities.

Καὶ γὰρ ὁ μικρὸς ἀδελφὸς κατ' ὄναρ εἶδε ταῦτα·
Μετὰ σκοτιᾶς ἀγείρεται, λέγει τοῖς ἀδελφοῖς του·
Ὅραμα εἶδον, ἀδελφοὶ, ἐν ταύτῃ τῇ ἑσπέρᾳ·
Ἱέρακές μοι ἐφάνησαν ἐπὶ Λευκῆς τῆς πέτρας,
Καὶ ἀετὸς χρυσόπτερος περιστερὰν διώκων
Ἄσπρην καθάπερ χίονα, κ' ἐσέβη 'ς τὸ κουβοῦκλιν,
Ἐν ᾧ κοιμᾶται ὁ γαμβρὸς μετὰ τῆς ἀδελφῆς μας.

Here the accent of *σκοτιά*, *του* for *αὐτοῦ*, *ἄσπρος* signifying white, *'ς* for *εἰς*, *κουβοῦκλιν* from cubiculum, and *μας* for *ἡμῶν*, are the novel peculiarities, and none of them need puzzle the scholar. As a contrast we take a few lines from one of the poems of Prodromus published by Miller.

Ὥρμησα τάχατε κἀγὼ τὸ νὰ γενῶ τζαγγάρης,
Μὴ νὰ χορτάσω τὸ ψωμὶν τὸ λέγουν ἀφρατίτζιν,
Ἀλλὰ τὸ μεσοκάθαρον τὸ λέγουσι τῆς μέσης,
Τ' ἐπιθυμοῦν γραμματικοὶ καὶ καλοστιχοπλόκοι.
Καὶ τεῶς γυρεύων ηὗρηκα καὶ τάρταρον ὀκάπου,
Κ' ἐδῶκά το κ' ἠγόρασα σουγλὶν ἀπὸ τζαγγάρην.

The lines are thus translated by Miller:—"Et moi aussi, j'ai essayé de la cordonnerie, non pas pour me rassasier de pain de gruau, mais de ce pain bis, dit de moyenne qualité, qui fait envie aux grammairiens et aux versificateurs de talent. Après maintes recherches, j'ai trouvé une menue monnaie, et je l'ai donnée pour prix d'une alène de cordonnier." After the fall of Constantinople some of the learned Greeks took an interest in the popular form of the language, and one of them, Sophianos, composed a grammar in the first half of the 16th century, which Legrand has published, along with a translation by the same scholar of Plutarch's treatise *On the Education of the Young*, into modern Greek. This grammar proves that the popular form of Greek was by that time fully developed, and it might still be taken as a good exposition of the ordinary spoken language of illiterate Greeks. Of course there were great varieties in this popular form. Almost every small district and every island had inflections, constructions, and words peculiar to themselves. Kavasilas wrote to Martin Crusius in the end of the 16th century that there were upwards of seventy modern dialects, of which that of the Athenians was the worst. But however many dialects there may have been, there is no reason to suppose that the difference was such as to prevent a Greek residing in one part of Greece from understanding a Greek residing in any other part. Since that time changes have taken place in the popular forms. Turkish words were introduced to a larger extent, but the language has remained substantially the same. There are indeed still a considerable variety of forms in the different districts, and one of the most amusing of modern Greek comedies Ἡ *βαβυλωνία*, *ἢ ἡ κατὰ τόπους διαφορὰ τῆς Ἑλληνικῆς γλώσσης*, by D. K. Byzantios, is based upon the different dialects spoken by the Greek of Asia Minor and the Peloponnesian, the Chian, Cretan, and Cypriote, the Albanian and Heptanesian. This language is no longer the language of cultivated Greek society, of literature, or of science. When Greece was stirred with new life, no question agitated the patriotic Greeks more intensely than that of the form which the language should take. Some, led by Chrysopoulos, maintained that the popular language was really ancient, that it was a mixture of Æolic and Doric, and that it ought therefore to be retained. Others, with Œconomos as their champion, were for adopting the classical language with a few slight modifications which could claim the sanction of some of the best Byzantine writers. A third party, headed by Corais, were for steering a middle course, and they have ultimately triumphed. Colonel Leake has well described the present language. "This style," he says, "may with tolerable accuracy be defined to consist in Hellenic words, arranged in the syntax of modern Europe, with a grammar partly Hellenic and partly modern. Inversions and transpositions occur with almost the same degree of frequency as in Italian, and the arrangement in general is not much more complex than that of our own language" (*Researches*, p. 54). We extract a specimen of it from the sixth volume or "Epilogos" of the *History of Greece* by Paparrhegopoulos.

Neo-Hellenic.

Ὅτε τῷ 1790 τρεῖς τοῦ ἔθνους ἀντιπρόσωποι καθυπέβαλον εἰς τὴν μεγάλην Αἰκατερίναν τὴν αἴτησιν τοῦ νὰ καταπέμψῃ τὸν ἔγγονον αὐτῆς Κωνσταντῖνον ὡς αὐτοκράτορα, οἱ ἄνδρες οὗτοι δὲν παρέστησαν πλέον ὡς Ῥωμαῖοι ἢ καὶ ἁπλῶς Χριστιανοὶ ἀλλὰ ὡς Ἕλληνες καὶ ἀπόγονοι τῶν Ἀθηναίων καὶ τῶν Λακεδαιμονίων.

In this sentence all the words are ancient. Two of them are contracted, *νὰ* for *ἵνα* and *δὲν* for *οὐδέν* and some have had their meanings modified. The remarks of Paparrhegopoulos relate to a subject which demands a brief notice. The Greeks at the time of the capture of Constantinople were proud of being Ῥωμαῖοι or Romans, and the term included all the Christians who formed the subjects of the Greek empire. Hence the term Romaic was the name given to the popular language. But during all the period of the Turkish domination the Greeks occasionally spoke of themselves as Γραικοί and Ἕλληνες, and when the period of revival came, they cast off the old name of Ῥωμαῖοι and Ῥωμαικὴ, and spoke only of Ἕλληνες and Ἑλληνική. Accordingly the Greek language is now spoken of as the Hellenic tongue. When it is necessary to distinguish the modern from the ancient, the language of cultivated men is called Neo-Hellenic, *νεοελληνική*, and the popular form is styled *ἁπλοελληνική* (see especially Dr. Clyde's *Romaic and Modern Greek*, Edin. 1855).

In narrating the history of this literature, we have at the earliest stage to treat separately those who used the classical language and those who used the vulgar. In both cases we cannot draw a fast line at the date of the fall of Constantinople, for, though that event is of great importance in the history of the Greeks as a people, it does not constitute a break in the literary history. It is often imagined that the dispersion of the Greeks in 1453 stood in close connection with the revival of literature in Western Europe. But the fact is that the Greeks had come into contact with the Westerns long before, and their influence had become decided before the Turks seized the capital of the Greek empire. The crusades had brought Greeks and Latins together. The Latin empire in Constantinople had made the contact still more frequent. Greeks and Latins

Greeks of the Renaissance before the fall of Constantinople.

had entered into keen discussion on the truth of the dogmas in regard to which they differed. Some of the Greeks had become converts to Roman Catholicism, or at least desired the union of the Eastern and Western Churches. In these circumstances they often left their native land to seek preferment in the church in which they could labor with greater sympathy. Many of them also had become connected by marriage or other ties with the Italian nobles who ruled in the Ægean, and circumstances led them to settle in Italy. Of the Greeks who thus found their way to the West before the taking of Constantinople, the most prominent were Leon or Leontios Pilatos, Georgios Gemistos Plethon, Manuel and John Chrysoloras, Theodorus Gazis, Georgios Trapezuntios, and Cardinal Bessarion. Hody has given a full account of most of these men in his work *De Græcis illustribus Linguæ Græcæ Literarumque Humaniorum Instauratoribus* (London, 1742). Pilatos was a native of Thessalonica and a pupil of Barlaam, a Calabrian monk who taught Petrarch Greek. Pilatos himself taught Boccaccio his native language, and expounded Homer in Florence. He died in 1364. Gemistos was a native of Lacedæmon. He taught in Constantinople, Athens, and Florence, and had in all places a large number of pupils who eagerly imbibed his Platonic teachings. His works were numerous, but most of them still lie hid in the great libraries of Europe unpublished. Manuel Chrysoloras was one of the pupils of Gemistos, and is famous as the translator of Homer and Plato. Both he and his brother John had many illustrious men as their pupils in Greek. Manuel taught in Milan, Venice, Padua, and Rome. He has the merit of composing the first Greek grammar that appeared in the West (ἐρωτήματα), published for the first time in Venice (1484). He made his first visit to Italy in 1393 in the capacity of ambassador from the Greek emperor to seek aid against the Turks, and he returned to Italy on the accomplishment of his mission that he might spread the knowledge of Greek literature. He was sent as deputy to the council of Constance, and he died in Italy in 1415. Theodorus Gazis, a native of Thessalonica, fled from his native place in 1430, and became a teacher of Greek in Ferrara, Rome, and Florence. He prepared a Greek grammar in four books (first published in Venice, 1495), which continued for a long time to be a text-book in Greece and other countries. He translated many of the classical writers, and wrote on the ancient history of the Turks and on theological subjects. He died in 1478 in Calabria, where he had settled in his old age. Georgios Trapezuntios was born in Crete in 1396. He received the appellation of Trapezuntios because his family had come from Trebizond. A Venetian noble took him to Venice to teach Greek in 1428. He removed to Rome in 1440, where he remained till 1450, at first highly honored, but subsequently, through the bitterness of his temper, falling into disgrace. After that he led a wandering and miserable life, and died in 1486. He translated many of the Greek writers into Latin, and wrote a treatise in which he compared Plato with Aristotle. Cardinal Bessarion was a native of Trebizond. He received his education in Constantinople. In 1425 he went to the Peloponnesus to hear Gemistos expound the philosophy of Plato. In 1439 he removed to Italy, after he had been made archbishop of Nicæa, because the Greeks bitterly resented his attachment to the party which saw no difficulty in a union between the Western and Eastern Churches. He rose to great honor in the West, obtaining the cardinal's hat. He died in Ravenna in 1472. He was passionately attached to the classical literature of his country, and took a profound interest in the education of his fellow-countrymen. He aided in the most liberal manner all the men of ability who came from Greece. He made a large collection of manuscripts. He translated portions of Xenophon, Aristotle, Theophrastus, and other Greek writers, and he wrote on the theological questions of the day.

The Greeks after the fall of Constantinople.

The Greeks who were most prominent in spreading a knowledge of Greek in Europe after the fall of Constantinople are Joannes Argyropoulos, Demetrios Chalcocondyles, Constantine and John Lascaris, and Marcus Musuros. Argyropoulos was a native of Constantinople, and there taught Constantine Lascaris. In the West he taught at various times at Padua (1434), Florence (1456), and Rome (1471), and had amongst his scholars Angelus Politianus and Reuchlin. He translated many of the works of Aristotle. Chalcocondyles was a native of Athens and became teacher of Greek in Florence in 1471; after some time he removed to Milan, where he died in 1511. He edited very many of the Greek authors. Constantine Lascaris, descended from a noble Bithynian family, taught Greek in various Italian cities, and finally settled in Sicily, where he died about 1500. He wrote a large number of works, most of them still unpublished. His best known work is his *Grammar*. He also transcribed manuscripts, and made a large collection of them. His name is well known to modern readers through the romance of Villemain (*Lascaris ou les Grecs du XVme siècle*). John was probably the younger brother of Constantine. He was principally employed in collecting manuscripts for the great men of the day, wrote several works, and edited several Greek books for the first time. He died at Rome in 1535.

Almost all these men were rather employed about literature than engaged in producing it. They taught Greek; several of them wrote Greek grammars; they transcribed and edited Greek classical writers; and they collected manuscripts. Bessarion laid the foundation of the library of St. Mark in Venice. The collections of Constantine Lascaris formed the nucleus of the Escorial library; John Lascaris and his pupil Budæus gathered the first stores for the national library in Paris; and Pope Nicholas V. employed the services of Bessarion, Gazis, and C. Lascaris in establishing the Vatican library. But almost none of these men accomplished much in literature strictly so called. The question which most deeply interested them was the philosophy of Plato and Aristotle. Somehow or other the championship of Plato was undertaken by those Greeks who eagerly desired the union of the Greek and Latin churches, and the philosophy of Aristotle was upheld by the opposite party. Gennadios, whom Mahomet II. appointed as patriarch of Constantinople after the capture of the city, showed himself a keen partisan of the Stagirite, and hurled his thunderbolts against the Platonists. Gemistos Plethon was the chief defender of the Platonic philosophy, and received unmeasured abuse from George of Trebizond for his heterodox opinions. The works on these subjects were numerous, but beyond these theological questions (for they were theological rather than philosophical) there is not much. Scholarship continued to survive in Greece or among the Greeks for a long time after the Turks began to rule in Greece, and a considerable list might be adduced, including the names of Apostolios, whose collection of Greek Proverbs is well known to scholars, and his son Arsenius, metropolitan of Monemvasia. Among the few who still used the Greek language for literary purposes Leo Allatius is prominent. His Greek verses show skill and cleverness. Mention also should be made of Constantine Rhodocanakis, honorary physician to Charles II. of England. He wrote verses on the return of Charles to England not without merit (see a very curious life of C. Rhodocanakis published in Athens, 1872).

Early works in modern Greek. Romantic poems.

We now return to the literature in the modern language, and here again we have to go back several centuries before the fall of Constantinople. We have already seen that the earliest production is the *Exploits of Digenis Acritas*, so called because he was the son of a Turk and a Greek, and because he spent a large portion of his time in watching the frontiers. There is reason to believe that his adventures formed the subject of poems in many parts of Greece. Some have called him a Cyprian Hercules, and believe him a kind of mythological character, while others regard him as a genuinely historical personage. The poem published by Legrand describing his adventures is imperfect. Many of the incidents are of a purely romantic nature. From the 12th to the 16th century many poems were composed in the popular language. Our knowledge of these works is still incomplete. Several of them lie hidden in the great libraries of Europe; but much is now doing to increase our knowledge. Many have been already published in the collections of Mavrophrydis, Sathas (ἀνέκδοτα), Wagner (*Carmina Medii Ævi*), and especially Legrand. They all breathe the spirit of chivalry, and are full of romantic adventures and tales of love. M. Gidel has the special merit of drawing attention to these poems in his *Études sur la Littérature Grecque Moderne* (Paris, 1866), and he has gone further into the subject in his *Nouvelles Études sur la Littérature Grecque Moderne* (Paris, 1878). He has

proved that the romances which delighted the knights of France and Italy found their way probably through the Genoese and Venetians and some French families into Greece, especially into the islands. The Greek minstrels took them and adapted them for their Greek audiences. He has given an analysis of the various poems and compared them with the Western forms. The most important in modern Greek are "The Old Knight" (12th century), a tale of the Round Table; "The Story of Belthander and Chrysantza" (probably 12th century); "The Loves of Lybistros and Rhodamne" (probably 12th century); "The War of Troy," taken from the *Guerre de Troie* of Benoit de Sainte-More, who wrote in the second half of the 12th century (the Greek translation was made some time before the fall of Constantinople); "Flore and Blanchefleur;" and the "History of Imberios and Margarona." There are various other poems belonging to this period of a different character, such as the "Oracles" of Leo the Wise, imitations of *Reineke Fuchs*, and "Physiologus." The history of Alexander the Great was a favorite theme, and there is a Greek version of Apollonius of Tyre. We do not know the authors of any of these poems. But about the time of the fall of Constantinople we meet with the names of some versifiers. Papaspondylos Zoticos described the battle of Varna (1444) in verse, and from the poem we gather that he was present at it. We have three poems written by Georgilas Limenitis (1450–1500), one "On the Deeds of the great Commander of the Romans, Belisarius;" another "On the Plague in Rhodes," which took place in 1498; and a third "A Complaint on the Fall of Constantinople." Some have been inclined to think that this last cannot be the work of Georgilas. From an examination of the poems of Georgilas and some other phenomena, Corais, in the prolegomena to the second volume of the Ἄτακτα, came to the conclusion that rhyme was unknown to Greek poems before the fall of Constantinople, and had become established as a feature of them when Georgilas wrote on the Rhodian plague. Gidel has accepted this as giving a clue to the dates of Greek poems. A third versifier was Jacobos Trivolis of Corfu, who lived in the beginning of the 16th century. He wrote the history of Tagiapiera, a Venetian noble, and the history of the king of Scotland and the queen of England, a tale taken from Boccaccio. Almost none of these poems have poetical merit; but they are interesting as specimens of the popular language, and curious as throwing light on the manners and thoughts of the Greeks of those days.

Historical poems.

From the earliest times the Greeks were in the habit of putting into verse any remarkable occurrence that stirred their feelings. Crusius tells us that in his time Greeks, especially on the islands, contended with each other in repeating or extemporizing verses, and the custom has remained down to the present day. Accordingly, the Greek popular poetry is rich in historical subjects: we have already noticed the poems on the battle of Varna and on the taking of Constantinople. There is also a chronicle of the conquest of the Morea (given by Ellissen in his *Analecten*). There are several lamentations over the fall of Constantinople. And the klephtic ballads relate real adventures. Almost every leader in the war of independence had his song in his honor. Some have thought that the largest portion of the ballad poetry of the Greeks is recent; but Legrand's collection lately published shows that some of them belong to very early times, being edited from a manuscript of the 16th century. There are two or three famous historical poems connected with the islands. Especially noteworthy is one on the exploits of Mercurios Boua by Coronæos.

Early popular poems.

There are three poems belonging to the 16th and 17th centuries which have obtained wide popularity among the Greeks. The first is the *Erotocritos*, the epic poem of modern Greece, of about 11,400 lines. Of its author Vincenzo Cornaro, a Cretan, we know almost nothing; but it is probable that he belonged to a noble Venetian family and lived in the middle or towards the end of the 16th century. The tale is one of two lovers who, after many trials of their fidelity to each other, are at last united and blessed. There is genuine poetry in the work. Many of the scenes are charming, and, as M. Gidel remarks, there is not a single situation which shocks propriety nor a single sentiment which is not modest and of rare purity. The second poem is a drama called *Erophile*, and its theme is the love of Panaretos and Erophile. The author of it was Georgios Chortakis, who was brought up in Rhethymnos, a Cretan town, and lived towards the end of the 16th and beginning of the 17th century. It was thought to be nearly the only drama of this period; but Sathas has brought to light the fact that there was a considerable number of them, and he has already published three, *Zeno*, *Stathes*, and *Gyparis*, in addition to the *Erophile*. Some of them are translations, and all of them are closely connected with Italian dramas of the same period. The *Erophile* has interludes to each act, dealing with an entirely different theme, and most probably written by a different author. The third poem, *The Shepherdess*, is a charming idyl written by Nicolaos Demetrios, a native of Apocorone in Crete, who lived in the beginning of the 17th century.

Early prose works.

There are few prose productions of any importance belonging to the early period of modern Greek literature. Crusius mentions works written by Malaxos, Zigomalas, and Canavoutzis. Sathas has more recently brought to light a number of chroniclers, such as those in the second volume of his *Bibliotheca Græca Medii Ævi*, that relate the history of Cyprus, Leontios Machaira, in the beginning of the 15th century, and Georgios Boustronios, whose narrative extends from 1456 to 1501. His sixth volume contains curious documents (the assizes of Cyprus, Cretan wills, etc.), which afford insight into the forms of modern Greek prevalent among the Cypriotes and Cretans, though a considerable number of them are written in classical Greek. Miklosisch and Müller have made a similar collection of documents, *Acta et Diplomata Græca Medii Ævi*. Even in the 18th century we find the classical language used much more frequently than the modern. Meletios, the man whose name stands most prominent in this period, wrote his *Ecclesiastical History from the time of Christ to the year 1700* in ancient Greek, and his work had to be translated into modern Greek to give it currency among the masses. Another ecclesiastical history by Sergios Makraios, given in the collection of Sathas (from 1750 to 1800), is written in the same language, and we find some writers like Caisarios Daponte and Meletios using sometimes the ancient and sometimes the modern form. We have almost no attempts at elegant literature in the modern Greek prose of this period. But it is possible that manuscripts containing such works may be hid among private family documents. One has recently been edited by Innocente Damaria (Turin, 1872), *The Loves of Erogelos and Erasmia*, by Holophilos, which was most probably written between the 12th and 15th centuries, but which might have been written by any one of the Scriptores Erotici, as the language discloses modern forms only in one or two sentences.

Literature of the 18th century.

In the 18th century a revival of enthusiasm for education and literature took place among the Greeks. Schools were established in every important Greek city, school books and translations from Continental languages poured forth from the presses of Venice, Trieste, Vienna, and other places where the Greeks had influence. The leaders in this movement were Eugenios Bulgaris, Nikephoros Theotokis, and Adamantios Corais. The first two, both natives of Corfu, were devout adherents of the Greek Orthodox Church, warm partisans of Russia, and both became archbishops in the Russo-Greek Church. They were true but narrow patriots. They wrote much in defence of Greek orthodoxy as against Latin heresy. Bulgaris also wrote on philosophy and Theotokis on physics, and the latter prepared or translated educational treatises on physics, mathematics, and geography. Far before these stands Adamantios Corais, who was above everything a Greek of widest aim and of the greatest culture. He was born in Smyrna in April, 1748. He studied nearly every branch of learning, medicine, theology, and literature, in the universities of Italy and France, and then devoted his life to the resuscitation of his country from ignorance and servitude. He edited a very great number of the classical writers, with admirable critical notes, and generally with prolegomena, which tried to awaken the interest of his countrymen in their past glories, and strove to rouse them to emulate their ancestors. He also devoted his attention to the modern language, especially in his Ἄτακτα, discussed the writings which had appeared in it, prepared a provisional dictionary of it, and determined the mode in which the popular dialect might become the basis of a literary language.

Modern era.

From the time of Corais we may date a new era in the history of the literature. Henceforth the works become exceedingly numerous, and efforts are made in every direction of literary activity. Perhaps no nation now produces so much literature in proportion to its numbers. The Greeks seem restless in their desire to give expression to their thoughts. They have indeed great difficulties to contend with in the way of publishing. The number of readers is necessarily small, owing to the smallness of the nation. To take an instance, one of their most important periodicals, the Ἀθήναιον, containing articles on archæology and literary history, which should be known to all scholars, had not more than 150 subscribers in 1876, as we are informed in the preface; 600 copies were published, of which 100 were sent by the university of Athens to the various libraries in Europe and America, 150 were distributed free, and only 150 were subscribed and paid for. The number of subscribers had not increased in August, 1879. In these circumstances many rich Greeks have come nobly forward and published books at their own expense; and much credit is due to the Zosimades, the Ralli, and the other Greeks who have served their country in this way. Very frequently scholars produce their best works for periodicals or even newspapers; and some most valuable treatises have been published as supplements to Greek periodicals. Translations of many of the best French novels have also been given away with these periodicals, and occasionally some of our most esteemed English writers have been thus made known to the Greeks; for instance, a translation of the *Bride of Lammermoor* was published by the editors of the *Pandora*. These circumstances, while impeding the production of Greek books, also tend to prevent foreigners from knowing exactly what the Greeks have done. Another circumstance that marks this period deserves notice. Almost every literary man of eminence makes efforts in every literary direction. Theologians, scholars, physicians, are all found in the list of poets. The same persons write school-books, histories, dramas, lyrics, and novels. It would be impossible to give even a notion of this endless activity. All that can be done is to point out a few of the principal writers.

Poetry.

In the early part of this period two poets claim our notice, Rhegas of Velestino in Thessaly, and Christopoulos. Rhegas was the poet of liberty, and his great war song, Δεῦτε παῖδες τῶν Ἑλλήνων, is well known to English readers through Byron's translation. He wrote many songs or hymns calculated to rouse his fellow-countrymen, but acting rashly he was seized and shot at Belgrade in 1798 at the age of forty-four. Christopoulos was born in Macedonia in 1770, and died in 1847. He devoted himself to songs of love and wine, and many of his anacreontics are melodious, graceful and charming. Somewhat later than Christopoulos comes Jacobos Rizos Neroulos, who was born in Constantinople in 1778, and died in 1850. Neroulos wrote lyrics, tragedies, and comedies with considerable success, but his best known book is a work published at Geneva in French in 1826—*Cours de la littérature Grecque moderne*—and admirably translated into modern Greek by Miss Olympia Abbot of Thessalonica. It is an interesting account of modern Greek literature up to the time at which the lectures were delivered, and is written in a bright and forcible style. It is perhaps rather too favorable to the phanariots, to whom Neroulos himself belonged, but it is an honest defence; and it has to be remembered, on the other hand, that he lashed the vices of the phanariots with great boldness in his comedies. From these writers we pass to the era of the independence of Greece. During this last period three writers have appeared who have established for themselves a permanent place in the history of mankind as men of true genius, Panagiotis Sontsos, Alexander Sontsos, and Alexander Rizos Rangabé. Panagiotis and Alexander Sontsos were brothers, and belonged to the phanariots. They were born in Constantinople in the first quarter of this century, and were educated first in Chios and then in the universities of Italy and France. They threw all their energies into the war for independence, and sang of its glories. But they conceived a determined dislike to Capodistrias. They were still more bitter against Otho, and, adopting extreme opinions and always discontented, they fell out of sympathy with their fellow-countrymen. Panagiotis received high posts of honor at the end of the war of independence, and Alexander was offered great literary distinctions; but the unmitigated abuse and contempt which they both, but especially Alexander, heaped on all men in authority rendered absence from their country a necessity. Alexander died in Smyrna in a hospital in 1863, and Panagiotis died at Athens in utter obscurity in 1868. Both tried various forms of poetry, but as nearly all critics have remarked, Panagiotis was always lyrical and Alexander continually returned to satire, whatever his subject might be. Both had a rich command of musical language, were highly ideal in their conceptions, were strongly patriotic, and possessed an ardent love of liberty. Of the two the muse of Panagiotis strove more after the sublime, but was less steady, less uniformly excellent than that of Alexander. Both were deficient in giving unity to their poems, or in forming a sustained and original plot. The plays of Panagiotis remind one of such works as Bailey's *Festus*, where there is a profusion of poetical conceptions but no coherent whole. Many passages in the works of both brothers bear a strong resemblance to lines which are to be found in the writings of poets whom they admired, especially Lamartine, Béranger, and Byron. The spirit of Byron pervades both. The principal works of Panagiotis are Ὁδοιπόρος (The Traveller), a drama in five acts, for which Byron's *Manfred* stood as model; Μεσσίας ἢ τὰ πάθη Ἰησοῦ Χριστοῦ (The Messiah), also a drama in five acts; and three other plays *Vlachavas*, *Caraiscakis*, and *The Unknown*, in all of which there is an utter want of character and plot, and a rich store of poetry; a novel, *Leandros*, and many lyrics, especially Ἡ Κιθάρα, first published in 1835. He tried in his later days to strike out a new style in modern Greek, but his effort was unsuccessful. Alexander's principal works are—Πανόραμα τῆς Ἑλλάδος, a collection of poems for the most part bitterly satirical, recently republished by Legrand at the end of his grammar; Ὁ Περιπλανώμενος (The Wanderer), a poem which was suggested by and contains many direct imitations of Byron's *Childe Harold;* and several comedies, *The Prodigal*, *The Premier*, *The Untamed Poet*, and *The Constitutional School*, and numerous odes and lyrical pieces. He also wrote one comico-tragic novel, Ἐξόριστος τοῦ *1831*, or *The Banished One of 1831*.

Sontsos.

Rangabé.

The other great poet that regenerated Greece has produced is Alexander Rizos Rangabé. He was born in Constantinople early in the century, and belonged like the Sontsos to a phanariot family. He thus describes his own career—"A pupil of Vardalachos and Gennadios, he completed his studies at the military school and at the university of Munich. In his own country he was at first an artillery officer, then a councillor in the ministry of public instruction and also in that of the interior, professor of archæology in the university (of Athens), minister for foreign affairs, deputy, and later on representative of his country in different foreign countries." His works are of wide range. He has written a grammar of modern Greek, contributed to a dictionary and a cyclopædia, composed a history of ancient Greece, and edited many school-books. He has written an able work on ancient art, and an exceedingly valuable and scholarly work on inscriptions, *Antiquités Helléniques*. He has contributed much to the *Pandora*, the *Archæological Journal*, and the *Eranistes*. He has narrated the results of his travels, and discussed mathematical problems. He has also composed several novels. And he has written a history of the literature of modern Greece,—bright, genial sparkling, and full of true and sometimes trenchant criticism. It is on his poems, however, that his claims to remembrance will specially rest. In these he shows fine poetic feeling, a rare command of exquisite and harmonious language, and a singular beauty and purity of thought and sentiment. His poetical works consist of a large collection of hymns, odes, and songs; long narrative poems; ballads; four tragedies and three comedies; translations of the *Antigone* of Sophocles, and of three plays of Aristophanes.

Other poets.

Besides these three poets there is a great number of writers who have composed poetry of considerable merit, but we can only mention the names of a few,—Valaoritis, Zalacostas, Salomos, Vlachos, Cokkinakis, Carasoutsas, Tantalides, Zampelios, Orphanides, Cleon and E. Rangabé, Euphrosyne Samartsidis, and Antoniadis. Elias Tantalides, who for a long time was blind and who died a few years ago, published an interesting collection of songs, including nursery rhymes and

school songs, with music (Athens, 1876). The production of poetry was much stimulated by an annual poetical contest. A sum of money was set aside for prizes, poems were sent in, judges were named, and when all was ready, a speech was delivered in the university by the convener of the judges, assigning their reasons for their decision and giving criticisms of the poems. The envelope of the successful candidate was then opened, and he received the laurel wreath with a thousand drachms. From what is stated in the *Athenaion* of Athens for May, June, July, and August, 1878, where the exposition of the contest of 1877 is given, it would seem that probably that of 1877 was to be the last. Amongst the poets of recent days special mention should be made of Chrestos A. Parmenides, who while in Manchester did much to make the works of his fellow-countrymen known to Englishmen, and the best works in recent English literature to Greece. Among other things he translated Roscoe's *Life of Lorenzo de' Medici*, Byron's *Sardanapalus*, Villemain's *Lascaris*, and poems of Goldsmith, Bryant, Burns, Goethe, and Victor Hugo. He also wrote original poems of great merit, and a novel called *Εὐγενία*. Two writers have distinguished themselves by poetic compositions in ancient Greek, Leukias and Philippos-Joannes.

Drama. The drama is a form of poetry to which the Greeks feel peculiarly prone. Rangabé gives a list of ninety writers of dramas in his *History of Modern Greek Literature*, and the list he says is incomplete. Out of these writers we may select for notice Demetrios N. Bernardakis, whose *Μαρία Δοξαπατρῆ*, "Maria, the daughter of Doxapater," with its prolegomena, has deservedly attracted much attention and been analyzed by Gidel.

History. In prose there is no department of literature which is not well represented. In history the Greeks are particularly strong. Perrhaevos has described with great vigor the exploits of Suli. Tricoupis's *History of the Revolution* is a masterly work. Philemon has given the Russian side of the revolutionary movements with great earnestness; and nearly every man who took a part in the movements has handed down his recollections, or, as in the case of Colocotronis, who was illiterate, has dictated them to some one who could put them into shape. The Greeks have been particularly active in investigating the history of the Byzantine empire, of the Venetian domination, and of special localities. The history of Paparrhegopoulos is especially valuable in regard to the later periods, and its style is singularly clear and flowing. Along with him should be mentioned Sakellion, Sakellarios, Sathas, Byzantios, Mustoxydis, Dragonmis, Triantaphyllis, and Paspatis. In

Theology. theology Œconomos stands forth as the first of preachers, occupying the place which Miniatis held as a popular orator in the 17th century. Contogonis is well known by his *History of Patristic Literature down to the Fourth Century*, and Bryennios by his edition

Philosophy. of *Clemens Romanus*. Braila stands first among Greek philosophers for profoundness and originality. Along with him may be mentioned Vamvas and Renieri. Greeks have also distinguished themselves in medicine, but very frequently they write their scientific books in French. They have also produced many treatises on law, political economy,

Law, etc. and on mathematics and the physical sciences. Little has been accomplished in the way of original novel-writing. We have seen that Panagiotis and Alex-

Fiction. ander Sontsos and Rangabé wrote novels, and others have done so likewise, but with moderate success. One recent work, *Ἡ Πάπισσα Ἰωάννα*, by Roidos, has gained considerable popularity, and is written in an attractive and vigorous style. Another novelist, Stephanos Xenos, is known to English readers by his work on the Ionian Islands called *East and West*. He is the author of a novel called the *Devil in Turkey*, and he wrote in Greek an interesting account of the Exhibition in London in 1851. Several ladies have distinguished themselves in the field of Greek literature. Especially deserving of mention is Dora d'Istria, whose work on the *Women of the West*, contributed to the *Pandora* and

Female authors. forming a pendant to her *Women of the East*, written in French, shows remarkable powers of research, exposition, and criticism. The Greeks, as might have been expected, have produced good editions of the classical writers. They have also done much to elucidate the archæology of their country, though most of their works on this subject are written in foreign languages. Among

Archæology. these works especially deserving mention are *Ancient Athens* of Pittakis, in French; the *Gravestones of the Ancient Greeks*, by Pervanoglous, in German; the *Hellenic Antiquities*, by Rangabé, in French; the *Sepulchral Inscriptions of Attica*, by Coumanoudis, in modern Greek; and *Dodona and its Ruins*, by Carapanos, in French. The works of Lambros on numismatics are of great value. The Greeks have also contributed much to a knowledge of the ancient Greek language. Asopios has gained a great

Philology. name in this direction, and the contributions of Constantinos Contos are very valuable. They have also done much to collect materials for a knowledge of existing dialects. Investigations have been made into the dialects of the Tzaconians by Œconomos and Neo-Locrian by Chalkiopoulos, and lists of peculiar words and forms to be found in Cythera, Chios, Crete, Cyprus, Locris, and other places, have appeared in *Pandora* and other journals. Castorchis has written much and well on Latin literature. The Greeks have a very large number of newspapers and journals, if we consider the number of the population; but, as might be expected, their existence is precarious, and many are short lived. Translations abound in modern

Translations. Greek, especially from the French, but the Greeks have also translated classical English and German works, and novels of all kinds. The translations include those of Müller and Donaldson's *History of Greek Literature*, by Valettas, and Shakespeare's *Romeo and Juliet*, *Hamlet*, and *Macbeth* by Bikelas.

Authorities.—A. R. Rangabé, *Histoire Littéraire de la Grèce Moderne*, Paris, 1877; Dr. Rudolf Nicolai, *Geschichte der neugriechischen Literatur*, Leipsic, 1876; Alfred Bougeault, *Histoire des Littératures Étrangères*, vol. iii., Paris, 1876; A. Papadopoulos Bretos, *Νεοελληνικὴ Φιλολογία*, Athens, 1854–57; Constantinos Sathas, *Νεοελληνικὴ Φιλολογία*, Athens, 1868; the work of Rizos Neroulos, and the collections of Mavophrydis, Legrand, Wagner, and Sathas mentioned above; Leake, *Researches in Greece*, London, 1814; short sketches of the literature in J. Donaldson's *Modern Greek Grammar*, Edin., 1853, in Geldart, *The Modern Greek Language*, 1870, and in Sargeant's *New Greece*. A full account of modern Greek grammars is given in Mullach's *Grammatik der Griechischen Vulgarsprache*, Berlin, 1856, and in the prefaces by Legrand to the *Grammar* of Sophianos, Paris, 1874, and his own *Grammaire Grecque Moderne*, Paris, 1878. Dictionaries:—Kind, *Modern Greek and German*; Byzantios and Dehèque, *Modern Greek and French*; Contopoulos, *Modern Greek and English*; Sophocles, *Byzantine Greek and English*. Collections of Modern Greek Poetry:—Chantseris, *Νέος Ἑλληνικὸς Παρνασσός*, Athens, 1841; Tepharikis, *Παρνασσός*, Athens, 1868; Antonio Manaraki, *Neugriechischer Parnass*, Berlin, 1879. Selections of poems:—Kind's *Neugriechische Anthologie*, Leipsic, 1847; J. Donaldson, *Lyra Græca*, Edin., 1854; Felton's *Selections from Modern Greek Writers in Prose and Poetry*, Cambridge, U. S., 1857; Vincent and Dickson, *Handbook of Modern Greek*, London, 1879. Collections of ballads by Fauriel, Zampelios, Passow, Tepharikis, Legrand, and of Cretan ballads by Anton Jeannaraki. Discussion of the modern Greek language and of ballads in Professor Blackie's *Horæ Hellenicæ*, 1874, and of the ballads in Tozer's *Researches in the Highlands of Turkey*, 1869. (J. D.)

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GREEK CHURCH, THE, or more properly the Eastern Church, is both the source and background of the Western. Christianity arose in the East, and Greek was the language of the Scriptures and early services of the church, but when Latin Christianity established itself in Europe and Africa, and when the old Roman empire fell in two, and the eastern half became separate in government, interests, and ideas from the western, the term Greek or Eastern Church acquired gradually a fixed meaning. It denoted the church which included the patriarchates of Antioch, Alexandria, Jerusalem, and Constantinople, and their dependencies. The ecclesiastical division of the early church, at least within the empire, was based upon the civil. Constantine introduced a new partition of the empire into dioceses, and the church adopted a similar division. The bishop of the chief city in each diocese naturally rose to a pre-eminence, and was commonly called *exarch*—a title borrowed from the civil jurisdiction. In process of time the common title *patriarch* was restricted to the most eminent of these exarchs, and councils decided who were worthy of the dignity. The council of Nicæa recognized three patriarchs—the bishops of Rome, Alexandria, and Antioch. To these were afterwards added the bishops of Constantinople and Jerusalem. When the empire was divided, there was one patriarch in the West, the bishop of Rome, while in the East there were at first two, then four, and latterly five. This geographical fact has had a great deal to do in determining the character of the Eastern Church. It is not a despotic monarchy governed from one centre and by a monarch in whom plenitude of power resides. It is an oligarchy of patriarchs. It is based, of course, on the great body of bishops; but episcopal rule, through the various grades of metropolitan, primate, exarch, attains to sovereignty only in the five patriarchal thrones. Each patriarch is, within his diocese, what the Gallican theory makes the pope in the universal church. He is supreme, and not amenable to any of his brother patriarchs, but is within the jurisdiction of an œcumenical synod. This makes the Greek Church quite distinct in government and traditions of polity from the Western. It has ever been the policy of Rome to efface national distinctions, but under the shadow of the Eastern Church national churches have grown and flourished. Revolts against Rome have always implied a repudiation of the ruling principles of Ultramontanism; but the schismatic churches of the East have always reproduced the ecclesiastical polity of the church which they have deserted.

The Greek Church, like the Roman, soon spread out far beyond the imperial dioceses which at first fixed its boundaries, but, unlike the Roman, it did not keep for Christianity all the lands it had once laid hold of. What Rome Christianized, with the exception of Africa, remained Christian The old empire was overrun by the barbarians, but the conquered empire imposed its law and its religion upon its conquerors, and pagan and heretic became in the end Catholic Christians. In the East it was otherwise. The empire maintained itself long and died hard; but its decline and fall meant not merely the overthrow of the supremacy of the emperors of the East, it meant also the destruction of civilization and the submergence of Christianity. In the West, German and Saxon, and Goth and Lombard, became Christian law-abiding peoples. In the East Arab and Kurd, the Seljuk and Ottoman Turk, remained what they were before they swarmed over the Eastern empire, and could never be taught either law or gospel. It is true that the Eastern Church more than made up for her losses by her missionary enterprise, but she never conquered her conquerors, and the historian is too apt to speak of her past glories and forget her present strength. The same reason also makes it difficult to describe, with any accuracy, the extent of the Greek Church. She has shifted her position so often that to describe her extent at any one period must be misleading. The church never at any one period occupied all the territories she has possessed.

The patriarchate of Constantinople included the imperial dioceses of Pontus, Asia, Thrace, and Eastern Illyricum—*i. e.*, speaking roughly, the greater part of Asia Minor, European

Turkey, and Greece, with a small portion of Austria. The imperial diocese of Pontus was governed by the exarch of Cæsarea, who ruled over thirteen metropolitans with more than 100 suffragans; now there are nine metropolitans (Kaisarieh, Nisi, Angouri, Niksar, Amasia, Isinid, Kadikiov, Broussa, Iznik), and one archbishopric (Trebizond), but the suffragans seem to have disappeared. Asia was governed by the exarch of Ephesus, who ruled over twelve metropolitans with more than 350 suffragan bishops. Of these there remain Ephesus, with its suffragans Aidene and Chisme, Smyrna, Artaki, Marmora, Allah Shehr, Rhodes, Samos, Khio, Cos, Paronaxia, Santorina, Andro, Milo, Lero, Scarpanto, Sephanto, Imbro, Lemno, Metelini, Molivo, Myra, and Konieh. In Asia Minor the church maintains but a small remnant of her former greatness; in Europe it is otherwise. The old outlines, however, are effaced wherever the Christian races have emancipated themselves from the Turkish rule, and the national churches of Greece, Servia, and Roumania have reorganized themselves on a new basis. Where the Turkish rule still prevails the church retains her old organization, but greatly impaired. The national churches of Russia, Georgia, and Armenia are offshoots from the patriarchate of Constantinople, but quite independent of its jurisdiction.

The patriarchate of Antioch has undergone most changes in extent of jurisdiction, arising from the transfer of sees to Jerusalem, from the progress of the schismatic churches of the East, and from the conquests of the Mahometans. At the height of his power the patriarch of Antioch ruled over 12 metropolitans and 250 suffragan bishops. In the time of the first crusade 153 still survived; now there are scarcely 20. Most of those that remain are called either metropolitan or archiepiscopal sees, but they have few or no suffragans. In Syria there are still Antioch, Aleppo, Laodicea, and Arcadia; in Phœnicia, Tyre and Sidon, Beyrout, Tripolis, Emesa, and Heliopolis; in Cilicia, Adana; in Syria, Epiphania; in Isauria, Seleucia; in Cyprus, Famagosta, with Piscopa, Baffo, Neapolis, Limasol, and Nicosia as suffragan sees. Cyprus has been independent of Antioch, however, since the council of Ephesus. Antioch also had jurisdiction beyond the bounds of the empire over Chaldæa and India, and the missionaries of Antioch seem to have preached Christianity in the borders of China. The Chaldæan Church now, however, is almost entirely Nestorian. The Thomas Christians of India do not belong to the Orthodox Greek Church. In Syria the Jacobites are more numerous than the Orthodox; while the Maronites of Lebanon have become subject to Rome.

In the earlier period of the church, ecclesiastical followed civil divisions so closely that Jerusalem, in spite of the sacred associations connected with it, was merely an ordinary bishopric dependent on the metropolitan of Cæsarea. Ambitious prelates had from time to time endeavored to advance the pretensions of their see, but it was not until the council of Chalcedon, in 451, that Jerusalem was made a patriarchate with jurisdiction over Palestine. From this time on to the inroad of the Saracens, the patriarchate of Jerusalem was highly prosperous. It ruled over three metropolitans with eighty suffragans. The modern patriarch has seven suffragans, all of whom enjoy the titles of metropolitan or archbishop,—Cæsarea, Scythopolis (Bethshan), Petra, Ptolemais, Sinai, Nablous, Samaria. The patriarchs however, are non-resident (they live in Constantinople), and the primate of Palestine is the metropolitan of Cæsarea.

The patriarch of Alexandria in ancient times possessed much more power than the others, and the church ruled by him was much more centralized. He had no metropolitans. His hundred suffragans were ordinary bishops. This perhaps in part accounts for the decay of the Orthodox church in Egypt; at present there is no bishop but the patriarch. The Christians in Egypt are for the most part Monophysites. The church of Nubia has been blotted out. The church of Æthiopia or Abyssinia is Monophysite, and acknowledges the Jacobite patriarch of Cairo.

HISTORY.—*Controversies and Schisms.*—To describe the controversies of the Greek Church is to write the history of the church of the first five centuries; in a short sketch like this all that can be done is to mention those causes of division which led (1) to the formation of the schismatic churches of the East, and (2) to the open rupture with Latin Christianity.

The great dogmatic work of the Greek Church was the definition of that portion of the creed of Christendom which concerns *theology proper*,—the doctrines of the essential nature of the Godhead, and the doctrine of the Godhead in relation with manhood in the incarnation, while it fell to the Latin Church to define *anthropology*, or the doctrine of man's nature and needs. The controversies which concern us are all about the person of Christ, the Theanthropos, for they alone are represented in the schismatic churches of the East. These controversies are most easily described, at least for our purpose, by reference to the œcumenical councils of the ancient and undivided church.

Rise of Sects.—All the churches of the East, schismatic as well as orthodox, accept unreservedly the decrees of the first two councils. The schismatic churches protest against the additions made to the creeds of Nicæa and Constantinople by succeeding councils. The Nicæo-Constantinopolitan creed declared that Christ was *consubstantial* (ὁμοούσιος) with the Father, and that He *had become man* (ἐνανθρωπήσας). Disputes arose when theologians tried to explain the latter phrase. These differences took two separate and extreme types, the one of which forcibly separated the two natures so as to deny anything like a real union, while the other insisted upon a mixture of the two, or an absorption of the human in the divine. The former was the creed of Chaldæa and the latter the creed of Egypt; Chaldæa was the home of Nestorianism, Egypt the land of Monophysitism. The Nestorians accept the decisions of the first two councils, and reject the decrees of all the rest as unwarranted alterations of the creed of Nicæa. The Monophysites accept the first three councils, but reject the decree of Chalcedon and all that come after it.

The council of Ephesus, the third œcumenical, had insisted upon applying the term Theotokos to the Virgin Mary, and this was repeated in the symbol of Chalcedon, which says that Christ was born of the Virgin Mary, the Theotokos, "according to the manhood." The same symbol also declares that Christ is "to be acknowledged in two natures, . . . indivisibly and inseparably." Hence the Nestorians, who insisted upon the duality of the natures to such a degree as to lose sight of the unity of the person, and who rejected the term Theotokos, repudiated the decrees both of Ephesus and of Chalcedon, and upon the promulgation of the decrees of Chalcedon formally separated from the church. Nestorianism had sprung from an exaggeration of the theology of the school of Antioch, and the schism weakened that patriarchate and its dependencies. It took root in Chaldæa, and became very powerful. No small part of the literature and science of the Mahometan Arabs came from Nestorian teachers, and Nestorian Christianity spread widely. "It was successfully preached to the Bactrians, the Huns, the Persians, the Indians, the Persarmenians, the Medes, the Elamites. The barbaric churches from the Gulf of Persia to the Caspian Sea were almost infinite . . . The Malabar coast and the Isles of the Ocean, Zocotra and Ceylon, were peopled with an increasing number of Christians. The missionaries of Balkh and Samarcand pursued without fear the footsteps of the roving Tartar, and insinuated themselves into the valleys of the Imaus and the banks of the Selinga." Their principal bishop took the title of patriarch of Babylon. His seat was later removed to Baghdad and then to Mosul; it is now at Julamerik in Kurdistan. In the 11th century he ruled over twenty-five metropolitans, and his jurisdiction extended from the Tigris to China, from Lake Baikal to South India. Persecutions weakened the church, Timur almost extirpated it. In the 16th century a schism occurred: many of the Nestorians yielded obedience to Rome. The Roman Nestorians are usually called Chaldæans, though all lay claim to the title. At present the patriarch rules over two metropolitans and sixteen suffragan bishops. The Nestorians dwell principally in Kurdistan, though many are found in Mesopotamia and in India. In the latter country they are numerous on the Malabar coast, and are called Thomas Christians.

The council of Chalcedon, the fourth œcumenical, declared that Christ is to be acknowledged "in two natures—unconfusedly, unchangeably," and therefore decided against the opinions of all who either believed that the divinity is the sole nature of Christ, or who, rejecting this, taught only one composite nature of Christ (one nature and one person, instead of two natures and one person). The advocates of the one-nature theory were called Monophysites, and they gave rise to numerous sects, and to at least three separate national churches—the Jacobites of Syria, the Copts of Egypt, and the Abyssinian Church.

The term "Jacobite" (from Jacobus Baradæus, a Syrian theologian) is properly confined to the Syrian Monophysites, but is sometimes used to denote all the various divisions of this heresy. The Jacobites therefore accept the first three councils and reject those that follow. The Armenian Church does the same, and it is common to class the Armenians with the Jacobites, while some theologians have made them more heretical than the Jacobites of Syria and Egypt (Neale, *Holy Eastern Church, Patriarchate of Alexandria*, pp. 8–10). This, however, seems a wrong opinion, and the Armenians ought to be reckoned as Orthodox (see ARMENIAN CHURCH). Apart, however, from theological criticism, the Jacobites are arranged under three patriarchates—Antioch, Alexandria, and Armenia. Antioch and Alexandria have intercommunion, but Armenia, in spite of times of reconciliation, stands apart. Under the patriarch of Alexandria is the metran or metropolitan of Abyssinia, and under the patriarch of Antioch the maphrian or primate of the East. The Jacobites or Copts of Egypt greatly outnumber the members of the Orthodox Greek Church there. The patriarch assumes jurisdiction over Egypt, Jerusalem, Nubia, Abyssinia, and the Pentapolis. He now resides in Cairo, and is chosen by lot in a council of all the bishops from a number of monks recommended by four convents to whom belongs this privilege. He has for suffragans the bishops of Menouf, Sherkeyeh, Behnese, Fayoum, Miniyeh, Senabau, Manfalout, Siout, Abuteg, Aschumin, Esne, Kauss and Nekada, and Khartoum. He has besides jurisdiction over twenty-six monasteries, and rules nominally over the Church of Abyssinia.

The Syrian Jacobites also form a patriarchate—the patriarchate of Antioch. While Antioch belonged to the empire the persecution of the state drove the Jacobite patriarch from the city. He settled at Amida, now called Caramit, which is still the ecclesiastical centre. The second dignitary is the maphrian (fruitbearer) of the East, who was originally a missionary bishop to the regions east of the Tigris. He is now settled at Mosul. The Syrian Jacobites could at one time boast 20 metropolitans and 103 bishops; now there are only 5 metropolitans (Caramit, Mosul, Maadan, Aleppo, and Jerusalem) without suffragans.

The decisions of Chalcedon, which were the occasion of the formation of all these sects outside, did not put an end to Christological controversy inside the Orthodox Greek Church. The most prominent question which emerged in attempting to define further the person of Christ was whether the will belonged to the nature or the person, or, as it came to be stated, whether Christ had two wills or only one. The church in the sixth œcumenical council at Constantinople declared that Christ had two wills. The Monotheletes refused to submit, and the result was the formation of another schismatic church—the Maronite Church of the Lebanon range. The Maronites, however, in the 12th century were reconciled to Rome, and cannot now be said to belong to the Greek Church.

Conflict with Rome.—The relation of the Greek Church to the Roman may be described as one of growing estrangement from the 5th to the 11th century, and a series of abortive attempts at reconciliation since the latter date. The estrangement and final rupture may be traced to the overweening pretensions of the Roman bishops and to Western innovation in the doctrine of the Holy Spirit, accompanied by an alteration of creed. In the early church three bishops stood forth prominently, principally from the political eminence of the cities in which they ruled—the bishops of Rome, Alexandria, and Antioch. The transfer of the seat of empire from Rome to Constantinople gave the bishops of Rome a possible rival in the patriarch of Constantinople, but the absence of an overawing court and meddling statesmen did more than recoup the loss to the head of the Roman Church. The theological calmness of the West, amid the violent theological disputes which troubled the Eastern patriarchates, and the statesmanlike wisdom of Rome's greater bishops, combined to give a unique position to the pope, which councils in vain strove to shake, and which in time of difficulty the Eastern patriarchs were fain to acknowledge and make use of, however they might protest against it and the conclusions deduced from it. But this pre-eminence, or rather the Roman idea of what was involved in it, was never acknowledged in the East; to press it upon the Eastern patriarchs was to prepare the way for separation, to insist upon it in times of irritation was to cause a schism. The theological genius of the East was different from that of the West. The Greek theology had its roots in Greek philosophy, while a great deal of Western theology was based on Roman law. The Greek fathers succeeded the Sophists, the Latin theologians succeeded the Roman advocates (Stanley's *East. Ch.*, ch. i.). This gave rise to misunderstandings, and at last led to two widely separate ways of regarding and defining one important doctrine—the procession of the Holy Spirit from the Father or from the Father and the Son. Political jealousies and interests intensified the disputes, and at last, after many premonitory symptoms, the final break came in 1054, when Leo. IX. smote Michael Cerularius and the whole of the Eastern Church with an excommunication. There had been mutual excommunications before, but they had not resulted in permanent schisms. "It was scarce two centuries since anathemas had been exchanged between Adrian I. and Photius, between Photius and Nicholas I. The sixth council had formally anathematized Honorius I. by name. There had been great violence of language in the 6th century between Gregory I. and John the Faster, and not many years before that the name of Vigilius had been deliberately erased from every one of the diptychs of the Eastern Church" (Ffoulkes's *Christendom's Divisions*, i. § 17). Now, however, the separation was final, and the ostensible cause of its finality was the introduction by the Latins of two words *filioque* into the creed. It is this addition which was and which still remains the permanent cause of separation. Ffoulkes has pointed out in his second volume (ch. 1–3) that there was a resumption of intercourse more than once between Rome and Constantinople after 1054, and that the overbearing character of the Norman crusaders, and finally the horrors of the sack of Constantinople in the fourth crusade, were the real causes of the permanent estrangement. It is undeniable, however, that the *filioque* question has always come up to bar the way in any subsequent attempts at intercommunion. The theological question involved is a very small one, but it brings out clearly the opposing characteristics of Eastern and Western theology, and so has acquired an importance far beyond its own worth. The question is really one about the relations subsisting between the persons of the Trinity and their hypostatical properties. The Western Church affirms that the Holy Spirit "proceeds from" the Father and from the Son. It believes that the Spirit of the Father must be the Spirit of the Son also. Such a theory seems alone able to satisfy the practical instincts of the West, which did not concern itself with the metaphysical aspect of the Trinity, but with Godhead in its relation to redeemed humanity. The Eastern Church affirms that the Holy Spirit proceeds from the Father only. The Eastern theologian thinks that the Western double procession degrades the Deity and destroys the perfection of the Trinity. The double procession, in his eyes, means two active principles (*αἰτίαι*) in the Deity, and it means also that there is a confusion between the hypostatical properties; a property possessed by the Father and distinctive of the First Person is attributed also to the Second. This is the theological, and there is conjoined with it an historical and moral dispute. The Greeks allege that the addition of the words *filioque* was made, not only without authority, and therefore unwarrantably, but also for the purpose of forcing a rupture between East and West in the interests of the barbarian empire of the West.

Attempts at reconciliation were made from time to time afterwards, but were always wrecked on the two points of papal supremacy, when it meant the right to impose Western usages upon the East, and of the addition to the creed. First there was the negotiation between Pope Gregory IX. and the Greek patriarch Germanus. The Latin conditions were practically recognition of papal jurisdiction, the use of unleavened bread enforced on the Greeks, and the Greeks to be permitted to omit *filioque* on condition that they burnt all books written against the Western doctrine. The Greek patriarch refused the terms. Then came negotiations under Innocent IV. and Clement IV., in which the popes proposed the same conditions as Gregory IX., with additions. These proposals were rejected by the Greeks, who regarded them as attempts to enforce new creeds on their church.

The negotiations at the council of Lyons (1274) were, strictly speaking, between the pope and the Greek emperor, and were more political than ecclesiastical. Michael Palæologus ruled in Constantinople while Baldwin II., the last of the Latin emperors, was an exile in Europe. Palæologus wished the pope to acknowledge his title to be emperor of

the East, and in return promised submission to the papal supremacy and the union of the Greek with the Latin Church on the pope's own terms. This enforced union lasted only during the lifetime of the emperor. The only other attempt at union which requires to be mentioned is that made at the council of Florence. It was really suggested by the political weakness of the Byzantine empire and the dread of the approach of the Turks. John Palæologus the emperor, Joseph the patriarch of Constantinople, and several Greek bishops came to Italy and appeared at the council at Florence—the papal council, the rival of the council of Basel. As on former occasions the Greeks were at first deceived by false representations; they were betrayed into recognition of papal supremacy, and tricked into signing what could afterwards be represented as a submission to Western doctrine. The natural consequences followed,—a repudiation of what had been done; and the Greek bishops on their way home took care to make emphatic their ritualistic differences from Rome. Soon after came the fall of Constantinople, and with this event an end to the political reasons for the submission of the Greek clergy. Rome's schemes for a union which meant an unconditional submission on the part of the Greeks did not cease, however, but they were no longer attempted on a grand scale. Jesuit missionaries after the Reformation stirred up schisms in some parts of the Eastern Church, and in Austria and Poland many of the Greeks were compelled to submit themselves to the see of Rome. The result of these schemes has been what is called the *Unia*, or the United Greeks. These various unions have commonly arisen from dissensions among the Greeks themselves when a portion of the dissentients have made submission to Rome. Rome commonly promised to allow them to enjoy their own liturgies and rites of worship, but usually broke her promises. This was done so systematically that the college of the Propaganda prints what profess to be the old liturgies of the Eastern churches, which are really so interpolated as to bring them surreptitiously into harmony with the Western rites. This is done so universally that it is impossible to trust to any professedly Eastern creed or service-book printed at the office of the Propaganda in Rome.

Differentiation of National Churches included in the Orthodox Greek Church.—Mr. Finlay, in his *History of Greece*, has shown that there has been always a very close relation between the church and national life. Christianity from the first connected itself with the social organization of the people, and therefore in every province assumed the language and the usages of the locality. In this way it was able to command at once individual attachment and universal power. This feeling died down to some extent when Constantine made use of the church to consolidate his empire. But it revived under the persecution of the Arian emperors. The struggle against Arianism was not merely a struggle for orthodoxy. Athanasius was really at the head of a national Greek party resisting the domination of a Latin-speaking court. From this time onwards Greek patriotism and Greek orthodoxy have been almost convertible terms, and this led naturally to revolts against Greek supremacy in the days of Justinian and other emperors. Dean Stanley is probably correct when he describes the heretical churches of the East as the ancient national churches of Egypt, Syria, and Armenia in revolt against supposed innovations in the earlier faith imposed on them by Greek supremacy. In the East, as in Scotland, the history of the church is the key to the history of the nation, and in the freedom of the church the Greek saw the freedom and supremacy of his race. For this very reason Orthodox Eastern Christians of alien race felt compelled to resist Greek domination by means of independent ecclesiastical organization, and the structure of the church rather favored than interfered with the coexistence of separate national churches professing the same faith. Another circumstance favored the creation of separate national churches. While the Greek empire lasted the Greek emperors had a right of investiture on the election of a new patriarch, and this right was retained by the Turkish sultans after the conquest of Constantinople. The Russian people, for example, could not contemplate with calmness as the head of their church a bishop appointed by the hereditary enemy of their country. In this way the jealousies of race and the necessities of nations have produced various national churches which are independent or autocephalous, and yet are one in doctrine with the Orthodox Greek Church. The most important of these are the churches of Russia, Georgia, Servia, Roumania, Greece, and Montenegro. The churches of Russia and Georgia have been united.

Russian Church.

The Church of Russia dates from 992, when Prince Vladimir and his people accepted Christianity. The metropolitan, who was subject to the patriarch of Constantinople, resided at Kieff on the Dneiper. During the Tartar invasion the metropolis was destroyed, and Vladimir became the ecclesiastical capital. In 1320 the metropolitans fixed their seat at Moscow. In 1582 Jeremiah, patriarch of Constantinople, raised Job, 46th metropolitan, to the patriarchal dignity; and the act was afterwards confirmed by a general council of the East. In this way the Russian Church became autocephalous, and its patriarch had immense power. In 1700 Peter the Great forbade the election of a new patriarch, and in 1721 he established the Holy Governing Synod to supply the place of the patriarch. This body now governs the Russian Church, and consists of five or six bishops, one or two other ecclesiastics of dignity, and several laymen, all appointed by the emperor. The Church of Georgia, which has existed from a very early period, and was dependent first on the patriarch of Antioch and then on the patriarch of Constantinople, has since 1801 been incorporated in the Russian Church. Its head, the archbishop of Tiflis, is a member of the Holy Governing Synod, with the title of exarch, and having under him four suffragans. Russia is divided for ecclesiastical purposes into eparchies of three classes, each of which is ruled over by a bishop. There are three eparchies of the first class, ruled by the metropolitans of Kieff, Novogorod and St. Petersburg, and Moscow. The steady increase of the Russian Church makes it difficult to detail with exactness the number of bishops belonging to the three classes; but, according to the report presented to the Holy Governing Synod in 1876, there are, in addition to the three eparchies of the first class, twenty-one of the second, thirty-three of the third, and six vicariates. These sixty-three bishops possess diocesan authority, and there are besides, excluding the exarchate of Georgia, fifty-six bishops ruling over monasteries.

Servian.

The Church of Servia has undergone great changes. In mediæval times, when Servia was a strong kingdom, the head of the church invariably claimed the title and authority of patriarch. In 1810, when Kara George achieved the independence of the kingdom, the archbishop of Carlowitz in Hungary was recognized as the head of the church, but in 1830 the national church was reconstituted and declared to be autocephalous. In 1838 the seat of government was removed to Belgrade, and the metropolitan of Belgrade is now the head of the Servian Church, though his right is still disputed by the archbishop of Carlowitz. He has under him as suffragans the bishops of Shabatz, Csatsäk, and Uschize, the last of whom resides at Karanowatz. Election to the episcopate is subject to the veto of the prince and of the patriarch of Constantinople. The extension of Servia under the provisions of the treaty of Berlin will probably cause some ecclesiastical changes.

Roumania.

Before the union of the two provinces of Moldavia and Wallachia, the Orthodox Greek Church was ruled by two metropolitans—the one at Jassy and the other at Bucharest. Since the independence of the united provinces there has been a long-continued conflict, which had for its design, not merely to throw off the supremacy of the patriarch of Constantinople, but to curb the influence of the higher clergy, and to assert the pre-eminence of the Slavonic over the Greek element. The result has been that the state, aided by the lower clergy and the people, has thrown off the supremacy of Constantinople, united the church under one metropolitan of Roumania, who has under him the metropolitan of Moldavia and six bishops, confiscated the property of most of the convents, which were centres of Greek influence, published liturgies either in the Slavonic or in the Roumanian language, and asserted the supremacy of the state.

Hellenic.

The constitution of the Church of Modern Greece is the result of the peculiar position of the patriarch of Constantinople. The war of liberation was sympathized in, not merely by the inhabitants of Greece, but by all the Greek-speaking Christians in the East. But the patriarch was in the hands of the Turks; he had been appointed by the sultan, and he was compelled by the Turkish authorities to ban the movement for freedom. When the Greeks achieved independence they refused to be subject ecclesiastically to a patriarch who was nominated by the sultan (June 9, 1828); and, to add to their difficulties, there were in the country twenty-two bishops who had been consecrated by the patriarch, twelve bishops who had been consecrated irregularly during the war, and about twenty bishops who had been deprived of their sees during the troubles—*i. e.*, fifty-three bishops claimed to be provided for. In these circumstances the Government and people resolved that there should be ten diocesan bishops and forty additional provisional sees. They also resolved that the church should be governed after the fashion of the Russian

Church by a synod; and they decreed that the king of Greece was to be head of the church. All these ideas were carried out with some modifications, and gradually. The patriarch of Constantinople in 1850 acknowledged the independence of the church, which gradually grew to be more independent of the state. The provisional sees were not all merged in the ten proposed dioceses. Greece at present is divided into four exarchies:—(1) The continent and Eubœa—divided into eight sees, of four archbishops and four bishops; (2) the Peloponnesus—divided into twelve sees, of six archbishops and six bishops; (3) the islands of the Ægean Sea—governed by one archbishop and three bishops; and (4) the Ionian Islands—governed by five archbishops. The Greek Church in Greece includes a good many monasteries; but the number has been diminished since the war of liberation, and a great many of those that remain have been made use of for the purposes of education. Many of these convents are dependent on the celebrated ancient monasteries of Athos, Sinai, and Jerusalem. The Greek Church has done and is doing a great deal for the cause of education in Greece.

Montenegrin. The bitter enmity which subsists between the people of the Black Mountain and the Turks made them from the beginning repudiate the authority of the patriarch of Constantinople, and the church is nominally independent. It is, however, very closely allied to the Russian Church. Up to the year 1852 the spiritual and the civil authority were vested in one individual, and the prince-bishops were always chosen from the family of Petrowitsch, but in that year the prince-bishop Danillo married, and demitted his episcopal functions. Since then there has been a bishop of Montenegro who has metropolitan functions. He has no suffragan bishops, but rules over three arch-priests and a large number of inferior clergy. He is consecrated by the Holy Governing Synod of the Russian Church.

Bulgarian. The Church of Bulgaria demanded independence about fifteen years ago, and has practically enjoyed it since 1858, although it has not yet obtained recognition. It is governed by an exarch who, while recognizing the supremacy of the patriarch of Constantinople, refuses to allow him to interfere in any way in the internal government of the church. It is still under excommunication by the patriarch. The new rights which Bulgaria has acquired under the treaty of Berlin will probably lead to a rearrangement of the church.

Doctrines and Creeds.—The Greek Church has no creeds in the modern Western use of the word, no *normative* summaries of what must be believed. It has preserved the older idea that a creed is an adoring confession of the church engaged in worship; and, when occasion called for more, the belief of the church was expressed more by way of public testimony than in symbolical books. Still the doctrines of the church can be gathered from these confessions of faith. The Greek creeds may be roughly placed in two classes,—the œcumenical creeds of the early undivided church, and later testimonies defining the position of the Orthodox Church of the East with regard to the belief of the Roman Catholic and of Protestant Churches. These testimonies were called forth mainly by the protest of Greek theologians against Jesuitism on the one hand and against the reforming tendencies of Cyril Lucaris on the other. The Orthodox Greek Church adopts the doctrinal decisions of the seven œcumenical councils, together with the canons of the Concilium Quinisextum or second Trullan council; and they further hold that all these definitions and canons are simply explanations and enforcements of the Nicæo-Constantinopolitan creed and the decrees of the first council of Nicæa. The first four councils settled the orthodox faith on the doctrines of the Trinity and of the Incarnation; the fifth supplemented the decisions of the first four. The sixth declared against Monotheletism; the seventh sanctioned the worship (*δουλεία* not *ἀληθινὴ λατρεία*) of images; the council held in the Trullus (a saloon in the palace at Constantinople) supplemented by canons of discipline the doctrinal decrees of the fifth and sixth councils.

The Reformation of the 16th century was not without effect on the Greek Church. Some of the Reformers, notably Melanchthon, expected to effect a reunion of Christendom by means of the Greeks, cherishing the same hopes as the modern Old Catholic divines and their English sympathizers. Melanchthon himself sent a Greek translation of the Augsburg Confession to Joasaph, patriarch of Constantinople, and some years afterwards Jacob Andreæ and Martin Crusius began a correspondence with Jeremiah, patriarch of Constantinople, in which they asked an official expression of his opinions about Lutheran doctrine. The result was that Jeremiah answered in his *Censura Orientalis Ecclesiæ* condemning the distinctive principles of Lutheranism.

The reformatory movement of Cyril Lucaris brought the Greek Church face to face with Reformation theology. Cyril was a learned Cretan, who, having travelled extensively in Europe, and having become acquainted with and devoted to the Reformed faith, was afterwards elected patriarch of Alexandria in 1602 and patriarch of Constantinople in 1621. He conceived the plan of reforming the Eastern Church by bringing its doctrines into harmony with those of Calvinism, and by sending able young Greek theologians to Switzerland, Holland, and England to study Protestant theology. His scheme of reform was opposed chiefly by the intrigues of the Jesuits. He was five times deposed, and five times reinstated. In the end he was murdered by the Turks at the instigation of the Jesuits. The church anathematized his doctrines, and in its later testimonies repudiated his confession on the one hand and Jesuit ideas on the other. The most important of these testimonies are (1) the Orthodox confession or catechism of Peter Mogilas, confirmed by the Eastern patriarchs and by the synod of Jerusalem (1643), and (2) the decree of the synod of Jerusalem or the confession of Dositheus (1672). Besides these, the catechisms of the Russian Church should be consulted, especially the catechism of Philaret, which since 1839 has been used in all the churches and schools in Russia. Founding on these doctrinal sources the teaching of the Orthodox Greek Church is:—[1]

Christianity is a Divine revelation communicated to mankind through Christ; its saving truths are to be learned from the Bible *and tradition*, the former having been written, *and the latter maintained uncorrupted* through the influence of the Holy Spirit; *the interpretation of the Bible belongs to the Church, which is taught by the Holy Spirit*, but every believer may read the Scriptures.

According to the Christian revelation, God is a Trinity, that is, the Divine Essence exists in Three Persons, perfectly equal in naturo and dignity, the Father, the Son, and the Holy Ghost; THE HOLY GHOST PROCEEDS FROM THE FATHER ONLY. Besides the Triune God there is no other object of divine worship, *but homage (ὑπερδουλία) may be paid to the Virgin Mary, and reverence (δουλία) to the saints and to their pictures and relics.*

Man is born with a corrupt bias which was not his at creation; the first man, when created, possessed IMMORTALITY, PERFECT WISDOM, AND A WILL REGULATED BY REASON. Through the first sin Adam and his posterity lost IMMORTALITY, AND HIS WILL RECEIVED A BIAS TOWARDS EVIL. In this natural state man, who even before he actually sins is a sinner before God by original or inherited sin, commits manifold actual transgressions; *but he is not absolutely without power of will towards good, and is not always doing evil.*

Christ, the Son of God, became man in two natures, which internally and inseparably united make One Person, and, according to the eternal purpose of God, has obtained for man reconciliation with God, and eternal life, inasmuch as He by His vicarious death has made satisfaction to God for the world's sins, and this satisfaction WAS PERFECTLY COMMENSURATE WITH THE SINS OF THE WORLD. Man is made partaker of reconciliation in spiritual regeneration, which he attains to, being led and kept by the Holy Ghost. This divine help is offered *to all men without distinction, and may be rejected.* In order to attain to salvation, man is justified, and when so justified CAN DO NO MORE THAN THE COMMANDS OF GOD. He may fall from a state of grace through mortal sin.

Regeneration is offered by the word of God and in the sacraments, *which under visible signs communicate God's invisible grace to Christians when administered cum intentione.* There are *seven* mysteries or sacraments. Baptism *entirely destroys original sin.* In the Eucharist the true body and blood of Christ are *substantially present, and the elements are changed into the substance of Christ, whose body and blood are corporeally partaken of by communicants.* ALL Christians should receive the bread and the WINE. *The Eucharist is also an expiatory sacrifice.* The new birth when lost may be restored through repentance, which is not merely (1) sincere sorrow, but also (2) *confession of each individual sin to the priest, and* (3) *the discharge of penances imposed by the priest for the removal of the temporal punishment which may have been imposed by God and the Church. Penance accompanied by the judicial absolution of the priest makes a true sacrament.*

The Church of Christ is the fellowship of ALL THOSE WHO ACCEPT AND PROFESS ALL THE ARTICLES OF FAITH TRANSMITTED BY THE APOSTLES AND APPROVED BY GENERAL SYNODS. *Without this visible Church there is no salvation.* It is under the abiding influence of the Holy Ghost, and *therefore cannot err in matters of faith.* Specially appointed persons are necessary in the service of the Church, *and they form a threefold order, distinct jure divino from other Christians, of Bishops, Priests, and*

[1] This summary has been taken, with corrections, from Winer. Small capitals denote differences from Roman Catholic, italics differences from Protestant doctrine.

Deacons. THE FOUR PATRIARCHS, OF EQUAL DIGNITY, HAVE THE HIGHEST RANK AMONG THE BISHOPS, AND THE BISHOPS *united in a General Council represent the Church and infallibly decide,* under the guidance of the Holy Ghost, all matters of faith and ecclesiastical life. All ministers of Christ must be regularly called and appointed to their office, and are consecrated *by the sacrament of orders. Bishops must be unmarried,* and PRIESTS AND DEACONS MUST NOT CONTRACT A SECOND MARRIAGE. To all priests in common belongs, besides the preaching of the word, the administration of the SIX SACRAMENTS,—BAPTISM, CONFIRMATION, PENANCE, EUCHARIST, MATRIMONY, UNCTION OF THE SICK. The *bishops* alone can administer the *sacrament* of orders.

Ecclesiastical ceremonies are part of the divine service; most of them have apostolic origin; and those connected with the sacrament must not be omitted by priests under pain of mortal sin.

LITURGY AND WORSHIP.—The ancient liturgies of the Eastern Church were very numerous, and have been frequently classified. Neale makes three divisions—the liturgy of Jerusalem or of St. James, that of Alexandria or of St. Mark, and that of Edessa or of St. Thaddæus; and Daniel substantially agrees with him. The same passion for uniformity which suppressed the Gallican and Mozarabic liturgies in the West led to the almost exclusive use of the liturgy of St. James in the East. It is used in two forms, a shorter revised by Chrysostom, and a longer called the liturgy of St. Basil. This liturgy and the service generally are either in Old Greek or in Old Slavonic—and frequent disputes have arisen in particular districts about the language to be employed. Both sacred languages differ from the language of the people, but it cannot be said that in the Eastern Church worship is conducted in an unknown tongue,—"the actual difference," says Neale, "may be about that between Chaucer's English and our own."

MONASTIC LIFE.—Monastic life was introduced into Christianity in the East, and has always remained a prominent feature in Greek Christianity. The monks usually follow the rule of St. Basil, but some monasteries, notably that of Sinai, obey the rule of St. Anthony. The monks are of three classes:—*κοινοβιακοί*, who live together in a monastery ruled over by a *ἡγούμενος* or *ἀρχιμανδρίτης*; *ἀναχωρηταί*, who live either in a cloister apart from the other monks or among the laity; and *ἀσκηταί*, who are hermits. The nuns, virgins or widows, all follow the rule of St. Basil. There are three great convents—at Jerusalem, Sinai, and Mount Athos; each has a great number of daughter monasteries throughout the East. Many monasteries are presided over by bishops, and many monks are in priests' and deacons' orders. Monks alone are eligible for election to bishoprics and the higher offices in the Eastern Church.

Number of adherents.—These can only be given approximately:—

Orthodox Greek Church in	Turkey	10,000,000
" "	Roumania	4,529,000
" "	Servia	1,345,000
" "	Montenegro	130,000
" "	Greece	1,310,000
" "	Austria	3,000,000
" "	Russia (including Poland, Siberia, and the Caucasus)	58,000,000
		78,314,000
To these may be added:—		
Russian Dissenters		1,051,000
Armenians		3,000,000
Nestorians (including the Thomas Christians of India)		360,000
Syrian Jacobites		90,000
Copts		121,000
Abyssinians		1,200,000
		5,822,000
United Greeks (chiefly in Austria and Poland)		4,670,000

See the common books on Church History, as those of Neander, Gieseler, Robertson, etc. Special mention may be made of Schröckh's *Christliche Kirchengeschichte,* and the various collections of councils, *e.g.,* Mansi's, or, for English readers, Hefele's *History of the Councils,* translated in Clark's series. For the controversies which gave rise to the schismatic churches, consult F. C. Baur, *Die Christliche Lehre von der Dreieinigkeit;* Dorner, *History of the Doctrine of the Person of Christ,* translated in Clark's series; J. H. Newman, *The Arians of the Fourth Century;* Swainson, *The Apostles' and Nicene Creeds.* For the *Filioque* controversy Waleh, *Historia Controversiæ de Processu Spiritus Sancti,* and the works of Swete and Langen, may be referred to, also Schaff's *History of the Creeds of Christendom.* The following are devoted specially to the history and condition of the Eastern Church:—M. Le Quien, *Oriens Christianus;* Asseman, *Bibliotheca Orientalis;* Stanley's *Eastern Church;* and, above all, J. M. Neale, *The Holy Eastern Church* (*General Introduction,* 2 vols.; *Patriarchate of Alexandria,* 2 vols.; and, published posthumously in 1873, *Patriarchate of Antioch,* 1 vol.). For liturgy, see Daniel, *Codex Liturgicus Eccl. Univ. in Epitomen redactus,* 4 vols., 1847–55, and the shorter works of Neale and Littledale; Renaudot, *Collectio Liturgiarum Orient.;* Leo Allatius, *De libris et rebus Eccles. Græcarum Dissertationes.* For hymnology, see Daniel, *Thesaurus Hymnologicus,* 4 vols., and Neale's translations of *Eastern Hymns;* and for creeds, the collections of Kimmel, Gass, and Schaff. (T. M. L.)

GREEK EMPIRE. See GREECE, p. 102 *sqq.*

GREEK FIRE is properly the name applied to the inflammable and destructive compounds used in warfare in the Middle Ages, and particularly by the Byzantine Greeks at the sieges of Constantinople. It was the precursor of gunpowder, and of such modern compositions as dynamite and nitroglycerin, and was frequently accessory to gunpowder for many years after its invention. But combustible mineral substances were employed in war much earlier than the Middle Ages. Greek fire has borne the names wildfire, maritime fire, wet fire, fire-rain; called by the French *feu grégeois,* by the Germans *griechisches Feuer,* it was "the oil of cruel fire" of the Chinese, the *oleum incendiarum* of the Romans, and the *πῦρ ὑγρόν*, liquid fire, of the Greeks. Procopius designates it "Medea's oil." Cinnamus (12th century) describes it as *πῦρ Μήδικον*, Median fire, the black clays of Media and Persia supplying the principal constituent. Used chiefly at sieges and in naval engagements, it was poured from cauldrons and ladles on the besiegers and their engines, or vomited through long copper tubes from the mouths of hideous figures set in the prows of ships. Sometimes flax was twisted and saturated with the liquid, then fired, and projected on arrows, lances, and javelins. At sea it was often flung in pots and phials. The heavy ballista and other military engines were pressed into the service in early times for scattering this destructive compound in large quantities, often in barrels. Owing to the viscid nature of Greek fire it adhered to whatever it touched. It is described as producing a thick smoke, a loud explosion, and a fierce flame, and as being quickened by the element of water. Sea-water is specially mentioned as intensifying its inflammability; and whenever it fell among ignitible materials terrible havoc was occasioned. The sight and sound of the engine discharging the torrent of fire carried dismay into many a warrior's breast. The devastating consequences pictured by early writers are probably overdrawn, but there can be no doubt that they were formidable. Liquid fire has been used in warfare from very remote times, as may be seen in the Assyrian bas-reliefs in the British Museum. Greek fire, properly so called, is said to have been employed for the first time against the Saracens in the siege of Constantinople, 673–679, the inventor being a Syrian named Callinicus. The art of compounding Greek fire was concealed at Constantinople with the most jealous care; indeed it was to Greek fire, while the secret of its manufacture was kept, that the city owed in great measure its safety. In 1755 two Frenchmen, Gaubert and Dupré, are reported to have rediscovered the art so carefully concealed by the Byzantine Greeks; but they were prohibited from making it known. Various projects for the use of this or similar preparations have been advocated in recent times. The ingredients and relative proportions of the composition are not exactly known, the secret having been very successfully preserved. The Syrian historian Michael applies the name naphtha to the "newly invented" Greek fire; and this probably was the destructive agent of the Assyrians, Persians, and other Eastern nations, springs of naphtha abounding in their territories. According to the author of *L'Esprit des Croissades,* Greek fire was compounded of the gum of the pine and other resinous trees reduced to powder, with the addition of brimstone, naphtha, and other bitumens. Fanciful substances were included, such as the water of a particular fountain in the East, duck's grease, etc. Friar Bacon mentions two of the ingredients, saltpetre and sulphur, but conceals the rest. Giambattista Porta states that Greek fire is made by boiling together willow charcoal, salt, ardent aqua vitæ, sulphur, pitch, frankincense, threads of soft Ethiopian wool, and camphor. In a Spanish MS. of the 13th century in the Bodleian library a different receipt is given; and others will be found in the *Liber ignium a Marco Greco præscriptus,* etc., Sloane MS. (Brit. Mus.) 323; in the Sloane MS. 7, *Modus faciendi ignum græcum,* etc.

From all that has been said it appears that naphtha —otherwise petroleum, rock oil, or Rangoon tar— and sulphur, and sometimes nitre, were the principal constituents; and the use of these, or two of them, in varying quantities with the charcoal mentioned by Porta, no doubt gave birth to gunpowder. An invention by Niepce comprised benzol and potassium, in the proportion of 600 to 1, placed in a glass vessel; and Disney's is believed to have included a solution of phosphorus in sulphide of carbon or chloride of sulphur. But of all the spontaneously combustible liquids, Bunsen's kakodyl, $As_2(CH_3)_4$, is probably the most deadly, while it is far in advance of the old Greek fire as a destroyer of life. A combustible used at the siege of Charleston, U. S., in 1863, consisted of (1) saltpetre, sulphur, and lampblack, pressed into small tubes, and (2) coal-tar naphtha, placed in shells or pumped through hose. The best military authorities appear now to agree that Greek fire is unsuitable for purposes of war, and comparatively little use has been made of it in recent times.

For further details see *Recepta varia de præparatione ignis Græci*, Sloane MS. 282; also Arundel MS. 164; Beckmann, *Gesch. der Erfindungen;* Dufresne, *Esprit des Croissades*, Amsterdam, 1780; Gibbon; Grose, *Mil. Antiq.;* Hoefer, *Hist. de la Chimie;* Joinville, *Memoirs*, 1807; Libri, *Hist. des sciences math. en Italie; Mechanics' Magazine*, 18th August, 1844; Napoleon III., *Etudes sur . . . l'Artillerie;* Poggendorff, *Gesch. d. Physik*, 1879; *Roy. Instit. Quart. Journ.*, xiv.; Scoffern, *Projectile Weapons*, 1858; and the writings of the Byzantine historians.

HORACE GREELEY.

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GREELEY, Horace, journalist and, as he himself most wished to be remembered, founder of *The New York Tribune*, was a scion of Scottish stock which was first transplanted to the north of Ireland in Cromwellian times and thence was removed to New England in the early years of the American colonies. The pioneer was Zaccheus Greeley, who with his two brothers came to these shores in 1640 and settled near Nutfield, New Hampshire. Many Ulster Scots made that region their home, and they presently changed the name of Nutfield to Londonderry, as it remains to-day, in memory of the heroism of their compatriots in the Jacobite War. In 1718 another Ulsterman, John Woodburn, came over and settled at Nutfield-Londonderry, and many years later his daughter, Mary Woodburn, became the wife of Zaccheus Greeley, the third of the name and the grandson of the founder of the Greeley family in America. These were the parents of Horace Greeley. It may be added in passing that in those earlier generations the name was variously spelled Greeley, Greely, Grealy, and Greale. The subject of this sketch was the third of the seven children born to Zaccheus and Mary Woodburn Greeley, and he first saw the light on February 3, 1811, at Amherst, New Hampshire, whither his parents had removed from Londonderry three years before. Their home there was on one of the poorest of the "hill farms" of that region, upon which it was possible to make only a bare living. The boy was thus ushered into a life of privation and of toil, and he suffered the additional disadvantage of being of weak and delicate frame. His advantages, however, are not to be forgotten. He inherited the integrity and shrewdness of his race, with much of its moral and physical heroism, and he was blessed with a mother of exceptional gifts of mind and soul. The disadvantage of frail health in his early years was thus counterbalanced by the close association with his mother which was thus made necessary, and the care and instruction which she consequently gave him. He was a precocious child. He could read before he could talk plainly, and at the age of four years was able to read almost any book that could be placed before him. His range of available literature was sorely limited, but what was lacked in quantity he made up in thoroughness of reading. Books were read and re-read studiously, the first of them being the Bible, which he read systematically from beginning to end before he was five years old. He also became an eager and intelligent reader of such newspapers as came into the household. At school he was a general favorite, because of his sweet and gentle disposition and his exceptional scholarship. He was by far the best speller in the school, and was a master of punctuation and all the technical details of English composition. The trustees of the school in the neighboring town of Bedford made him, by formal resolution, the sole exception to their rule against the admission of pupils from other villages. A number of citizens became so interested in him as to offer to defray the cost of sending him through the well-known Phillips Academy at Exeter, N. H., but their generous proposal was declined, perhaps with wisdom, and the boy was confined to the educational advantages of the common school, and of such books as he could borrow from the neighbors. It is said that even in those early days he formed and frequently expressed the intention of becoming a newspaper editor. When he was ten years old the family removed from Amherst to West Haven, Vermont, and there settled upon another farm, upon which he worked with his father for five years.

His advent into the profession of which he was destined to be the foremost member occurred in the spring of 1826, when he was a little more than fifteen years old. He became at that time a printer's apprentice in the office of *The Northern Spectator*, at East Poultney, Vermont. It was not a particularly promising start. The paper was not an important one. The apprentice was a lank, ill-clad, "slouchy" youth, with almost white hair, stooping shoulders and a whining voice. The terms of his apprenticeship, which he secured by answering an advertisement of "Help Wanted," were that for six months he should receive nothing but his board and instruction, and thereafter in addition the pittance of forty dollars a year. Thus he began his career. We have said that ten years before he had been a good speller. That accomplishment aided him in the mastery of his trade. At the end of the first day at the case he was as good a typesetter as some who had been long at the work. In a few weeks he was the best workman in the office, and began to be entrusted with other duties than typesetting, even with minor editorial work. Despite his peculiarities of dress and deportment, he became a general favorite in the office, and also in the village of East Poultney, where he was a prominent member of a debating society. In five years he became master of every detail of the editing and printing profession as practiced in that place. Then came a change which for the moment seemed disastrous but which was doubtless greatly for his good. This was the failure of *The Northern Spectator* and the closing of its office. Had not that happened, he might have spent his life as a rural editor and printer. As it was, he was thrown adrift upon the world and thus was soon carried to the great city with which he was ever afterward identified. He went first to Erie County, New York, whither his parents had removed, and worked for a time in local offices there. Then, in August, 1831, he made his way to New York City, almost as ill-clad and penniless as when he had entered the East Poultney office. He had ten dollars in his pocket, and a few clothes tied up in a handkerchief and carried upon the end of a stick over his shoulder. His appearance in the streets of New York, on the morning of August 18, 1831, was a fitting

companion piece to the picture of Benjamin Franklin eating dry bread as he trod the pavements of Philadelphia. He had no friends, and no knowledge of the city, and his uncouth appearance was against him. Office after office rejected his application for work. But at last he found employment in the office of John T. West, at a job no other typesetter wanted to undertake. This was the setting up of a New Testament, in very small type and with innumerable Greek references. He accepted the work unhesitatingly, and performed it rapidly and accurately, making for himself a name as an unsurpassed master of the printer's stick and case. Other odd jobs as a journeyman printer followed, until the end of 1832.

It was upon January 1, 1833, that the next marked step in his career was taken. At that date, in partnership with Francis V. Story, under the firm name of Greeley and Story, he began the publication of the first "penny paper" in the world. This was *The Morning Post*, which failed within a month. The young firm continued in the business of job printing, however, and upon Mr. Story's death in July, 1833, became known as Greeley & Co., the new partner being Jonas Winchester. Upon March 22, 1834, appeared the first number of *The New-Yorker*, a weekly political and literary journal, of which Greeley himself was the editor as well as publisher. It was from the first a marked paper, being decidedly in advance of its time in ideas and in the expression of them. It soon had a wide circulation, and was regarded as a high authority on political statistics and other matters, but owing to poor business management was never pecuniarily profitable. The job printing business of the firm paid for it, however, and its publication was continued for seven years. Meantime Greeley also wrote leading editorials for *The Daily Whig* of Albany, and in 1838–9 edited in that city *The Jeffersonian*, a Whig paper published for campaign purposes. In 1840 he edited *The Log Cabin*, a daily paper devoted to the election of William Henry Harrison to the Presidency. This paper attained an enormous circulation, for those times, and its editor rose into national prominence. Finally, after Harrison had been elected and installed, and the mission of *The Log Cabin* had been fulfilled, the issue of that paper of April 3, 1841, contained the announcement that a week later there would appear in New York the first number of "a new morning journal of politics, literature, and general intelligence." It was to be published in the interest of the people, and was to be sold at one cent the copy. That was the beginning of *The New York Tribune*, which first appeared on April 10, 1841, and with which Greeley's name was ever after inseparably identified. The paper began with six hundred subscribers. Rival papers, published at two cents, resented its intrusion into a field which they regarded as their own, and strove to discourage it even to the extent of using physical force against the boys who sold it. The new paper prospered, however, and soon became one of the most prominent and most influential in the country. It was devoted to scientific and literary progress, to temperance reform, and to the abolition of slavery. At first it was a Whig paper, then it became Anti-Slavery Whig, and finally Republican, being from the foundation of the latter party one of its foremost journals. It was made an earnest advocate of the protectionist system, upon which Greeley wrote and lectured much, and during the Civil War it was one of the staunchest supporters of the national government.

Greeley was not only the editor of *The Tribune;* he was its most prolific writer. His contributions to its editorial columns were voluminous. Yet however much he wrote, every line was instinct with originality and with power. It would not be too much to say that he was by far the greatest political and sociological controversialist of his age. To such work he gave the best there was in him. He lectured much, made many speeches in political campaigns, and published some books. But all these utterances were simply enlargements or compilations of editorials. Nor would he permit himself to be drawn away from his chosen work. James Gordon Bennett in 1844 proposed to him that they join forces in establishing *The New York Herald*, but Greeley declined, and the wisdom of his declination was manifest when Bennett started *The Herald* and showed in it his ideas of journalism. Each of the two was a great paper, but in spirit and purport they were different as the poles. For Greeley and Bennett to have co-operated upon the same paper, would have been simply impossible. In 1848 Greeley was elected a Representative in Congress from New York, to fill a vacancy, and served from December, 1848, to March, 1849, but he did not distinguish himself in that place, save by leading a successful campaign against "mileage" abuses, and he showed no desire to return to it. He published in 1859 a volume of essays entitled "Hints toward Reform." The next year he visited England, was one of the jurymen at the Crystal Palace World's Fair, and took notes from which he afterward published a volume of "Glances at Europe." He took a sympathetic interest in Fourierism, adopted vegetarianism for a time, and took pains carefully to investigate the "spiritualism" of the famous Fox Sisters. He was also an advocate of the civil rights of women, and of the abolition of the death penalty. Indeed, he interested himself in so many "causes" as to incur at times the criticism of being a "faddist," though no man was ever at heart more free from mere fads or more tremendously in earnest in doing what he believed to be the work of humanity. With the downfall of the Whig party he identified himself with the Republican party, and was a member of its first State Convention in New York, at Saratoga Springs in 1854. In 1856 he took a prominent part in the first Presidential campaign of the new party, and at Chicago in 1860 he was a conspicuous force in the National Convention which nominated Abraham Lincoln for the Presidency. William Henry Seward, Senator from New York, was a candidate for that nomination, but Greeley opposed him. The friends of Seward had prevented his becoming a delegate to the convention from New York, whereupon Greeley secured his election as a delegate from Oregon. When finally Seward was defeated and Lincoln was nominated, Greeley declared that he had acted not from any personal motives but from convictions of public duty. He expressed appreciation of Seward, "but," he said, "I did not, and I do not, believe it advisable that he should be the Republican candidate for President, and each subsequent day's developments have tended to strengthen my confidence that what I did was not only well meant but well done." After Lincoln's election as President, Greeley expressed the opinion that Seward would be the best choice for Secretary of State.

Greeley was not at first an Abolitionist, and never was one in the sense that Garrison and Phillips were Abolitionists. But his logical and trenchant attacks upon slavery and the slave power, increasing year by year in intensity, were recognized by southern leaders as more dangerous than the fulminations of the extreme Abolitionists. Efforts were made to exclude his paper from the mails, and he was actually indicted by a southern court as a disturber of the peace. He was a bitter opponent of the Mexican War, which he regarded as waged for the extension of slavery, and he threw himself into the struggle over Kansas with all the vehemence of his nature. In connection with it he published in 1856 a "History of the Struggle for Slavery Extension or Restriction in the United States from 1787 to 1856." In 1859 he made a trip across the continent, by way of Kansas, Colorado and Utah, and was received in California with much enthusiasm. He was a candidate for a United States Senatorship from New York in 1861. He at first shrank from the idea of a Civil War, and was almost inclined to prefer that the slave States should be permitted to go their way in peace. But the secessionist attack upon the United States flag roused him to the supreme effort of his life. He became at once the most earnest advocate of of inexorable prosecution of the war and restoration of the Union. He was for a time impatient with Lincoln for not moving more swiftly, and for not more promptly emancipating the negroes, and he drew from Lincoln, in reply to his urgings, one of the most noteworthy of that President's letters, declaring his supreme purpose to be to save the Union, either with or without slavery. That was in August, 1862. At the beginning of the next year the Emancipation Proclamation was issued, and thereafter Greeley's support of Lincoln was unqualifiedly loyal and earnest. In the "Draft Riots" in New York City in the summer of 1863, Greeley and his paper were the objects of especial animosity on the part of the disunionist mob, and *The Tribune* office was attacked and narrowly escaped destruction. In 1864 Greeley became convinced that the Confederates were ready for peace, and prevailed upon the President to send him to Canada to confer with Confederate commissioners to that end. It was found that the Southerners had not sufficient authority to treat for peace, and the negotiations ended in failure, and in some censure of Greeley for seeking them. In the fall of that year he was chosen a Presidential elector. Thereafter to the end of the war, Greeley was unwavering in his support of the government and in his demands that the war should be prosecuted to a decisive end. He favored the rigorous punishment of the conspirators responsible for the assassination of Lincoln, advocated the impeachment of President Johnson, and supported the candidacy of Grant for President in 1868. In 1869 he was the Republican candidate for State Controller of New York, and in 1870 was a Republican candidate for Congress, but was defeated both times.

There now came, however, a radical change in his political career. He chafed under the government's delay in bringing Jefferson Davis to trial and finally went to Richmond and placed his name on the Confederate leader's bail bond. Seldom has any political act in American history raised a greater storm. Greeley was denounced and abused with unsparing savagery, but stood his ground and replied to his critics with caustic vigor. The abuses of the Reconstruction era in the South, and the official corruption that sprang up at Washington, aroused his ire, and more and more separated him from the party of which he had been one of the founders and greatest leaders. He asserted his independence of the Republican party, and opposed the obviously inevitable renomination of Grant for a second term. Finally, he announced that if Grant were renominated, he would not support him. In May, 1872, a national convention of dissenting Republicans met at Cincinnati, to consider an organized schism from the party. Greeley was not a member of it and did not attend it. He had no expectation or desire of being nominated by it, but strongly favored the nomination of Lyman Trumbull, of Illinois. The convention, however, nominated him for the Presidency, giving him 482 votes, to 187 for Charles Francis Adams. He was also nominated by the National Democratic convention. On May 20 he accepted the nomination, and on August 14 he began the most remarkable campaign in American history. He was the first Presidential candidate to go upon the stump in all parts of the Union. He spoke almost daily, sometimes several times a day, spending the intervals in travelling from place to place. His speeches were marvels of cogency and force. But he won few votes. His old colleagues of the Republican party were repelled by what they regarded as his treason, and the Democrats hesitated to support a man whom they had for years hated and reviled and who had unsparingly denounced them. The clearest sighted observers saw long in advance that he was doomed to defeat, though he himself, once one of the most unerring political seers, seemed to expect success. Election came, and he was overwhelmingly defeated. He scarcely staggered under the blow, but with a fortitude nothing short of sublime resumed the editorship which during the campaign had been entrusted to his chosen lieutenant. But the strain had been too great for his sensitive mind. The death of his wife a few weeks before, the tremendous efforts of the campaign, the savage vilification of foes, the desertion or coldness of friends who could not understand him, all combined to hasten the end. Brain fever set in, and despite the expert treatment of physicians and the tenderest care of his family and friends, he died at a private hospital at Pleasantville, New York, on November 29, 1872. The time of his funeral was a time of national mourning. His body lay in state in the New York City Hall, the funeral sermon was preached by Henry Ward Beecher, and the President and other high dignitaries of the United States followed his bier. Since then statues and monuments have been erected in his honor, and his name has been enrolled without challenge or reproach among those of the most illustrious of his countrymen. Few men have been the subjects of more acrimonious controversy during their lives, and few have received after death more universal praise. That circumstance is in accord with his own character. There was no man of his time more unsparing in attack — as when he referred in print to a former colleague and eminent public man as "that little scoundrel," and began an editorial reply to an "esteemed contemporary" with "You lie, you villain, you lie!" Yet there was none with a kinder or more generous heart, as was shown supremely in his chivalric conduct in becoming bondsman for Jefferson Davis.

Greeley will ever rank among the greatest editors of the world. For many years he was with *The Tribune*, directing its policy in every detail and inspiring its every line. Yet it must not be forgotten that he had in a notable degree the faculty of selection, and of surrounding himself with men of approved ability. No paper has ever had a more accomplished and distinguished corps of editorial writers and contributors than that which he gathered about him on *The Tribune*. The names of George Ripley, Charles A. Dana, George William Curtis, Bayard Taylor, Margaret Fuller, Edmund Clarence Stedman, William Henry Fry, Henry J. Raymond, William Winter, and others, attest this fact — none of them more notably than that of the distinguished man whom Greeley himself chose, at the zenith of his career, to be his closest friend, lieutenant and successor, Whitelaw Reid. Greeley married a Miss Cheney, of Connecticut, who bore him three children. One of these, a petted son, died in boyhood. The others, daughters, survived him. He made his home at Chappaqua, in Westchester County, New York, where he had a farm and tract of woodland in which he took much pleasure. In addition to the works already mentioned he wrote a monumental history of the struggle between freedom and slavery, entitled "The American Conflict," also "Recollections of a Busy Life," "What I know about Farming," "An Overland Journey to San Francisco," and "Essays on Political Economy." He has been the subject of several biographies, by James Parton (1855, 1868, and 1872), by L. D. Ingersoll (1873), by F. N. Zabriskie (1890), and others.

W. Fletcher Johnson.

June, 1904.

GREEN BAY, a city of the United States, capital of Brown county, Wisconsin, is situated at the head of Green Bay, an inlet on the west shore of Lake Michigan. The bay is 100 miles long, from 15 to 35 miles wide, and of considerable depth. The city stands near the mouth of Fox River, with a small stream known as the East River on the other side, its situation affording it a secure harbor. It is 242 miles N. of Chicago, 114 N. of Milwaukee, and 120 N. E. of Madison, the capital of the State. By the completion of a canal connecting the Fox and Wisconsin rivers at Portage City, Green Bay has become the terminus of the inland water-system which unites the great lakes with the Mississippi and the Gulf of St. Lawrence with the Gulf of Mexico. The nearness of Green Bay to the forests of the State makes it a centre of the lumber trade, and it exports annually large quantities of planks, boards, shingles, staves, and headings. It has several other manufactories, an iron furnace, a foundry, machine-shops, tanneries, planing-mills, and breweries. The fishing interests, especially in white-fish and lake-trout, are important. Three lines of railway and the largest lake steamers minister to its commerce. Though the French formed settlements on the bay as early as 1745, the site of the present city was not laid out until 1830 and 1835, when the villages of Navarino and Astor were founded. In 1839 these were incorporated under the name of Green Bay, and in 1854 a city charter was granted. It was in 1868 created a bishop's see by Pius IX., and a handsome cathedral church in the Romanesque style has been erected since. The growth of the place has been rapid even for an American city. The population in 1860 numbered 2275, and 4666 in 1870, exclusive of Fort Howard across the river, with its population of 2462, which commercially may well be regarded as part of the city. In 1900 the State census gave 18,684 to Green Bay.

GREENE, Maurice, an English composer, was born in London towards the close of the 17th century (about 1696, it is generally stated). He was the son of a clergyman in the city of London, and soon became a chorister of St. Paul's Cathedral, where he studied under Charles King, and subsequently under Richard Brind, organist of the cathedral from 1707 to 1718, whom, on his death in the last-named year, he succeeded. Nine years later he became organist and composer to the chapel royal, on the death of Dr. Croft. In 1730 he was elected to the chair of music in the university of Cambridge, and had the degree of doctor of music conferred on him. Dr. Greene was a voluminous composer of church music, and his collection of *Forty Select Anthems* is a standard work of its kind. He also wrote a *Te Deum*, several oratorios, a masque, *The Judgment of Hercules*, and a pastoral opera, *Phœbe* (1748). He is also among the writers of glees and catches, a form of music peculiar to English composers (see Glee); and a collection of *Catches and Canons for Three and Four Voices* is amongst his compositions. In addition to this he wrote many occasional pieces for the king's birthday, having been appointed master of the king's band in 1735. But it is as a composer of church music that Greene will be chiefly remembered. It is here that his contrapuntal skill and his sound musical scholarship are chiefly shown. The influence of Handel is, however, discernible in his compositions. With that great master Greene was originally on intimate terms, but his equal friendship for Buononcini, Handel's rival, estranged the German master's feelings from him, and all personal intercourse between them ceased. Greene, in conjunction with Festing and others, originated that excellent institution, the Society of Musicians, for the support of poor artists and their families. He died September 1, 1755.

GREENE, Nathanael (1742–1786), an American general, son of a Quaker who followed the joint occupation of a farmer and smith, was born at Potowhommet, Warwick county, Rhode Island, May 27, 1742. From his early years he was employed in assisting his father, but he succeeded, notwithstanding this, in acquiring a large amount of general information, and made a special study of mathematics, history, and law. At Coventry, where he removed to take charge of a forge of his own, he was the first to establish a public school; and in 1770 he was chosen a member of the legislature of Rhode Island. Sympathizing strongly with the revolutionists he in 1774 joined the "Kentish Guards," and on this account was expelled from the Society of Friends. In 1775 he was appointed to the command of the contingent of 1000 men raised by Rhode Island, and after joining Washington before Boston he was named brigadier-general. In 1776 he obtained the rank of major-general and accompanied Washington to New Jersey, where he took part in the battles of Trenton and Princeton. At the urgent request of Washington he in 1778 accepted the office of quartermaster-general, on the understanding, however, that he should retain the right to command in the field, a right of which he took advantage at the battle of Monmouth, 24th June of the same year, and at the battle of Springfield, 23d June, 1780. In August following he resigned his office, and on the 2d of December he succeeded Gates in the command of the Southern army. In this position he was soon successful in restoring the demoralized and helpless troops to a condition of thorough vigor and efficiency; and though not always technically victorious in the combats in which he engaged, he conducted operations in such a masterly manner that the enemy gained little advantage from any victories they obtained, and were never able to baffle him in what was essential in his plans. At the beginning of the campaign, he detached General Morgan to attack the enemy at Cowpens, with a result that was brilliantly successful. Then followed a series of clever retreats to avoid engaging superior forces, until he deemed himself strong enough to attack the enemy at Guilford Court House; and although he here suffered defeat, the British army a few days afterwards retreated towards Wilmington. After following a short distance in pursuit he changed his line of march, and advancing into South Carolina attacked Lord Rawdon at Camden, and again suffered a defeat. But this reverse also failed to impede his energy, and after capturing a number of forts he again engaged Lord Rawdon at the battle of Eutaw Springs, which though a drawn combat, resulted in the British abandoning South Carolina. For his services in the campaign he was presented with two pieces of captured ordnance, a British standard, and a gold medal. Georgia and North and South Carolina also made him valuable grants of land. He died from sunstroke at his estate of Mulberry Grove, Savannah, June 19, 1786. His *Life and Letters*, 3 vols., edited by G. W. Greene, were published in 1867–71.

GREENE, Robert (1560–1592), dramatist and miscellaneous writer, was born at Norwich about the year 1560. As an eastern counties man (to one of whose plays, *Friar Bacon*, the Norfolk and Suffolk borderland owes a lasting poetic commemoration) he naturally received his education at Cambridge, where he took his B. A. from St. John's College in 1578, proceeding M. A. in 1583 from Clare Hall, where it is possible that he had expectations of a fellowship. In 1588 he was incorporated at Oxford, so that on some of his title-pages he styles himself "utriusque Academiæ in Artibus Magister," and Nash humorously refers to him as "utriusque Academiæ Robertus Greene." Between the years 1578 and 1583 he had travelled abroad, according to his own account very extensively, visiting France, Germany, Poland, and Denmark, and learning at first hand to "hate the pride of Italie" and to know the taste of that poet's fruit, "Spanish mirabolanes." Whether on his return he took holy orders, the evidence on the subject is insufficient to determine; according to the title-page of a pamphlet published by him in 1585 he was then a "student in phisicke." Already, however, after taking his M. A. degree, he had according to his own account begun his London life, and engaged in pursuits more congenial to his tastes. He became "an author of playes and a penner of love-pamphlets, so that I soone grew famous in that qualitie, that who for that trade growne so ordinary about London as Robin Greene?" He rapidly sank into the worst debaucheries of the town, though not without being inspired by a passing impulse towards a better life, and derided in consequence by his associates as a "Puritane and Presizian." His marriage, which soon after this took place failed to steady him; if Francesco, in Greene's pamphlet *Never too late*, is intended for the author himself, it had been a runaway match; but the fiction and the autobiographical sketch in the *Repentance* agree in their account of the unfaithfulness which followed on the part of the husband. He lived with his wife for a while; "but forasmuch as she would perswade me from my wilfull wickednes, after I had a child by her, I cast her off, having spent up the marriage-money which I obtained by her. Then left I her at six or seven, who went into Lincolnshire, and I to London," where his reputation as a playwright and writer of pamphlets "of love and vaine fantasyes" continued to increase, and where his life was a feverish alternation of labor and debauchery. He tells us how in the end he was friendless "except it were in a fewe alehouses," where he was respected on account of the score he had run up. When the end came he was a dependant on the charity of the poor and the pitying love of the unfortunate. Henri Murger has drawn no picture more sickening and more pitiful than the story of Greene's death, as told by his Puritan adversary, Gabriel Harvey—a veracious though not an unprejudiced narrator. (Greene had stung his vanity by an allusion to his paternal origin in the prose-tract of *A Quip for an Upstart Courtier*.) After a banquet where the chief guest had been the dramatist Nash,—an old associate and perhaps a college friend of Greene's, any great intimacy with whom, however, he seems to have been anxious to disclaim,—Greene had fallen sick "of a surfeit of pickle herringe and Rennish wine." At the house of a poor shoemaker near Dowgate, deserted by all except his compassionate hosts and two women,—one of them the mother of his illegitimate son, Fortunatus Greene,—he died September 2, 1592. Shortly before his death, he wrote under a bond for ten pounds which he had given to the good shoemaker, the following words addressed to his long-forsaken wife:—"Doll, I charge thee, by the loue of our youth and by my soules rest, that thou wilte see this man paide; for if hee and his wife had not succoured me, I had died in the strectes.—Robert Greene."

Shortly after Greene's death the dramatist Henry Chettle published a pamphlet from the hand of the unhappy man, entitled *Greene's Groat's-worth of Wit bought with a Million of Repentance*. This ill-starred production may almost be said to have done more to excite the resentment of posterity against Greene's name than all the errors for which he so unctuously professed his (doubtless sincere) repentance. For in it he chose to point the fact of his own conversion by exhorting three of his *quondam* acquaintance to go and do likewise. Of these three Marlowe was one—to whom and to whose creation of "that Atheist Tamberlaine" (perhaps to both author and hero under the name of the latter) he had repeatedly alluded or referred in previous pamphlets. The second was Peele, the third probably Nash. But the passage addressed to Peele contained a transparent allusion to a fourth dramatist, who was an actor likewise, and of whom Greene accordingly thought himself entitled to speak with insolent arrogance as of "an vpstart crow beautified with our feathers, that with his *Tygres heart wrapped in a player's hyde* supposes hee is as well able to bombast out a blanke-verse as the best of you; and being an absolute Iohannes-fac-totum, is in his owne conceyt the onely shake-scene in a countrey." The phrase italicized parodies a passage occurring in *The True Tragedie of Richard, Duke of Yorke*, etc., and retained in Part III. of *Henry VI.* If Greene (as many eminent critics have thought) had a hand in *The True Tragedie*, he must here have intended a charge of plagiarism against Shakespeare. But it seems more probable that, while (as Mr. R. Simpson suggested) the upstart crow beautified with the feathers of the three dramatists is a sneering description of the actor who declaimed their verse, the *animus* of the whole attack (as Dr. Ingleby explains it) is revealed in its concluding phrases. This "shake-scene," *i. e.*, this *actor*, had ventured to intrude upon the domain of the regular staff of play-wrights—their monopoly was in danger.

Altogether not less than thirty-five prose-tracts are ascribed to Greene's prolific pen. To these, which are by no means all of a personal or even controversial character, he owed in his lifetime a great part of his celebrity. Nearly all of them are interspersed with verses; in their themes

they range from the "misticall" wonders of the heavens to the familiar but "pernitious sleights" of the sharpers of London. But the most widely attractive of his prose publications were no doubt those to which he more especially refers under the designation of "love-pamphlets," and which, as he tells us, brought upon him the outcry of Puritan censors. In these popular productions he appears very distinctly as a follower of the fashionable euphuistic style, indeed two of them are by their titles announced as a kind of sequel to the mother romance. But though Greene's style shows the same balanced oscillation to and fro, and his diction the same elaborate ornateness, as those of Lyly, he contrives to interest by the matter as well as to attract attention by the manner of his narratives. It is known that on his *Pandosto, the Triumph of Time* (1588) Shakespeare founded his *A Winter's Tale;* in fact, the novel contains the entire plot of the comedy, though some of the subordinate characters in the latter (including the immortal Autolycus) were added by Shakespeare.

In Greene's *Never too late*, announced in its author's unctuous variety of the euphuistic manner as a "Powder of Experience: sent to all youthfull gentlemen" for their benefit, the hero of the Palmer's story is in all probability intended for Greene himself; and this episodical narrative has a vivacity and truthfulness of manner which savor of an 18th century novel rather than of an Elizabethan tale concerning the days of "Palmerin, King of Great Britaine." The experiences of the Roberto of *Greene's Groat's-worth of Wit* are even more palpably the experiences of the author himself, though they are possibly overdrawn—for a born rhetorician exaggerates everything, even his own sins. Much that might be enlarged upon in Greene's manner as a writer of prose fiction shows how already in the Elizabethan age there was a possibility of the English novel anticipating what proved the slow course of its actual development.

For us, however, Greene's name lives chiefly if not solely as that of a dramatist. Only four plays remain to us of which he was indisputably the sole author. The earliest of these seems to be *The History of Orlando Furioso, one of the Twelve Peeres of France*—which has (on unsatisfactory evidence) been dated as before 1586, and is known to have been acted on February 21, 1592. It is a free dramatic adaptation of Ariosto (who in one passage is textually quoted), and contains a large variety of characters and a superabundance of action. Fairly lucid in arrangement and fluent in style, it lacks in the treatment of its main situation—the madness of Orlando—the tragic power to which in truth its author was a stranger. Greene's *Orlando* has been described as "a stepping stone to *Lear* and *Hamlet*," but its priority to Kyd's *Spanish Tragedy* (to which the author of this observation likewise refers) is not proved. Very few dramatists between Sophocles and Shakespeare have succeeded in subordinating the grotesque effect of madness to the tragic; and Greene (the close of whose play is tameness itself) is not among the number.

Of the *Comical History of Alphonsus, King of Arragon*, Henslowe's *Diary* contains no trace. But it can hardly have been first acted long after the production of Marlowe's *Tamburlaine*, which had been brought on the stage at least three years before. For this play—which is oddly enough called "comical," though it contains not a single comic character, and is surely unintentionally humorous in the effect of some of its passages—was manifestly written in emulation of Marlowe's tragedy. While Greene cannot have thought himself capable of surpassing Marlowe as a tragic poet, he very probably wished to outdo him in "business," and to equal him in the rant which, since there has been an English theatre, has been sure to bring down at least part of the house. *Alphonsus* is accordingly not less sensational than *Tamburlaine*, and supplied its share of quotations to ancient Pistol. It is a *history* proper,—a dramatized chronicle or narrative of warlike events,—and a very effective one of its kind. Its fame could never equal that of Marlowe's tragedy; but its composition showed that Greene could seek to rival the most popular drama of the day, without falling very far short of his model.

In the *Honourable History of Friar Bacon and Friar Bungay* (not known to have been acted before February, 1592, but very possibly written by 1588) Greene once more attempted to emulate Marlowe; but on this occasion, while producing something very different from the play with which he placed his own in competition, he succeeded in producing a masterpiece of his own. Marlowe's *Doctor Faustus*, which there is every reason to believe suggested the composition of Greene's comedy, is a work which, even in the form in which it has come down to us, reveals the mighty tragic genius of its author; and it was fortunate for Greene's fame that he resolved on an altogether distinct treatment of a cognate theme. Interweaving with the popular tale of Friar Bacon and his wondrous doings a charming idyl (so far as we know, of his own invention), the story of Prince Edward (I.)'s love for the Fair Maid of Fressingfield, he produced a comedy brimful of amusing action and genial fun, and at the same time containing a dramatic love-story of unsurpassed freshness and brightness. *Friar Bacon* remains a dramatic picture of English life with which *The Merry Wives* alone can vie; and not even the ultra-classicism in the similes of its diction can destroy the naturalness which constitutes its perennial charm.

In *The Scottish Historie of James IV.* (not printed till 1598, acted by 1592) Greene seems to have reached the climax of his dramatic powers. The "historical" character of this play is pure pretence, so that one wonders how a Tudor dramatist could have dared to invent a fictitious name and unreal experiences (of a painful kind) for King Henry VII.'s daughter. Its theme is the illicit passion of King James for the chaste lady Ida, to obtain whose hand he endeavors, at the suggestion of a villain called Ateukin, to make away with his own wife. She escapes in doublet and hose, attended by her faithful dwarf; but on her father's making war upon her husband to avenge her wrongs, she effects a reconciliation between them. Not only is this well-constructed story effectively worked out, but the characters are vigorously drawn, and in Ateukin there is a touch of Iago. The fooling by Slipper, the clown of the piece, is unexceptionable; and lest even so the play should hang heavy on the audience, its action is carried off by a "pleasant comedie"—*i. e.*, a prelude and some dances between the acts—"presented by Oboram, King of Fayeries"—the Oberon of *A Midsummer Night's Dream* (probably later in date than Greene's play).

It is hard to have to abandon the belief that *George-a-Greene the Pinner of Wakefield* (printed 1599), a delightful picture of English life fully worthy of the author of *Friar Bungay*, has been rightly attributed to him. Of the comedy of *Fair Em*, which resembles *Friar Bacon* in more than one point, it is most improbable that Greene was the author. The disputed question as to his supposed share in the plays on which the Second and Third Parts of *Henry VI.* are founded has been already referred to. He was certainly joint author with Thomas Lodge of the curious drama called *A Looking Glasse for London and England* (printed 1594)—a dramatic apologue conveying to the living generation of Englishmen the warning of Nineveh's corruption and prophesied doom. The lesson was frequently repeated in the streets of London by the "Ninevitical motions" of the puppets; but there are both fire and wealth of language in Greene and Lodge's oratory. The comic element is not absent, being supplied in abundance by Adam, the clown of the piece, who belongs to the family of Slipper and of Friar Bacon's servant, Miles.

Greene's dramatic genius has nothing in it of the intensity of Marlowe's tragic muse; nor perhaps are there any passages in his poetry equalling certain of Peele's when at his best. On the other hand, of none of Shakespeare's predecessors or contemporaries can it be said, as of Greene, that his dramatic poetry is occasionally animated with the breezy freshness which no artifice can simulate, but which nothing but obtuseness can mistake. He can construct neatly and with facility, though of course belonging to a period of our dramatic literature when the art of construction was still in its infancy. He has created no character of commanding power—unless Ateukin be excepted; but his personages are living men and women, and marked out from one another with a vigorous but far from rude hand His comic humor is undeniable, and he unites a spirit of true farcical fun with a capacity for light and graceful dialogue. His diction is overloaded with classical ornament but even this he frequently employs with pleasing aptness. His versification is easy and fluent; and its cadence is at times singularly sweet. He creates his best effects, like a true artist, by the simplest means; and he is indisputably one of the most gifted and one of the most pleasing among our early dramatic authors.

The best account of Greene and his writings (including a list of all his prose tracts) is that by the late Mr. Dyce, prefixed to his edition of *The Dramatic and Poetical Works of Robert Greene*, 1 vol., 1861; the 2 vol. edition was published in 1831. It contains copious extracts from *Pandosto*, and from other prose-writings by Greene. *Greene's Groat's-worth of Wit* is printed in part i. of Dr. Ingleby's *Shakespeare Allusion-Books* (*New Shakespeare Society's Publications*, 1874). Dr. Ingleby's general introduction, and a supplement by the late Mr. Richard Simpson, as well as the observations in Mr. Simpson's *School of Shakespeare*, will be of great value to readers of Greene. W. Bernhardi's *Robert Greene's Leben und Schriften* (Leipsic, 1874) is an essay full of useful research; and Prof. J. M. Brown, of Christchurch, New Zealand, has contributed a spirited, but at the same time judicious, criticism of Greene to the *New Zealand Magazine* for April, 1877. A Russian monograph on him by N. I. Storozhenko (Moscow, 1878) is described as perhaps the fullest hitherto published. *Friar Bacon and Friar Bungay* has been edited, together with Marlowe's *Doctor Faustus*, for the Oxford Clarendon Press (1878). (A. W. W.)

GREENFINCH (German *Grünfink*), or GREEN LINNET, as it is very often called, a common European bird, the *Fringilla chloris* of Linnæus, ranked by many systematists with one section of Hawfinches, *Coccothraustes*, but apparently more nearly allied to the other section *Hesperiphona* (*cf.* FINCH, vol. ix. p. 167), and perhaps justifiably deemed the type of a distinct genus, to which the name *Chloris* or *Ligurinus* has been applied. The cock, in his plumage of green and gold, is one of the most finely colored of our common birds, but he is rather heavily built, and his song is hardly commended. The hen is much less brightly tinted. Throughout Britain, as a rule, this species is one of the most plentiful birds, and is found at all seasons of the year. It pervades almost the whole of Europe, and in Asia reaches the river Ob. It visits Palestine, but is unknown in Egypt. It is, however, abundant in Mauritania, whence specimens are so brightly colored that they have been deemed to form a distinct species, the *Ligurinus aurantiiventris* of Dr. Cabanis, but that view is now generally abandoned. In the north-east of Asia and its adjacent islands occur two allied species—the *Fringilla sinica* of Linnæus, and the *F. kawarahiba* of Temminck. No species of Greenfinch is found in America. (A. N.)

GREENHEART, one of the most valuable of timbers, is the produce of *Nectandra Rodiæi*, nat. ord. *Lauraceæ*, a tree which grows to a height of 70 feet, native of Guiana, where, inland, it exists in great abundance. The Indian name of the tree is Sipiri or Bibiru, and from its bark and fruits is obtained the febrifuge principle Bibirine (see BIBIRINE). Greenheart wood is of a dark green color, sap wood and heart wood being so much alike that they can with difficulty be distinguished from each other. The heart wood is one of the most durable of all timbers, and its value is greatly enhanced by the fact that it is proof against the ravages of many marine borers which rapidly destroy piles and other submarine structures of most other kinds of wood available for such purposes. In the Kelvingrove Museum, Glasgow, there are two pieces of planking from a wreck submerged during eighteen years on the west coast of Scotland. The one specimen—greenheart—is merely slightly pitted on the surface, the body of the wood being perfectly sound and untouched; while the other—teak—is almost entirely eaten away. Greenheart, tested either by transverse or by tensile strain, is one of the strongest of all woods, and it is also exceedingly dense, its specific gravity being about 1150. It is one of the few woods included in the first class of Lloyd's Register for shipbuilding purposes, and it is extensively used for keelsons, beams, engine-bearers, and planking, etc., as well as in the general engineering arts, but its excessive weight unfits it for many purposes for which its other properties would render it eminently suitable.

GREENLAND, or GRÖNLAND, is the name applied to a large continental island, the greater portion of which lies within the Arctic Circle, and all of which is arctic in character (see vol. i., Plate X.). It is entirely unconnected with any portion of Europe or America, though in the extreme north only separated from the latter by the narrow strait which lies between it and the outlying portion of America known as Grinnell Land. From Europe it is divided by the North and Greenland Seas,—the Faroe Isles, Jan Mayen Island, Iceland, and part of Shetland being the only lands between it and Norway. Denmark Strait is the sea between it and Iceland, and it is more than probable that Spitzbergen is the only great group of islands lying to the east of its northern portion. On the west, Davis Strait and Baffin's Bay separate it from the opposite shore. The latter sea narrows to the north into the gulf generally known as Smith Sound, though, in reality, Kane Sea, Kennedy Channel, Hall Basin, and Robeson Channel are the names which have been successively applied in the progress of exploration to the northern continuations of the sound so named more than two hundred years ago by William Baffin. The exact northern termination of Greenland is not known, the country never having been doubled on the north; but we know enough from the explorations of Markham, Beaumont, and other officers of Nares's expedition, to lead to the conclusion that the ice-encumbered Polar Ocean circles around the headlands of the broken country which forms its supposed limits in about 83° N. lat.

From Cape Farewell, or Kangersuak,—an island lying about 18 miles from Pamiagdluk, the most southern Danish post on the west,—to Cape Britannia, is about 1380 miles; and the greatest breadth of Greenland is about 77° 30′ N. lat.—690 miles from the one coast to the other. The shore-line is fully 3400 miles long; but so little is the country known with accuracy, and so broken is it by fjords and coast-lying islands, that any accurate estimate of its area is impossible. Thus Dr. Rink, who has been connected with the government in various capacities for upwards of thirty years, estimates its area at 512,000 square miles. This estimate allows 192,000 square miles for what has been called the outskirts—or islands uncovered by ice—with their fjords, and 320,000 for the interior, believed to be almost entirely covered by a glacier ice-cap. Pop. 11,890.

On the east coast, Cape Bismarck, in 76° 47′ N. lat., marks the limits of exploration; though as early as 1670 Lambert is said to have sighted land several degrees further north. From Cape Bismarck south to Cape Farewell (59° 35′ N. lat.) the coast is very imperfectly known, whole stretches being entirely uncharted, even in the rudest fashion. This arises from the Spitzbergen ice-stream continually pouring down that shore, rendering it possible to approach within sight of it only on rare occasions, and to land still more rarely. Yet, from the explorations of Hall and Lindenow in early times, and those in this century by Scoresby,[1] Graah,[2] the German expedition,[3] and Mourier (1879), we know its general features. These are—high beetling cliffs, great glaciers creeping down to the sea, and deep inlets, like Scoresby Sound and Franz Josef Fjord, penetrating the land for distances which cannot as yet be definitely stated. A number of islands also are dotted over the chart here; but there are few "ice fjords," the slope of the inland ice being evidently chiefly towards the west coast. The west coast is of much the same character,—only, on this side, the fjords with which it is intersected have been nearly all followed to their heads. Many of them stretch several miles into the interior, and the greater number are ended by glacier prolongations of the "inland ice," which discharge icebergs; these are known as "ice fjords." The Greenland fjords, like those of Norway, British Columbia, and other countries with a western exposure, bear every mark of having been at one time the beds of glaciers, when the climate and physical geography of the country were different from what they are at present. The country cannot be said to be mountainous, yet heights of from 3000 to 4000 feet are common, and the aspect which the coast presents is that of high cliffs,—black when steep, white where the snow can lie; snow for eight or nine months in the year on even the lower lands; icebergs and broken floe-ice floating off the coast; an "ice-foot" attached to the shore early in the spring; and glaciers peeping down through the valleys between the cliffs and fjelds. There are one or two still higher points, such as Petermann's Peak—near the shores of Franz Josef Fjord on the east coast (11,000 feet), Payer's Peak, Sukkertoppen, and the familiar Sanderson's Hope. With the exception of Disco, there are no large islands; but the bays, fjords, straits, and peninsulas of this extremely broken coast are so numerous that it is needless mentioning them by name.

The Interior Ice-covering.—The Danes divide Greenland into two physical divisions—the "outskirts" and the "inland ice." The first comprises the coast-lying land, the latter the interior. If we ascend any considerable emi-

[1] *Journal of a Voyage to the Northern Whale Fishery* (1823).
[2] *Reise til Östkysten af Grönland* (1832; trans. by G. Gordon Macdougall, 1837).
[3] Koldeway, *Die zweite deutsche Nordpolarfahrt* (1873–75).

nence on the west coast, and look eastward, we do not find mountains and valleys as in most other countries, but only one huge, seemingly endless, expanse of glacier ice gradually rising towards the east, until the view is bounded by a white horizon. If we cross the coast-lying land, which varies in breadth from a few miles to twenty, or in a few cases much more, we come to this "inland ice," generally in the form of a glacier offshoot of it which has crept down into a fjord, or is making its way to the sea in one of the mossy valleys lying between two high cliffs, noisy with mollemokes or with the weird scream of cormorants, which at various sheltered places have colonies in these "skarvefjelde." In the former case the glacier usually presents a steep wall facing the sea, from which great fragments of ice are continually breaking off, or the icebergs being detached by the force of the sea; then it is "sermik soak"—the "great ice wall"—of the Eskimo. In the latter case, it presents a slope on which the explorer can climb, and ascend into the interior over the inland ice, of which it is a prolongation. A little way eastward, the covering is found to be hard glacier ice, rising by a gentle slope—covered in the winter and spring with a thick coating of snow, which partially melts during the summer, forming considerable lakelets on the surface of the ice, or courses over it in the shape of streams that thunder down the deep *crevasses* which divide it here and there as in ordinary glaciers. No sign of living thing is seen on it, save patches here and there of a low order of plants identical with or allied to the "red snow" (*Ancylonema Nordenskjöldii*,[1] *Protococcus vulgaris*, *P. nivalis*, and *Scytonema gracilis*); no moraine of any description, showing that the ice could not have impinged on land in its travels; and no sign of the ice having come in contact with any other physical influence save that of the atmosphere, unless the presence here and there in hollows of the minute powder-like mineral "kryokonite" is to be considered an exception. The few explorers who have ever attempted to penetrate this terrible waste all give the same account.[2] Travel eastward, and nothing but ice—rough, crevasse-torn, white, earthless, moraineless, lifeless—is seen, until, in the far distance, the view is bounded by a dim, misty horizon of ice, which, at a distance of about 30 miles inland, rises to a height of 2000 feet above the sea. North is ice; south is ice; and behind are seen the "outskirts," or ice-bare islands. The only exception to this general statement is to be found in the fact that here and there the ice has licked in and surrounded, but not yet covered, bits of high land near the coast, which stand out black amid the surrounding icy whiteness. Such an island in the ice is known to the Greenlanders as a "nunatak." A noted one has long been known to exist some 50 miles east of the westward edge of the inland ice north of Frederikshaab. It was long supposed to be merely the east coast mountains, the country being narrow at this point; but the explorations of Lieut. Jensen, R.D.N., in July and August, 1878, prove it to be a peak 5000 feet high—*i. e.*, about 3000 feet above the surrounding ice—entirely isolated. On the other side of this mountain ridge the glacier field was observed stretching without interruption as far as the eye could see, the plateau apparently rising higher and higher to the east,[3] which may account for the fact that the German explorers did not notice the inland ice in their explorations of Franz Josef Fjord. The high peak only proves that, though in the course of ages the winter snow, unmelted by the summer heats, has got compressed into the glacier sheet which has covered the interior, and is partially discharging its surplus in the form of icebergs on the coast, it has not yet accumulated to such depths as to overwhelm these elevated places. It may, however, do so in time; for, though it is clear that at one time the climate of Greenland was very different from what it is now, it is equally evident that at no very distant date the ice overspread much of the now uncovered outskirts. The so-called "glaciers" which reach the sea are long or short, broad or narrow, according to the character of the valley through which they creep seaward. Thus a coast "glacier," so called, may be 40 miles broad, like the Great Glacier of Humboldt, or only a few yards, like most of the others in Greenland. When the glacier reaches the sea it ploughs along the bottom, until, by the force of the water, its end is buoyed up and finally broken off in the shape of an iceberg, which is carried by the winds and currents out to sea to be in time again melted and absorbed into the ocean whence it originally sprang. If, on the contrary, the sea is shallow, the glacier will protrude for a considerable distance, as in the case of the Isblink, a little north of the fishing-station of Avigait (62° 32′ N. lat.), which is a low sandy beach projecting about 8 miles in front of the inland ice, and forming a breakwater against the force of the waves. From under the Arctic glacier pours, as in the Alpine ones, a muddy stream, which silts up some of the fjords, and forms deposits identical with the laminated glacial clays of Britain. Such, in brief, is the inland ice of Greenland, which has been known since the days of Fabricius,[4] but has only been recently generally recognized, and even yet is imperfectly understood in its all-important bearings on the study of ancient glacial remains.

Geology.—So far as made out, the structure of explored Greenland is as follows:—

(1.) *Laurentian gneiss* forms the greatest mass of the exposed rocks of the country bare of ice. They are found on both sides of Smith Sound, rising to heights of 2000 feet, and underlie the Miocene and Cretaceous rocks of Disco Island, Noursoak Peninsula, and the Oolites of Pendulum Island in East Greenland. It is possible that some of these rocks are also of Huronian age, but it is doubtful whether the rocks so designated by the geologists of the "Alert" and "Discovery" expedition are really the rocks so known in Canada, or are a continuous portion of the fundamental or oldest gneiss of the north-west of Scotland and the Western Isles.

(2.) *Silurian.*—Upper Silurian, having a strong relation to the Wenlock group of Britain, but with an American facies, and Lower Silurian, with a succession much the same as in British North America, are found on the shores of Smith Sound, but not as yet so far south as the Danish possessions.

(3.) *Devonian* rocks are believed to occur in Igaliko and Tunnudiorbik Fjords, in S. W. Greenland, but as they are unfossiliferous sandstone, rapidly disintegrating, this cannot be known. It is, however, likely that this formation occurs in Greenland, for in Dana Bay, Capt. Feilden found a species of *Spirifera*, and *Productus mesolobus* or *costatus*, though it is possible that these fossils represent the "Ursa stage" (Heer) of the Lower Carboniferous. But a few Devonian forms have also been recorded from the Parry Archipelago, which tends to confirm belief in the existence of a sporadic Devonian formation in Greenland.

(4.) *Carboniferous.*—In erratic blocks of sandstone, found on the Disco shore of the Waigatt, have been detected a *Sigillaria* and a species of either *Pecopteris* or *Gleichenia*, perhaps of this age; and probably much of the extreme northern coast of Grinnell Land, and therefore, in all likelihood, the opposite Greenland shore, contains a clearly developed Carboniferous Limestone fauna, identical with that so widely distributed over the North American continent, and referable also to British and Spitzbergen species. Of the Coal Measures above these, if they occur, we know nothing at present. Capt. Feilden notes as suggestive that, though the explorers have not met with this formation on the northern shores of Greenland, yet it was observed that a continuation of the direction of the known strike of the limestones of Feilden peninsula, carried over the polar area, passes through the neighborhood of Spitzbergen, where the formation occurs, and contains certain species identical with those of the Grinnell Land rocks of this horizon. The facies of the fossils is, according to Mr. Etheridge, North American and Canadian, though many of the species are British. The corals are few in number, but the *Molluscoida* (*Polyzoa*) are more numerous in species and individuals. No Secondary rocks have been discovered in the extreme northern parts of West Greenland, but they are present on the east and west coasts in more southerly latitudes than Smith Sound.

(5.) *Jurassics.*—These do not occur on the west coast, but on the east coast the German expedition discovered marls and sandstones on Kuhn Island, resembling those of the Russian Jurassics, characterized by the presence of the genus *Aucella*, an ammonite (*Perisphinctes Payeri*), *A. striolaris*, *Belemnites Panderianus*, *B. volgensis*, *B. absolutus*, and a *Cyprina* near to *C. syssolæ*. On the south coast of the same island are coarse-grained, brownish micaceous, and light-colored calcareous sandstone and marls, containing fossils, which render it prob-

[1] Berggren, *Öfv. Kongl. Vet. Akad. Förh.*, 1871, p. 293.

[2] Full accounts of these explorations are given by Brown in *Arctic Papers of the R. G. S.* (1875), and in "Das Innere von Grönland" (Petermann's *Mittheilungen*, 1871), as well as in "Physics of Arctic Ice" (*Quarterly Journal of the Geol. Soc.*, 1869).

[3] *Geograph. Magazine*, 1878, p. 282; *Deutsche Geog. Blätter*, 1878; *Die zweite deutsche Nordpolarfahrt* (1873), etc.

[4] *Fauna Groenlandica* (1780), p. 4; Nordenskjöld, *Redogörelse för en Expedition till Grönland år 1870* (1871), also translated in *Geolog. Mag* (1873), and Nordenskjöld's *Arctic Voyages* (1879); Rink, "Om Grönlands Inland" (No. 9, *Fra Videnskabens Verden*, 1875), *Danish Greenland* (1877), and *Grönland geographisk og statistisk beskrevet* (1857); Helland, *Ueber die Gletscher Nordgrönlands und die Bildung der Eisberge* (1877); and the various works and memoirs cited by Brown in *Arctic Papers of R. G. S.* (1875).

able that they are of the same age as the coal-bearing Jurassics of Brora, Skye, and Mull (Scotland), and the Middle Dogger of Yorkshire. There is also coal on Kuhn Island.

(6.) *Cretaceous.*—Beds of this age, consisting of sandstones and coal, are found on the northern coast of Disco Island, and the southern side of the Noursoak Peninsula, the beds in the former locality, "the Kome strata" of Nordenskjöld, being the oldest. They reach 1000 feet in thickness, occupying undulating hollows in the underlying gneiss, and dip towards the Noursoak Peninsula at 20°, when the overlying Atanakerdluk strata come in. Both these series contain numerous plant remains, evergreen oaks, magnolias, aralias, etc., and seams of lignite (coal), which is hurnt; but in neither occur the marine beds of the United States. Still, the presence of dicotyledonous leaves, such as *Magnolia alternans*, in the Atauakerdluk strata, proves their close allianco with the Dakota series of the United States. The underlying Kome beds are not present in the American series. They are characterized by fine cycads (*Zamites articus* and *Glossozamites Heheneggeri*), which also occur in the Urgonian strata of Wernsdorff.

(7.) *Miocene.*—This formation, one of the most widely spread in polar lands, though the most local in Greenland, is also the best known feature in its geology. It is limited to Disco Island, and perhaps to a small part of the Noursoak Peninsula, and the neighboring country, and consists of numerous thin beds of sandstone, shalo, and coal,—the sideritic shale containing immense quantities of leaves, stems, fruit, etc., as well as some insects, and the coal pieces of retinite. The study of these plant and insect remains shows that forests containing a vegetation very similar to that of California and the southern United States, in some instances even the species of trees being all but identical, flourished in 70° N. lat. during geological periods comparatively recent. These beds, as well as the Cretaceous series, from which they are as yet only imperfectly distinguished, are associated with sheets of basalt, which penetrate them in great dykes, and in some places, owing to the wearing away of the softer sedimentary rocks, stand out in long walls running across the beds. These Miocene strata have not been found further north on the Greenland shore than the region mentioned; but in Lady Franklin Bay, on the Grinnell Land side of Smith Sound, they again appear, so that the chances are they will he found on the opposite coast, though doubtless the great disintegration Greenland has undergone and is undergoing has destroyed many of the softer beds of fossiliferous rocks. On the east coast, more particularly in Hochstettor Foreland, the Miocene beds again appear, and we may add that there are traces of them even on the west coast, hetween Sonntag Bay and Foulke Fjord, at the entrance to Smith Sound. It thus appears that since early Tertiary times there has heen a great change in the climate of Greenland.

(8.) *Post-Tertiary Beds.*—These consist of raised sea-beaches found along the whole coast of Greenland, containing *Mollusca* and other organic remains, identical with those living in the neighboring sea. These terraces are very marked on the shores of Smith Sound, and are believed to be proof of the gradual elevation of the land in that quarter, such elevation being known to be going on all round the polar basin. Within the Danish possessions, however, the coast is falling,—places, the site of hamlets within the memory of man, being no longer habitahle, and other localities which, when the Danes first eame to the country a century and a half ago, were bare, being now covered at the lowest tides.

Mines.—In addition to the formations named, there are numerous other rocks—primitive or metamorphic—which it is impossihle to classify accurately, in which are found numerous minerals, either in veins or scattered. Few of these are of economic importance. *Graphite* is found in great abundance, particularly on an island off Upernivik, but the mining of it has proved unprofitable. *Cryolite* is found in quantity in Greenland only, and is at present the only mineral mined there for the European and American markets (see CRYOLITE). It is found only in one spot, Ivigtut, on the shore of Arsut Fjord in 61° 10′ N. lat., traversing a granitic-like gneiss in veins, associated with argentiferous lead, copper, zinc, tin, tantalite, molybdenite, zircon, fluor spar, etc.; hut none of the metallic ores have heen found profitablo to work. The numher of lahorers employed usually amounts to 100 in summer and 30 in winter, in addition to the officials aud their families. In the nine years succeeding 1857, when a license was granted to a private company to work the cryolite, 14,000 tons were exported, and during the next nine years 70,000 tons, or, on an average, 26 ship-loads per annum. *Steatite* or soap-stone has been long used hy the natives for the manufacture of their lamps and other vessels. Native *iron* is found in various places; the most remarkable of these finds were the great nodules of Uvifak on Disco Island,—the weight of the largest of which was calculated at 46,200 lb,—at one time helieved to he aerolites, but now known to he simply native iron of the same quality as that scattered in the gneiss on which the masses were found superimposed. *Copper* has been found in several places, but only in nodules and laminæ of very limited extent. Coal of poor quality, associated with the Cretaceous and Miocene beds, is found in the districts about Disco Bay and Umenak Fjord, but it is only mined to the extent of 40 or 50 tons per annum, for use in the houses of the Danish officers, unless when an exploring ship refills with it. The coal of Kuhn Island is Jurassic.[1]

Climate.—The southern part has a climate much the same as the northern shores of Norway and Iceland; further north the temperature decreases with the increase of latitude, while the severity of the winter season is intensified hy the country heing shrouded for several months in the year in darkness,—in the far north seldom even relieved by the rare displays of the aurora, though the starlight and moonlight are brilliant beyond what the inhabitants of lower latitudes are accustomed to. Again, during the summer there is an equally long continuance of the sun above the horizon. Spring and autumn are disagreeable, rain, sleet, and snow being frequent, while, the soa not being frozen over, travelling becomes difficult. In North Greenland sledging along the ice-covered coast is pleasant during the winter, but in the south the sea is not continuously congealed; hence no dogs are kept, and the winter exercise of the sometimes scurvied residents is confined to within a few yards of the houses, when the great depth of snow will admit even of this. The climate is very uncertain—the weather changing suddenly from hright sunshine, with swarms of mosquitos enjoying their brief holiday, to dense fog, driving in clouds around the headlands, and even heavy falls of snow accompanied by icy cold winds. At Julianehaab the mean annual temperature is about 33° Fahr., and at Upernivik, 13°. In January, at Van Rensselaer harbor, Kane experienced as low a temperature as — 66·5° Fahr. At Sabine Island, on the east coast, the temperature is much the same at the same periods as on the opposite west coast, except in the month of December. Again, at Upernivik the mean temperature of the three summer months is 38°; at Julianehaab it is 48°; and for the three winter months respectively — 7° and 20°. The winter at Julianehaab is not much colder than that of Norway and Sweden in the same latitude, but its mean temperature for the whole year is like that of Norway 600 miles further north. In other words, its winter is not severe, but its summer is arctic, and, so far as the summer goes, the same generalization may be made regarding all Greenland. In the most northern settlements a temperature of 52° is oppressive, hut until the thermometer falls to — 28° no one complains of extreme cold. At Upernivik (72° 48′ N. lat.) the highest temperature that has been noted is 59°. At Julianehaab 68° has once been recorded, perhaps the highest *known* Greenland heat. Often in January and February a peculiar warm wind or "föhn" begins to hlow, raising the temperature to 42°. On the other hand, at Upernivik, in July a day was observed with a mean temperature helow 32°, and a single observation in the same month has shown 27½° Fahr. The prevailing winds—the "föhn,"[2] which blows from points hetween true E. S. E. and true E. N. E., excepted—follow the direction of the coast, "blowing from the south with snow and rain, and from the north clearing the sky, or in summer frequently accompanied by mist." Mirage, parhelia, paraselenæ, anthelia, and auroral displays are common. There is less snow in the north than in the south. At Julianehaab it once snowed in June continuously for thirty-six hours, and in 64° N. lat. not a single drop of rain fell from September 27, 1862, to May 20, 1863, on which day the snow had obtained a depth between the houses of from 8 to 20 feet.[3] The temperature of the soil at Godthaab, 4 feet under the ground, only varied between the extremes 31·5 in March and 40·1 Fahr. in September (Rink).

Animals and Plants.—The flora and fauna are essentially European, notwithstanding the proximity of the country to America. This fact renders it probable that Davis Strait and Baffin's Bay are gulfs of old date, and points to the likelihood of East Greenland having been connected with Europe in a comparatively recent geological period. Possibly the islands between Norway and Greenland are remains of this land-bridge, over which the Lapland plants and animals found their way to Greenland. With one notahle exception—the musk-ox—the plants and animals of the east coast are more European than those of the west, though this consists rather in the absence of European animals and plants on the latter shore than in the presence of American ones. The mammals of Greenland are—

[1] Analyses in Heer's *Flora Fossilis Arctica*, vol. i. p. 5, and Brown *Trans. Geol. Soc. Glasgow*, vol. v. p. 43. See also Moss, *Proc. Roy. Dub Soc.*, 1877, and Feilden and Rance, *Quart. Journ. Geol. Soc.*, 1878, p 563; Appendix to Koldeway, *Zweite deutsche Nordpolarfahrt*, vol. ii. p 510; K. J. V. Steenstrup, *Viddenskab. Medd. fra den naturhistoriske Forening i Kjöbenhavn*, 1874, p. 77, and 1875, p. 284; Rink, *Om den geog. Beskaffenheb af de danske Handelsdistrikter i Nordgrönland* (1852); Giesecke's *Mineralogiske Rejse i Grönland*, by Professor Johnstrup (1878), etc.

[2] Hoffmeyer, *Geog. Mag.*, 1877, p. 225; Nares, *Ibid.*, p. 316.

[3] For additional details regarding temperature, see Rink, *lib. cit* (1877), pp. 56, 372; the *Collectanea Meteorologica* of the Copenhagen Meteorological Institute; the Admiralty's *Manual and Instructions for the Arctic Expedition of 1875*, pp. 613–749; and Nordenskjöld, *Oesterreich. Ges. Met. Zeit.*, 1872, pp. 114–142.

the wolf (one, apparently a straggler from the opposite shores, being killed in 1869), the dog, fox (white and blue varieties), white bear, ermine, walrus, five or six species of seals, the lemming, the arctic hare, the musk-ox, the reindeer, the right whale, four species of fin-whale, the sperm-whale (very rare), the bottle-nose, white whale, narwhal, caaing whale, porpoise, euphrosyne dolphin, two species of *Lagenorhynchus*, and the sword-fish. Of these the ermine, lemming, and musk-ox are not found as far south as the Danish possessions. They inhabit the shores of Smith Sound and East Greenland in about the same latitude, but do not stretch farther south, so that the probabilities are that they have migrated round the northern end of the country, and are kept from spreading southward by the glaciers. The mouse, goat, sheep, and ox have been introduced, and the cat is domesticated as far north as Danish women have wandered. Goats, sheep, and oxen live only in the little greenish valleys of the extreme south; in the north there are none. A few pigs are kept at Ivigtut. The right whale is now rarely killed off the coast of Greenland, the whalers merely passing up the coast to the fishing-grounds further north and west. The Eskimo at Holstensborg still occasionally harpoon one or two, but the industry is a mere shadow of what it once was. The humpback, one of the fin-whales, is now and then killed, but the narwhal and white whale form the staple "fishery" of the Greenlanders. Of seals it has been calculated that there are annually captured 51,000 of the floe-rat (*Phoca hispida*), between 1000 and 2000 of the kasigiak (*P. vitulina*), 23,000 saddlebacks (*P. Greenlandica*), 1000 of the ugsuk or thong-seal (*P. barbata*, the ground or "grown" seal of the English sealers), and 3000 of the bladdernose (*Cystophora cristata*). About 200 walruses, 600 white whales, 100 narwhals, a few porpoises, on an average one right whale (in the season from December to March, when it goes as near the coast as the ice will permit in the south), and two or three humpbacks (*Magaptera longimana*), are killed. The other whales are rare, and are captured only under peculiar circumstances. The average catch of the Greenlanders thus amounts to 89,000 seals, 700 white whales and narwhals, and 2 or 3 large whales. Of these seals it may be stated that 38,000 have been caught with harpoons and bladders, 38,000 killed by fire-arms, and 13,000 caught in nets. The polar bear is almost extinct,—about 50 being annually killed in the north, or in the south when they have floated from the east coast on the Spitzbergen heavy ice which doubles Cape Farewell and impinges on the coast south of 69° N. lat., or occasionally in the intervening space where a wandering bear has been carried south on a broken-up floe. The reindeer, once killed in enormous quantities, is sharing the fate of the bear. Between 1845 and 1849 about 25,000 were shot annually, and 16,000 skins were exported. In 1872 there were not more than 1000 killed, and only 6 skins exported. It is now rarely seen in Mid Greenland. The number of foxes trapped averages 1500 per annum; in 1874 5000 were caught, chiefly between 60° and 61° N. lat. About 1000 white hares are killed. The true bird denizens of Greenland cannot be given at higher than 63, while 62 others are reported as stragglers. Of the denizens 5 belong to the Old World, 11 to the New World, 45 are common to both worlds, and 2 are doubtful.[1] Only the raven, ptarmigan, hawk, owl, and a few sea-birds are resident all the year round; the rest are migratory. The ptarmigan is killed for food to the extent of about 12,000 per annum, while the number of eider ducks destroyed is so enormous that the export of eider down has fallen within the last twenty years from 5600 to 2000 lb. Rink estimates the number killed annually at 20,000, and that of auks and smaller sea-fowl at 50,000. The eggs taken yearly, chiefly those of eider ducks, have been estimated at 50,000. Of the 79 or 80 fishes described from Greenland very few are peculiar to it; of these the shark (*Somniosus microcephalus*) is caught for the sake of the oil extracted from its liver, to the extent of from 16,000 to 20,000 per annum. The cod is a migratory fish, and is caught on the banks to the extent of 200,000 per annum, chiefly by the natives. A few salmon trout (*Salmo carpio*) are caught in the little lakes and brooks, while the large and small holibut, the red fish (*Sebastes*), and the nepisak (*Cyclopterus lumpus*) form a considerable portion of the food of the natives. The capelin (*Mallotus villosus*) is caught in enormous quantities (over 1½ million lb are dried annually), while a few smaller fish and mussels complete the tribute which the Eskimo take from the sea laving their barren shores. There are no reptiles or amphibians in Greenland, and the lists of invertebrata contain little of general interest.[2]

The vegetation in the height of summer is, in favorable situations, profuse in individual plants, but scanty in species. The plants are of the usual arctic type, and identical with or allied to those found in Lapland or on the summits of the highest British hills. Forest there is none in all the country. In the north, where the lichen-covered or ice-shaven rocks do not protrude, the ground is covered with a carpet of mosses, creeping dwarf willows, crowberries, bilberries, and similar plants, while the flowers most common are the andromeda, the yellow poppy, pedicularis, pyrola, the Alpine rose (rhododendron), saxifrages (12 species), drabas, dryas, etc.; but in South Greenland there is something in the shape of bush,—the dwarf birches even rising a few feet in very sheltered places, and the vegetation is less arctic and more abundant. Altogether, 361 flowering plants, ferns, horse-tails, quillworts, and club mosses have been described, while the lists of cryptogamic plants, though very imperfect, show a profuse vegetation of the lowlier orders.[3] No crops, in the strict acceptation of the term, are cultivated in Greenland, but at Godthaab attempts have been made to grow turnips, radishes, lettuce, and chervil in little gardens made with earth brought from the site of old Eskimo houses. Potatoes never grow larger than small marbles, while pease only produce seeds barely recognizable. At Nanortalik strawberries have been produced in a forcing frame, carrots matured tolerably well, and turnips have been grown weighing half a pound. Rhubarb grew vigorously, but could not be raised from seed, while cabbage leaves, under the most favorable circumstances, were poor and flavorless. In the north, radishes represent the highest triumph which horticulture has achieved. Flowers, owing to the long sunlight, grow very well indoors, but require great care, otherwise they soon die.

Government.—Excluding the extreme northern parts of Greenland, and the north-east coast,—which may be claimed by the English, Americans, and Germans "by right of discovery,"—the trade of Greenland is a strict monopoly of the Danish crown, dating from 1774, and is at present administered in Copenhagen by a Government board,—the "Kongelige Grönlandske Handel,"—and in the country by various officials in Government pay. In order to meet the double purposes of government and trade, the west coast, up to nearly 74° N. lat., is divided into two inspectorates, —the southern extending to 67° 40′ N. lat., the northern comprising the rest of the country,—their respective seats of government being at Godthaab and Godhavn. These inspectorates are ruled by two superior officials or governors responsible to the director of the board in Copenhagen. Each of the "inspectorates" is divided into "districts," each district having, in addition to the capital or "coloni" (a hamlet containing three or four Danish dwellings, a storehouse, blubber-boiling house, in a few cases a Lutheran "missionair" or clergyman, a teacher, and a physician), several outlying posts and Eskimo hunting stations, each presided over by an "udligger," who is responsible to the "colonibestyrer" or superintendent of the district. These trading settlements, which dot the coast for a distance of 1000 miles, are about 60 in number, and collect the products from 176 inhabited places. From these Eskimo hunting and fishing stations blubber is the chief article received, in parcels weighing from 50 to 100 lb, and forwarded in casks to the "coloni," where it is boiled into oil, and prepared for being despatched to Copenhagen by means of the Government sailing ships, which arrive and leave between May and November. For the rest of the year all navigation is stopped, though the winter months form the busy seal-killing season. The principle which the Government acts upon is to give the natives low prices for their produce, but to sell them European articles of necessity at prime cost, and other stores, such as bread, at prices which will scarcely pay for the purchase and freight, while no merchandise is charged, on an average, more than 20 per cent. over the cost price in Denmark. In addition, the Greenland people are allowed to order goods from private dealers, on paying freight for them at the rate of 2½d. per 10 lb, or 1s. 6d. per cubic foot. The prices to be paid for European articles are fixed every year, the prices current in Danish and Eskimo being printed and distributed by the Government. According to a calculation, founded on the average of the last few years, about 22 per cent. of the value in the European market is paid for the products in Greenland. Out of the payment five-sixths are given to the sellers, and one-sixth devoted to the Greenlander's public fund, spent in "public works," in charity, and on other unforeseen contingencies. The object of the monopoly is solely for the good of the Greenlanders,—to prevent spirits

[1] Newton, *Manual and Instructions* (1875), p. 94.

[2] See *Manual and Instructions for the Arctic Expedition of 1875*, and the papers there by Brown, Newton, Lütken, Reinhardt, Schjödte, Mörch, and others, abstracted with corrections in the appendix to Rink, *lib. cit.* (1877), numerous memoirs and papers in the Danish scientific journals and transactions, Jeffrey's and Carpenter's report of the "Valorous" expedition (*Proc. Roy. Soc.*, vol. xxv.), the appendix to Nares's *Voyage to Polar Seas*, 1875–76, and the references in these works and in appendix to Nordenskjöld's *Voyages*, 1879.

[3] See the appendix to Rink, *lib. cit.*, the references to papers there given, those printed in the *Manual* already referred to, and the memoirs of Berggren, Fries, and Agardh in the *Transactions* of the Upsala and Stockholm Academies, 1861–74. A flora of Greenland is in preparation by Prof. Lange.

being sold to them, and the vice, disease, and misery, which usually attend the collision between civilization of the trader's type and barbarism, being introduced into the primitive arctic community. The inspectors are, in addition to being trade superintendents, magistrates, but serious crime is practically unknown; while the cases of theft which have occurred within a decade are so few that they are held in recollection as historical events. The "vices of civilization" are few, and its diseases unknown. The Danish officials are mostly men of considerable intelligence, and all of good character, though their pay is small. The inspector receives £328 and a residence; the average salaries of the 11 "colonibestyrere" are £250, of the 18 clerks —"assistants" or "volunteers"—£106, besides residence, fuel, and attendance. In addition there are about 182 "udliggers," seamen, mechanics, etc., each receiving an average of £25 a year, besides, in the case of the outpost traders, a percentage on their trade. Though the officials are all-powerful, yet, owing to the exertions of Dr. Rink, local councils or "parsissaet" were organized in 1857 in every district. To these parish parliaments delegates are sent from every station,—shrewd men, wise in council, and well acquainted with the wants of the Greenlanders. These "parsissoks"—elected at the rate of about one representative to 120 voters—wear a cap with a badge (a bear rampant), and aid the European members of the council in distributing the surplus profit apportioned to each district, and generally in advising as to the welfare of that part of Greenland under their partial control. In 1873 there were deposited, in a savings bank established in Greenland, £200 as contributions for the support of illegitimate children; £199, 10s., sums gained by inheritance or by other unforeseen circumstances; £791, savings from wages, chiefly those of the Europeans; and £121, savings of the Eskimo, or half-bloods. But thrift is the least prominent feature in the Eskimo character. The "municipal council" has the disposal of 20 per cent. of the annual profits made on produce purchased within the confines of each district. It holds two sessions every year, and the discussions are entirely in the Eskimo language. In addition to their functions as guardians of the poor, the parish M. P.'s have to investigate crimes and punish misdemeanors, settle litigations and divide inheritances. They can impose fines for small offences not worth sending before the inspector, and, in cases of high misdemeanor, have the power of inflicting corporal punishment. During the first ten or twelve years the following causes were submitted to trial:—one single case of having in passion occasioned the death of a person, and another of openly threatening; five or six instances of grosser theft or cheating, and as many of concealment of birth and crimes relating to matrimony; every year a few petty thefts, and instances of making use of the tools of others without permission, or of like disorders; and several trifling litigations.

Trade.—The trade of Greenland is entirely confined to that part of the coast colonized by the Danes,—the rude natives of Smith Sound and the east coast contributing nothing to the world's riches. Neither do the civilized people of any other nation trade on the coast, the English "Greenland seal and whale fishery" being a misnomer, for the fisheries are pursued on the west coast of Davis Strait and Baffin's Bay, and in the sea between Jan Mayen and Spitzbergen, and occasionally within sight of the east coast of Greenland. Taking the Greenland trade as confined to the west coast, we find, according to the calculations of Rink, that the earnings of the 1877 families of Eskimo under the Danish crown are on an average £15,016 per annum,—giving each family an average annual income of £8 from the produce of the hunt sold to the royal officials. These payments are made in paper notes used as a currency in Greenland. During the twenty years 1853–72, excluding cryolite, the average annual exports consisted of 1185 tuns of oil, 35,439 seal-skins, 1436 fox-skins, 41 bear-skins, 811 waterproof jackets, 1003 waterproof trousers, 3533 lb raw eider down, 6900 lb feathers, 2300 lb whale-bone, 550 lb narwhal ivory, 87 lb walrus ivory, 1817 reindeer hides. During the period 1870–74 the mean annual value of the products received from Greenland was £45,600; that of the cargoes sent thither, £23,844; and the mean expenditure on the ships and crews, £8897. Not including the royalty paid by the company which exports the cryolite (from 1853 to 1874 equal to £58,924), the average profit of the Greenland trade was, for the 21¼ years between 1853 and 1874, about £6600 yearly. The capital sunk in the "royal trade" is calculated at £64,426; and, taking the whole amount of net revenues from the present trade during the period between 1790 to 1875, the interest on the capital as well as the income from the cryolite royalty being subtracted, the present "direktor" of the Kongelige Grönlandske Handel considers that £160,000 has been earned.

Trading Districts and Census.—A Danish "coloni" in Greenland is not at the best of times a cheerful place, though, in the long days of summer, some of those in the fjords of South Greenland are comparatively pleasant. The houses are almost invariably built of wood, pitched over, and built more for warmth than for appearance. In addition to the three or four Danish houses—the usual number at the chief settlement—there are from 20 or 30 to 300 or 400 Eskimo at the place. They usually live in huts built of turf and stone, each entered by a short tunnel, which in most respects are an improvement over the primitive dwellings of the race elsewhere (see Eskimo). In South Greenland there are seven trading districts; in North Greenland five. From Cape Farewell northward these are as follows. *Julianehaab* had in 1870 2570 inhabitants, and 8 trading stations. Of the inhabitants, 1056 belonged in 1872 to the Moravian mission settlements, which do not extend much farther north, the other clergy being members of the Danish Church, between whom and the "Herrnhutians" something of the *odium theologicum* exists. In this district also are the remains of the old Norse settlements of Red Erik, his contemporaries, and his successors. *Frederikshaab* has 6 trading stations, which collect about 68 tuns of oil and 1000 seal-skins annually. The population in 1870 was 821; at Ivigtut, in this district, are the cryolite mines. *Godthaab* has 999 people, 6 stations, and a trade return of 74 tuns of oil and 1000 seal-skins annually. It is the most southern station for eider down, and formerly also for reindeer skins. Cod-fish were also once caught here in great abundance, but this business is now almost abandoned. Godthaab "coloni" is the chief settlement in Greenland. "Besides the usual trade officials, one or two Danish missionaries who manage the seminary, and two or three Moravian missionaries [at Ny Herrnhut], the royal inspector of South Greenland, and the physician for the northern part of it reside in this place. In addition to the seminary, Godthaab has a church, of rather imposing appearance for Greenland, but too large for the community, and built of bricks, a material very little suited to the country. The houses of the natives, almost all with sloping roofs of boards, look very pretty, but at Ny Herrnhut they offer a sad appearance. The latter station has a two-storied building, containing accommodation for the missionaries, schoolroom, and church or 'meeting hall' as it is called." At Lichtenfels is another Moravian settlement, but the community has within the last thirty years decreased to one-half, and, owing chiefly to the indiscreet asceticism demanded from their flock by these unworldly men and women, is perhaps the most destitute of material comfort of any in Greenland. In this district are also found Norse ruins, part of the region having been the Vester Bygd of the Icelanders, just as that further south was their Öster Bygd. *Sukkertoppen* is one of the loftiest and most picturesque districts. It yields about 92 tuns of oil and 1000 seal-skins, also some cod-fish, a few reindeer, and most of the eider down of the country. It has six trading posts, and 765 people. *Holstenborg* has four trading posts, and now yields about 60 tuns of oil and 400 seal-skins, besides whalebone and eider down. There are 545 inhabitants. In 67° 40′ N. lat. Nagsutok or North Ström Fjord forms the boundary between South and North Greenland; the settlements which follow are therefore in the latter inspectorate. *Egedesminde* is in a state of decadence, the present production being about 74 tuns of oil and 3400 seal-skins collected annually by six stations. In 1870 the population was 1008, the greater number living at the chief settlement of the same name. *Christianshaab* has four trading posts, which collect from 481 inhabitants 110 tuns of oil and 1700 seal-skins. Christianshaab is one of the pleasantest districts in North Greenland, the valley on the opposite side of the harbor from the "coloni" abounding with crowberries and bilberries, and bright in July with the blue and yellow arctic flowers. Claushavn is the chief post, and derives its support from the seals killed among the enormous crop of icebergs poured out by the great Jakobshavn ice fjord. Many of the bergs ground here until they are lifted by spring tides and carried by the wind out into Baffin's Bay. *Jakobshavn* has eight stations, collecting 104 tuns of oil and 900 seal-skins from 424 people. *Godhavn*, on Disco Island, was at one time a seat of the whale-trade, in 1798 no less than 20 whales having been caught there; but this industry has now entirely ceased, the last whale caught by the government officials being in 1851. Its chief importance is in the fact that Godhavn (or Lievely) is the seat of the Government of North Greenland, and the place at which exploring and whaling vessels often call. Its trade is insignificant, the district returning on an average only about 30 tuns of oil and 400 seal-skins; the settlement has for many years been actually a loss to the Government. There are in the district 245 people, who are perhaps the least industrious and self-reliant of all the Greenlanders. *Ritenbenk* has five stations, returning 116 tuns of oil and 3500 seal-skins, collected by 447 people. *Umanak* is one of the most profitable districts,—the "coloni" with its six outposts returning to the "royal trade" about 180 tuns of oil and

8300 seal-skins, collected from 798 people. *Upernivik* is the most northern district, its limits being those of the natives belonging to the Danish settlements. It is very profitable,—its average return being 148 tuns of oil and 6500 seal-skins, besides eider down and bear-skins, with formerly a considerable quantity of reindeer-skins. In 1870 there were 702 people in the district, the chief of the outposts being Pröven ("the experiment"), and Tasiusak (73° 24′ N. lat.), the most northern Danish trading post, and the most northern permanent abode of civilized men or women, for the trader has a Danish wife with him. "To a European female," writes the director of the Royal Greenland Board of Trade, "this indeed seems to be one of the most melancholy places of residence that can be found." In the service of the Danish mission there were in 1870 53 appointed teachers, besides several other teachers classed as seal hunters or fishers. In the service of the royal trade were 12 outpost traders, 15 head men and "boatswains," 14 carpenters and smiths, 19 coopers, 15 cooks, 54 sailors and laborers, besides 10 pensioners and 33 midwives; 5 officers were enumerated as natives, but 3 of them are more properly Europeans. In the same year the Europeans numbered 237, of whom 95 were engaged in the trade, 8 were Danish and 11 Moravian missionaries, and 38 lived at the cryolite mine; the rest were women and children.[1] Altogether there were in 1870, 9825 people in Danish Greenland (including 9408 natives), and in 1878, 9800. The details of the latter census are not published, but they do not in any material manner alter those just given. The inhabitants of the east coast are not believed to exceed 800, if so many, and yearly this number is being lessened by immigration to the Danish settlements on the west coast. The natives of the shores of Smith Sound, north of Melville Bay, number about 200; and it is satisfactory to learn that of late these ἔσχατοι ἀνδρῶν are not decreasing.[2] Their most northern settlement is Etah. From the information of the Eskimo, Hans Hendrik, it appears that Dr. Kane was in error in asserting that the Smith Sound natives knew nothing of those to the south of the glaciers of Melville Bay.

History.—Greenland was first landed on about the year 986 by Erikr Rauthi, or Red Erik, a banished Icelandic jarl, though some time previously the country had been sighted by Ulf Kraku, another Icelander. Erik and his house early settled at Brattelid,—the present Eskimo station of Igaliko,—situated on an isthmus between two fjords, believed to be the Erik's and Einar's Fjords of the old sagas, where to this day can be traced the walls of about seventeen dwellings, one of which bears evidence of having been Erik's house. Other settlers followed, and among these was Bjarni, son of Herjulf, one of Erik's companions, whose home was probably at Herjulf's Ness, opposite the Moravian settlement of Frederiksdal, where have been found tombs containing wooden coffins, with skeletons wrapped in coarse hairy cloth, and both pagan and Christian tombstones with runic inscriptions. This Bjarni, in his wanderings, discovered the continent of America (Vinland), and, among those who were attracted hither, was Leif, who went ashore near where the town of Taunton now stands. After this there is said to have been a considerable trade between Norway and America, and between both countries and the Greenland colonists. The latter even penetrated to 73° N. lat, as early as the year 1235, and left a small runic stone recording the event.[3] Christianity was introduced, and Arnold appointed the first bishop, in 1126; and Greenland, like Iceland, had a republican organization up to the year 1261, when Hakon Hakonsen, king of Norway, induced the Greenlanders to swear allegiance to him. Henceforth they were Norwegian subjects, and their country one of the queen's domains. From that day may be dated the beginning of their decay and final disappearance as colonists, though the black death, foreign enemies, and the attacks of the Eskimo, who about this period burst upon the colonies from the north, had something to do with it. These settlements were called respectively the Easter Bygd or Building and the Vester Bygd, both being now known to be on the west coast, though for long the view was persistently held that the first was on the east coast, and numerous expeditions have been sent in search of these "lost colonies" and their imaginary survivors. The last bishop appointed to Greenland died in 1540, but long before that date those appointed had never reached their sees. The country had also been visited by a hostile fleet (believed to be English), and about the end of the 15th century it would appear that all colonization had ceased. When in 1585 John Davis visited it there was no sign of any people save the Eskimo, among whose traditions are one or two relating to the old Norsemen. For more than two hundred years Greenland seems to have been neglected—almost forgotten. It was visited by whalers, chiefly Dutch, but nothing in the form of permanent settlements was established until the year 1721, when the first missionary, Hans Egede, landed. Amid many hardships and discouragements he persevered;[4] and at the present day the remnant of the native race is civilized and Christianized, instead of wild and pagan, as they were when he arrived among them. The colonists of the eighteenth century were, many of them, convicts and other offenders; and the trade was a monopoly in the hands of private individuals. In 1733–34 there was a dreadful epidemic of small-pox which destroyed an immense number of the people. In 1774 the trade ceased to be profitable as a private monopoly, and to prevent it being abandoned the Government took it over. In 1807–14, owing to the war, communication was cut off with Denmark; but since that date the country has been prospering in a languid fashion, though, if the Government ceased its fostering care, the Eskimo, and with them what trade is carried on, must become extinct.

Of late years, the northern part of the country has been explored by Inglefield (1852), Kane (1853–55), Hayes (1860–61), Hall (1871–73), and to some extent by Nares (1875–76), whose discovery of the probable northern termination of the country in about 83° N. lat. had been already presaged theoretically.[5] The east coast has been explored by Scoresby (1822), Clavering (1823), Graah (1829–30), the German expedition (1869–70), and Mourier (1879), while the interior has been penetrated for a short way by the Danes, Americans, English, and Swedes whose names have been noted above, and by others.[6] In like manner, the scientific history of the country has been investigated by a host of savants from the days of Fabricius to our own, whose names are too numerous to recount, though, in the works above quoted, these are given either directly or indirectly. For further information, see the articles Eskimo and Polar Regions.

(R. B.)

GREENLEAF, Simon (1783–1853), American jurist, was born at Newburyport, Massachusetts, December 5, 1783. After studying law in Massachusetts and Maine, he began in 1806 to practise at Standish in the latter State, proceeding finally to Portland in 1818. There, after two years, he became reporter of the supreme court of Maine, and during his twelve years of office published nine volumes of *Reports*. Resigning in 1832, Greenleaf became in 1833 Royale professor, and in 1846 Dane professor of law in Harvard University, where he received the degree of doctor of laws. He retired in 1848 from his active duties, becoming emeritus professor, and after being for some years president of the Massachusetts Bible Society died at Cambridge, Mass., October 6, 1853.

Greenleaf's principal work is a *Treatise on the Law of Evidence*, 1842–53. He published also *A Full Collection of Cases Overruled, Denied, Doubted, or Limited in their Application, taken from American and English Reports*, in 1840, expanded afterwards to 3 volumes; and an *Examination of the Testimony of the Four Evangelists by the Rules of Evidence administered in the Courts of Justice, with an Account of the Trial of Jesus*, 1846. This was republished in England in 1847.

GREENOCK, a seaport town of Renfrewshire, Scotland, on the south bank of the Firth of Clyde, 22 miles below Glasgow, in 55° 57′ 2″ N. lat. and 4° 45′ 30″ W. long. In front of the town there is a fine and extensive bay, formerly known by the name of the Bay of St. Lawrence, from a religious house that anciently stood there. Behind the town the land rises into a picturesque ridge of hills, about 800 feet high, between which and the bay Greenock stretches for upwards of two miles and a half along the shore.

Greenock is an irregularly built town. The western part is occupied by spacious streets and numerous fine villas, but the central and busier part is composed of narrow and rather mean and overcrowded streets and lanes. The board of police are taking measures, however, to have some of these opened up and occupied with an improved class of buildings. The view from the heights behind the town is exceedingly striking and picturesque, and notwithstanding the steep slopes towards the south, the town is steadily progressing in that direction, as well as along the shore, where premises for shipbuilding and various public works, and also dwelling-houses, are extending the town both east and west. Amongst noticeable structures may be enumerated the custom-house, a handsome Doric edifice, and the Watt monument, a building erected to the memory of the celebrated James Watt, whom with just pride the

[1] *Danish Greenland* (1877), p. 355, corrected by recent Government returns and private correspondence.

[2] Feilden, Appendix to Nares, *lib. cit.*, vol. ii. p. 187; *Narrative of "Polaris" N. Polar Expedition*, p. 477, etc.

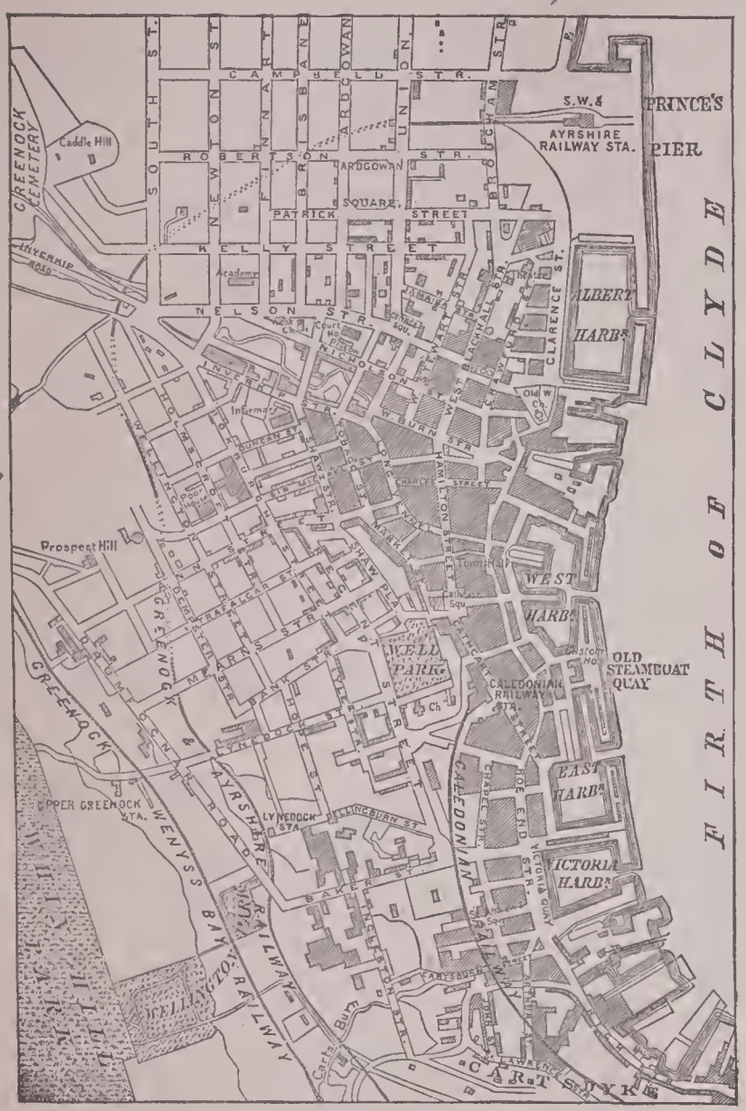
[3] This stone, not much bigger than a hone, was until recently in the Copenhagen Museum of Northern Antiquities. It was stolen, however, and the priceless monument is now only represented by a model.

[4] Fenger, *Bidrag til Hans Egedes og den grönlandske Missions Historie, 1721–1760* (1879).

[5] Brown, *Arctic Papers of R. G. S.* (1875), p. 70.

[6] "The Physical Structure of Greenland" (*Arctic Papers of R. G. S.*, pp. 1–73); see also for history the works catalogued in Chavannes, Karpfs, and Le Monniers, *Die Literatur über die Polar-Regionen der Erde* (1878).

town claims as a native. The latter contains an exquisite statue of the philosopher by Chantrey, and accommodates a public library founded in 1783, having now upwards of 15,000 volumes. Associated with it is also a museum and lecture hall, built at the expense of the late Mr. James M'Lean, and opened in 1876. The town also contains several elegant churches, a spacious academy, and various other educational and charitable institutions, the chief of the latter being the public hospital and infirmary, and the Wood mariners' asylum, an institution founded by Sir Gabriel Wood for the benefit of decayed seamen belonging to Clyde ports. The corporation is about to erect a suite of municipal buildings fronting the principal street of the town, on which it is proposed to expend not less than £80,000. Greenock possesses two public parks; and in 1866



Plan of Greenock.

a magnificent esplanade, a mile and a quarter in length, skirting the shore, was laid off at an expense of £20,000, and is now a favorite promenade and recreation ground. A new carriage-drive is being constructed, at a cost of about £10,000, across the heights to the south-west of the town.

The water supply is derived from two enormous reservoirs in the high lands behind the town called Loch Thom and Loch Gryfe. The Loch Thom works were completed in 1828, and the Gryfe works were added in 1873. The Loch Thom works are so constructed that they not only supply water to the town, but provide also in their course power to drive the machinery of a number of mills of great size, the water descending from mill to mill till it reaches the level of ordinary supply. Street tramways were introduced in 1873, and connect the town with Gourock. The gasworks of the town, which were originally situated in a populous district, have recently been removed to a small island, Inchgreen, on which a commodious establishment has been erected. The principal industries are shipbuilding and sugar-refining. Many of the steamers of the Cunard Company, the Peninsular and Oriental Company, and the Allan Line have been built at Greenock, and the excellence of the iron sailing ships of Greenock yards has become almost proverbial. There are eighteen large sugar refineries in the town, some of which turn out 1000 tons of refined sugar per week. Greenock is connected *via* Paisley with Glasgow by two competing lines of railway, by one of which there is also direct communication with Ayrshire and the south-west. All the important Clyde passenger steamers call at or sail from Greenock; indeed for passenger traffic by steamer it is a more important town than Glasgow, as the greater portion of the travelling public, to save time and avoid the unsavory odor of the upper reaches of the river, make the journey between Glasgow and Greenock by rail. A large amount of passenger and goods traffic is also carried on between Greenock and Belfast, Londonderry, Dublin, Liverpool, etc.

In the earlier part of the 17th century Greenock was an obscure fishing village, consisting of one row of thatched cottages; and in 1716 there were only six slated houses in the place. In 1741 the population of Greenock was 4100; a century later it was 38,846; in 1851, 39,391; in 1861, 42,785; in 1871, 57,825; and in the middle of 1879 it was estimated in the Registrar-General's reports at 76,955. In 1635 "the town or village of Greenock" was erected by Charles I. into a burgh of barony under a charter granted in favor of John Schaw and Helen Houston, his spouse, and down to 1741 the government of the burgh was administered by the baron-bailie appointed by the superior. In 1741 and 1751 charters were granted by Sir John Schaw, under which feuars and subfeuars were empowered to elect a town council of nine members—two bailies, a treasurer, and six councillors—for the good government of the town. Under these charters Greenock possessed the most liberal burghal constitution enjoyed by any Scotch burgh till the passing of the Reform Act—the first municipal election under the provisions of which took place in 1833. Greenock was then advanced to the position of a parliamentary burgh, with the right to return one representative to parliament. Municipally the town is divided into five wards, and the town council consists of a provost, six bailies, a treasurer, and eight councillors. Pop. (1901), 67,645.

The beginning of the harbor of Greenock was made by John Schaw, already mentioned as the first superior of the burgh. Till the commencement of the 18th century, however, it was little more than an insecure landing-place; but in 1703 an agreement was entered into between the superior and feuars of the town, whereby he advanced money and they submitted to a voluntary assessment for the extension and improvement of harbor accommodation. The harbor constructed under this agreement was not finished till 1710, in which year Greenock was established as a custom-house port. In 1751 an Act of Parliament was obtained whereby a duty of 2d. Scots was imposed on every Scots pint of ale or beer "brewed, brought in, tapped, or sold" within the town "for cleaning, deepening, building, and repairing" the harbor and piers. Till the year 1772 the harbor was simply leased to the town by the superior, but in that year and in 1773 the magistrates and town council received a feu-right to it from John Shaw Stewart, the owner of the Greenock estate. From that date down to the present time the additions made to the harbor by parliamentary authority have been very numerous. The dock and quay accommodation now amounts to eighty acres. In addition there is in course of construction an immense dock to be named the "James Watt Dock," which is intended to afford accommodation to vessels of the largest tonnage, and maintain them waterborne in all states of the tide. The estimated cost of this dock, with warehouses and sheds, is £250,000. The harbor trustees who now have the management of the docks consist of the town council and nine elective members chosen by the local shipowners and harbor ratepayers.

The commercial prosperity of Greenock received its first great impetus from the Treaty of Union in 1707. The earliest trade seems to have been in herrings, a trade which, however, has long been extinct. Trading in tobacco was also carried on at a very early period. It was first brought from the colonies, and then exported to the Continent. The Greenland whale-fishing commenced as far back as 1762, but it never rose to be of any importance, and is now discontinued. The American war greatly interrupted the progress of Greenock, as the principal trade of the port was then with that country; but after the peace in 1783 it speedily revived, and within the seven following years the shipping trade was trebled in amount. At present the principal intercourse is with the East and West Indies, Australia, and the United States and Canada. Newfoundland and South America have also employed a consider-

able quantity of shipping. The gradual increase of trade is shown by the following table of the number and tonnage of vessels that entered and cleared from and to foreign ports in various years since 1784 :—

	INWARDS.				OUTWARDS.			
	British.		Foreign.		British.		Foreign.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
1784	52	6,569	4	530	63	7,297	3	520
1804	165	30,802	25	5,120	155	31,896	20	5,965
1824	188	46,162	11	3,054	188	46,857	9	2,699
1853	274	94,575	44	13,764	153	55,630	45	11,975
1878	428	219,521	178	64,918	419	198,267		

Interesting historical details will be found in *Memorials of James Watt*, by G. Williamson, 1856. The first volume of *Historical Sketches of the Town and Harbors of Greenock*, by Dugald Campbell, appeared in 1879. (J. PA.)

GREENOUGH, HORATIO (1805–1852), an American sculptor, son of a Boston merchant, was born at Boston, September 6, 1805. At the age of sixteen he entered Harvard College; but while there he devoted his principal attention to art, and in the autumn of 1825 he went to Rome, where he enjoyed the advantage of instruction from Thorwaldsen. After a short visit in 1826 to Boston, where he executed busts of John Quincy Adams and other persons of distinction, he returned to Italy and took up his residence at Florence. Here one of his first commissions was from James Fenimore Cooper for a group of Chanting Cherubs; and the success of this work, joined to the strong recommendation of Cooper, Dana, Everett, and others, led to his being chosen by the Government to execute the colossal statue of Washington for the national capital. It was unveiled in 1843; and as an accurate likeness, conceived in a lofty and truly poetical spirit, it is entitled to high rank among modern works of a similar kind. Shortly afterwards he received a second commission from Government for a colossal group, the "Rescue," intended to represent the conflict between the Anglo-Saxon and Indian races. In 1851 he returned to Washington to superintend its erection, and in the autumn of 1852 he was attacked by brain fever, of which he died, 18th December. Among other works of Greenough may be mentioned a bust of Lafayette, the Medora, and the Venus Victrix in the gallery of the Boston Athenæum. Greenough was a man of wide culture, and his occasional productions in prose and verse gave evidence of a capacity to attain the same eminence in literature as in art. See *Memoir of Horatio Greenough*, by H. T. Tuckerman, 1853.[1]

GREENSHANK, one of the largest of the birds commonly known as Sandpipers, the *Totanus glottis* of most ornithological writers. Some exercise of the imagination is however needed to see in the dingy olive-colored legs of this species a justification of the English name by which it goes, and the application of that name, which seems to be due to Pennant, was probably by way of distinguishing it from two allied but perfectly distinct species of *Totanus* (*T. calidris* and *T. fuscus*), having red legs and usually called Redshanks. The Greenshank is a native of the northern parts of the Old World, but in winter it wanders far to the south, and occurs regularly at the Cape of Good Hope, in India, and thence throughout the Indo-Malay Archipelago to Australia. It has also been recorded from North America, but its appearance there must be considered accidental. Almost as bulky as a Woodcock, it is of a much more slender build, and its long legs and neck give it a graceful appearance, which is enhanced by the activity of its actions. Disturbed from the moor or marsh, where it has its nest, it rises swiftly into the air, conspicuous by its white back and rump, and uttering shrill cries flies round the intruder. It will perch on the topmost bough of a tree, if a tree be near, to watch his proceedings, and the cock exhibits all the astounding gesticulations in which the males of so many other *Limicolæ* indulge during the breeding-season—with certain variations, however, that are peculiarly its own. It breeds in no small numbers in the Hebrides, and parts of the Scottish Highlands from Argyllshire to Sutherland, as well as in the more elevated or more northern districts of Norway, Sweden, and Finland, and probably also from thence to Kamchatka. In North America it is represented by two species, *Totanus semipalmatus* and *T. melanoleucus*, there called Willets, Telltales, or Tattlers, which in general habits resemble the Greenshank of the Old World. (A. N.)

GREENWICH, a market-town and parliamentary borough in the county of Kent, England, is pleasantly situated on the right bank of the Thames, 6 miles S. E. of London Bridge by the river. The streets towards the river are narrow and irregular, but in the higher situations there are many fine terraces and villas. The town has manufactories of various kinds, including the works of the telegraph maintenance company, engineering works, soap works, chemical works, and a brewery. On account of its picturesque views, its fine air, and its public park and other attractions, it is one of the favorite resorts of Londoners.

Fronting the river stands the splendid range of buildings in the Grecian style of architecture, formerly known as Greenwich Hospital, but now the Royal Naval College. It occupies the site of an ancient royal palace called Greenwich house, which was a favorite royal residence as early as 1300, but was granted by Henry V. to Thomas Beaufort, duke of Exeter, from whom it passed to Humphrey, duke of Gloucester; and it did not revert to the crown till his death in 1433. It was the birthplace of Henry VIII., Queen Mary, and Queen Elizabeth. The building was enlarged by Edward IV., by Henry VIII., who made it his chief residence and named it *Placentia*, by James I., and by Charles I., who erected the "Queen's House" for Henrietta Maria. Along with other royal palaces it was at the Revolution appropriated by the Protector, but it reverted to the crown on the restoration of Charles II., by whom it was pulled down, and the west wing of the present hospital was erected as part of an extensive design which was not further carried out. In its unfinished state it was assigned by the patent of William and Mary to certain of the great officers of state, as commissioners for its conversion into a hospital for seamen. As it now stands, the building consists of four blocks. Behind a terrace 860 feet in length, stretching along the river side, are the buildings erected in the time of Charles II. by Webb from Inigo Jones's designs, and in that of Queen Anne from designs by Sir Christopher Wren; and behind these buildings are on the west those of King William and on the east those of Queen Mary, both from Wren's designs. In the King William range is the painted hall. Its walls and ceiling were painted by Sir Thomas Thornhill with various emblematic devices, and it is hung with portraits of the most distinguished admirals, and paintings of the chief naval battles of England. In the centre of the principal quadrangle of the hospital there is a statue of George II. by Rysbrack, sculptured out of a single block of marble taken from the French by Admiral Sir George Rooke. The oldest part of the building was in some measure rebuilt in 1811, and the present chapel was erected to replace one destroyed by fire in 1779. The endowments of the hospital were increased at various periods from bequests and forfeited estates. Formerly 3000 retired seamen were boarded within it, and 5000 or 6000 others, called out-pensioners, received stipends at various rates out of its funds; but in 1865 an Act was passed empowering the Admiralty to grant liberal pensions in lieu of food and lodging to such of the inmates as were willing to quit the hospital, and in 1869 another Act was passed making their leaving on these conditions compulsory. It has since been devoted to the accommodation of the students of the Royal Naval College, for which purpose it was formally opened in 1873. Behind the College is the Royal Hospital School, where 1000 boys, sons of petty officers and seamen, are boarded.

Another of the attractions of Greenwich is the park, 190 acres in extent, in which is situated the Royal Observatory. It was enclosed by Humphrey, duke of Gloucester, in 1433, and laid out by Charles II. It still contains a fine avenue of Spanish chestnuts planted in his time; and the hill rising towards the south commands a fine prospect over London, the Thames, and the plains of Essex. The Royal Observatory was built in 1675, for the advancement of navigation and nautical astronomy. From it the exact time is conveyed at one o'clock every day by electric current to London and all the other chief towns of the kingdom; and English geographers reckon longitude from its meridian. Adjoining Greenwich Park is Blackheath, an open common much frequented by excursionists, and also used for golf and cricket.

Greenwich possesses a considerable number of almshouses and other charitable foundations, among which may be

[1] [His brother, Richard S. (born 1819), is a novelist and a noted sculptor. Resided chiefly in Paris and Rome.—AM. ED.]

mentioned Queen Elizabeth's College; Trinity Hospital, founded by Henry Howard, earl of Northampton, in 1613; the Jubilee Almshouses, founded by subscription of the inhabitants in 1809 in commemoration of the fiftieth anniversary of George III.; the Green Coat School, the Gray Coat School, and the Orphan Girl's School. The parish church is dedicated to St. Alphege, archbishop of Canterbury, who suffered martyrdom at Greenwich.

Greenwich is first noticed in the reign of Ethelred, when it was from 1011 to 1014 the station of the Danish fleet. It has been the place of debarkation of many illustrious personages, as well as in 1806, after the battle of Trafalgar, of the remains of Lord Nelson, which lay in state in the painted hall of the hospital previous to their removal for interment in St. Paul's Cathedral. In 1577 it returned two burgesses to parliament, but it was not again represented till the same privilege was conferred on it by the Reform Act of 1832. The population of the parish in 1871 was 40,412. The population of the parliamentary borough —whose limits were extended in 1868, and include the parishes of Charlton next Woolwich, Plumstead, and St. Nicholas and St. Paul, Deptford, and part of Woolwich—is 169,361, and the area 8581 acres, of which 657 are in Surrey. Pop. (1901), 95,757.

GRÉGOIRE, Henri (1750–1831), bishop of Blois and French revolutionist, was born at Vého near Lunéville, 4th December, 1750. After studying at Metz and Nancy, he became curé of Embermesnil and professor at the college of Pont-à-Mousson. In 1783 he was crowned by the academy of Nancy for his *Éloge de la Poésie*, and in 1788 by that of Metz for an *Essai sur la régénération physique et morale des Juifs*. He was chosen in 1789 by the clergy of the district of Nancy to represent them in the states-general, where he took a leading part in the deliberations, and gave energetic support to the republicans. Along with four other curés he abandoned his order and joined that of the *tiers état;* he presided at the permanent sitting of sixty-two hours while the Bastile was being attacked by the people, and made a vehement speech against the enemies of the republic; and he subsequently took a prominent share in abolishing the privileges of birth and religion. Under the new constitution of the clergy he was chosen bishop by the department of Loir-et-Cher, taking the title of bishop of Blois. As a member of the national assembly he proposed the motion for the abolition of the kingly office, which was carried by acclamation. During the trial of Louis XVI., being absent with other three colleagues on a mission for the union of Saxony to France, he along with them wrote a letter urging the condemnation of the king, but omitting the words *à mort;* and he endeavored to save the life of the king by proposing in the assembly that the penalty of death be suspended. His subsequent action was very influential in moderating extreme republican views: he opposed the national renunciation of Christianity, and was the first to advocate the reopening of the churches; exerted himself to get measures put in execution for restraining the vandalistic fury against the monuments of art; extended his protection to artists and men of letters, and obtained for them pecuniary encouragement from the state; and devoted much of his attention to the reorganization of the public libraries, the establishment of botanic gardens, and the improvement of technical education. He also took a great interest in negro emancipation, and on his motion men of color in the French colonies were admitted to the same rights as whites. On the establishment of the new constitution, Grégoire was elected to the council of 500, and after the 18th Brumaire he became a member of the new legislative assembly. In this capacity he voted in the minority of five against the proclamation of the empire, and opposed the creation of the new nobility and the divorce of Napoleon from Josephine; but notwithstanding this he was subsequently created a count of the empire and officer of the legion of honor. During the later years of Napoleon's reign he travelled in England and Germany, but in 1814 he had returned to France and was one of the chief instigators of the action that was taken against the empire. After the second restoration he was excluded from the Institute, and when in 1819 he was elected to the assembly by the department of Isère, his election was annulled. From that time, therefore, he lived in retirement, occupying himself in literary pursuits and conducting a voluminous correspondence with most of the eminent savants of Europe; but as he had been deprived of his bishopric and of his pension as a senator, he was compelled to sell his library to obtain the means of support. He died at Paris, May 20, 1831. As he had remained steadfast to his republican principles the ecclesiastical authorities refused him the last offices of religion, and the rites of Christian sepulture, but through the intervention of the civil power mass was said over his body in the church of the Abbaye aux Bois by a proscribed priest; and after the hearse set out from the church the populace unyoked the horses and themselves drew it to the cemetery of Mont Parnasse. Grégoire forms a striking exception to most of the French revolutionists in combining zeal for republicanism with a moderation which sought to check every form of license, and with a steadfast adherence to the religion of which he was a priest; and it was further a remarkable feature of his character that, though a sincere Roman Catholic, he was thoroughly tolerant of the religious views of others.

Besides several political pamphlets, Grégoire was the author of *Histoire des sectes réligieuses, depuis les commencement du siècle dernier jusqu'à l'époque actuelle*, 2 vols., 1810; *Essai historique sur les libertes de l'église gallicane*, 1818; *De l'influence du Christianisme sur la condition des femmes*, 1821; *Histoire des confesseurs, des empereurs, des rois, et d'autres princes*, 1824; *Histoire du mariage des prêtres en France*, 1826. *Grégoireana, ou résumé général de la conduite, des actions, et des écrits de M. Le Comte Henri Grégoire*, preceded by a biographical notice by Cousin d'Avallon, was published in 1821; and the *Mémoires ecclesiastiques, politiques, et littéraires de Grégoire*, with a biographical notice by H. Carnot, appeared in 1840.

GREGORIAN CHANT. See Plainsong.

GREGORAS, Nicephorus. See Byzantine Historians, vol. iv. p. 545.

GREGORY, St., surnamed the Great (*c.* 540–604), the first pope of that name, and one of the four doctors of the Latin Church (Ambrose, Augustine, and Jerome being the other three), was born at Rome about the year 540. His father Gordianus possessed senatorial rank, and his mother Sylvia is said to have been remarkable for her mental endowments. Educated for the legal profession, Gregory about his thirtieth year was chosen by the citizens to the high position of prætor urbanus; this post he is said to have occupied for three years (571–574), discharging its duties with great pomp and magnificence; but on the death of his father, having become deeply impressed with a sense of the transitoriness and vanity of all earthly things, he retired from public life and gave up his whole fortune to pious uses, building six monasteries in Sicily and one in Rome; in this last, which was dedicated by him to St. Andrew, he embraced the Benedictine rule, and divided his whole time between works of charity and the exercises of fasting, meditation, and prayer. It was while he was still a simple monk of St. Andrew that the often repeated incident related by Bede is believed to have occurred. Having seen some English slaves of striking beauty exposed for sale in the public market, "non Angli sed Angeli," he set his heart upon the evangelization of Britain, and was only prevented by the command of his ecclesiastical superiors from setting out in person to seek the realization of his pious wish. About 578 or 579 he was appointed abbot of his monastery, and likewise one of the seven deacons (regionarii) of the Roman Church; and in 582 he was sent by Pelagius II. to Constantinople as papal apocrisiarius or responsalis at the imperial court. There he remained for upwards of three years, during which he negotiated several matters of importance and delicacy; but amid his diplomatic and other engagements he found time to begin, if not even to complete, one of his largest works, the *Moralia*, or exposition of the book of Job. A few years after his return from the Eastern capital, the death of Pelagius (590) caused a vacancy in the papal chair, and the choice of the clergy, senate, and people unanimously fell upon Gregory. He strongly deprecated the bestowal of this honor, and wrote to the emperor (Maurice) imploring him not to confirm the nomination. A pious fraud, committed by the city prætor then in office, prevented the letter from reaching its destination; and though Gregory hid himself for a time, he was at length obliged to yield to the urgency of his friends by accepting the papal crown (September, 590). The pontificate of fourteen years which followed was marked by extraordinary vigor and activity, which made themselves felt throughout almost every department of the doctrine, discipline, and worship of the entire Western Church. By means of earnest prayer and wisely expended pains the aggressions of the Lombards were checked, and order and tranquillity were speedily restored to Rome; in Italy and France he

tightened the too long relaxed reins of ecclesiastical discipline; in England, Spain, and Africa the powers of Paganism, Arianism, and Donatism were perceptibly weakened; as against the Eastern emperor and the patriarch of Constantinople the prerogatives of the bishop of Rome were asserted with a vigor previously unwitnessed; the ceremonies of the church were regulated and extended, the liturgy further developed. The anniversary of Gregory's death, which took place at Rome on the 12th of March, 604, is observed as a duplex by the Latin Church, and even in the Greek Church his wisdom and sanctity continue to be commemorated. The hyperbolical panegyrics of those ecclesiastical writers who lived nearest his time (such as Gregory of Tours and Isidore of Seville) must of course be taken with considerable reservation; but they are interesting as showing how powerful and profound was the impression he left upon his contemporaries and immediate successors—an impression and an influence well entitling him to the epithet of "great." Of the personal qualities of Gregory, the most obtrusive are beyond all question the singular strength and energy of his character. Firmly and intensely convinced of the divineness of the Christian doctrine and life as these had presented themselves to his mind and heart, he suffered no obstacle and no discouragement to triumph over his determination to give them all the currency and prevalence that were possible in his day. Having clearly seen the end he had in view, he with equal discernment made choice of his measures for its attainment. The refinements alike of literature and of art had for him no place in the Christian scheme; it is needless to say that he therefore despised them both for himself and for others. There is some room for hoping indeed that the burning of the books of the Palatine library was due to some ruder pontiff; but there is no possibility of mistake as to the literary taste of the man who could write (pref. to *Moralia*)—"non metacismi collisionem fugio, non barbarismi confusionem devito, situs motusque etiam et præpositionum casus servare contemno, quia indignum vehementer existimo ut verba cœlestis oraculi restringam sub regulis Donati." The uniformity of the Roman ritual, the ascendency of the Roman hierarchy, the prevalency of the Catholic dogma,—these were not merely the highest, they were the only, ideals he had ever caught sight of. It ought not therefore to surprise us if in striving towards them he sometimes was tempted, and yielded to the temptation, to sacrifice truthfulness to what he conceived to be the truth, and the mere claims of humanity to the demands of what he regarded as a higher love. Never purely selfish, he was, apart from the exigencies of his ecclesiastical position, singularly tolerant, liberal, and kindly.

Of the numerous extant works attributed to Gregory the Great the following are undisputed:—the *Moralia*, in thirty-five books, being an exposition of the book of Job, composed between 580 and 590; the twenty-two *Homilies on Ezekiel* (about 595), and the forty *Homilies on the Gospels* (about 592); the *Regula* (or *Cura*) *Pastoralis*, dedicated to John, archbishop of Ravenna (about 590); the *Dialogues* with Peter the deacon, in four books, on the lives and miracles of the Italian saints (593 or 594); and the *Letters*, in fourteen "registers," arranged according to the years of his pontificate. He was also the author of various rhymed hymns, nine of which are still extant and appear in the collected editions of his works. They are characterized more by simplicity of language than by depth of feeling. The *Concordia quorundam testimoniorum sacrarum scripturarum*, and also the *Commentaries* on 1 Kings, Canticles, and the seven penitential psalms usually ascribed to him, are spurious. His liturgical works, the *Sacramentarium* and *Antiphonarium*, have been considerably tampered with by mediæval collectors and revisers; and even the *Letters* are not wholly free from interpolations. Of Gregory's merits as an expositor little need be said; he avowedly adopts in all cases the allegorical method, which in his hands is unflinchingly carried out, with, in many cases, sufficiently astounding results. As Milman has remarked, "It may safely be said that, according to Gregory's license of interpretation, there is nothing which might not be found in any book ever written." In practical homiletics, however, he is very often just and profound as well as high-toned; but it would be too much to say that he was superior to the prejudices of his time; in particular his preference for the monastic and ascetic forms of the Christian life is carried to a height which a wider observation of the conditions of human usefulness and happiness will never cease to regard as excessive. His *Dialogues*, which have been translated into Anglo-Saxon, Greek, and even Arabic, describe the most astonishing miracles with an artless simplicity which, as suggestive of entire belief, is certainly interesting to the student; yet it is difficult (as Gibbon has pointed out) to free the lavish dispenser of miraculous filings from the chains of St. Peter from the suspicion of some degree of pious insincerity. The *Letters* are, as might be expected, of great importance from the light they throw upon the history of those times.

The complete editions of the works of this great father of the Latin Church have been, as was to be expected, numerous. The earliest was that of Lyons (1516), which was rapidly followed by those of Paris (1518–39), Basel (1551), and Rome (1588). The best edition is the Benedictine (Paris, 1705), in 4 vols. fol., reprinted at Venice (1768–76), in 17 vols. 4to, and in Migne's *Patrology*, vol. lxxv.–lxxix. See Wiggers, *De Gregorio Magno* (1838–40); Marggraf, *De Greg. M. Vita* (1844); Lau, *Gregor. d. Grosse nach s. Leben u. Lehre dargestellt* (1845); Pfahler, *Gregor der Grosse u. seine Zeit* (1852); and Baxmann, *Politik der Päpste von Gregor I. bis Gregor VII.* (1868–69). There is a convenient edition of the *Cura Pastoralis* by Westhoff (1860).

GREGORY II., St., pope from 715 or 716 to 731, succeeded Constantine I., his election being variously dated May 19, 715, and March 21, 716. Having, it is said, bought off the Lombards for thirty pounds of gold, he used the tranquillity thus obtained for vigorous missionary effort in Germany, and for strengthening the papal authority in the churches of England and Ireland. By excommunicating Leo the Isaurian, he prepared the way for a long series of revolts and civil wars, which tended greatly to the establishment of the temporal power of the popes. He died in 731, and subsequently attained the honor of canonization, February 13th being the day consecrated to his memory in the *Martyrology*.

GREGORY III., St., pope from 731 to 741, a Syrian by birth, succeeded Gregory II. in March, 731. His pontificate, like that of his predecessor, was disturbed by the iconoclastic controversy, in which he vainly invoked the intervention of Charles Martel. During his reign also it was that Boniface in Germany, on whom he conferred the pallium, Wilibald in Bohemia, and Bede in England carried on their most successful missionary labors. He died 29th November, 741, and was succeeded by Zacharias I.

GREGORY IV., pope from 827 to 844, was chosen to succeed Valentinus in December, 827, on which occasion he recognized the supremacy of the Frankish emperor in the most unequivocal manner. His name is chiefly associated with the quarrels between Lothaire and Louis the Debonaire, in which he espoused the cause of the former, for whom, in the Campus Mendacii, as it is usually called (833), he secured by his treachery a temporary advantage. The institution of the feast of All Saints is usually attributed to this pope. He died January 25, 844, and was succeeded by Sergius II.

GREGORY V., pope from 996 to 999, a grandson of the emperor Otho the Great, succeeded John XV. when only twenty-four years of age, and until the council of Pavia (997) had a rival in the person of the antipope John XVI., whom the people of Rome, in revolt against the will of the youthful emperor Otho III., Gregory's cousin, had chosen. The most memorable acts of his pontificate were those arising out of the contumacy of the French king, Robert, who was ultimately brought to submission by the rigorous infliction of a sentence of excommunication. He died suddenly, and not without suspicion of foul play, 18th February, 999. His successor was Silvester II.

GREGORY VI., pope from 1044 to 1046, who as Johannes Gratianus had earned a high reputation for learning and probity, succeeded Benedict IX., having bought off the antipopes Sylvester III. and John XX. In a council held by the emperor Henry III. at Sutri, in 1046, he was accused of simony, and his election was found to have been informal. This led to his degradation, and was followed by his withdrawal into Germany, where he died in the following year (1047). He was succeeded by Clement II.

GREGORY VII., St., one of the greatest of the Roman pontiffs, was born about the year 1015 at Soano or Saona, a small town in Tuscany, where his father, Bonic or Bonizon, is said to have followed the trade of a carpenter. His own name, Hildebrand or Hellebrand, is suggestive of a German extraction; but of his remoter ancestry nothing is recorded. His youth was passed at Rome in the monastery of St. Mary on the Aventine, where a relative was at that time prior; here the archpriest Johannes Gratianus (afterwards Gregory VI.) was one of his instructors, and the youthful scholar early attracted the attention of such visitors as Laurentius of Amalfi and Odilon of Clugny. There is some reason to believe that, after passing his novitiate in Rome, Hilde-

brand removed for some years to the great Burgundian cloister, at that time under the charge of the last-named ecclesiastic; but all the earlier years of his life are involved in considerable obscurity. In 1046 he became one of the chaplains of the newly elected pope, Gregory VI., whom he shortly afterwards accompanied into his German exile; and on the death of that pontiff some two years later, he retired to Clugny, where his learning and sanctity made a deep impression, and where, according to some accounts, he was ultimately promoted to the office of prior. As a monk of Clugny he appears to have oftener than once visited the imperial court for the transaction of ecclesiastical business; and in 1049 he is said in a very special way to have come under the notice of Bruno, bishop of Toul, then on his way to Rome to take possession of the chair of St. Peter, which he occupied for some years under the title of Leo IX. It was at Hildebrand's instance that Bruno, who had been nominated by the emperor merely, consented to refrain from assuming the pontifical vestments, and to present himself to the Romans in the garb of a simple pilgrim, until he should have been elected in a more regular manner. The ascendency which Hildebrand had thus acquired over this pope he never afterwards lost; in 1050 he became cardinal subdeacon, and in following years he was entrusted with various missions of great importance, taking also a prominent part in the important synods of Rheims and Mainz, as well as in those of Rome. On the death of Leo IX. in 1054 the Roman people had signified a desire that the subdeacon should succeed him; this honor and responsibility however Hildebrand declined; but he was one of three legates who went to Germany to consult with the emperor about the choice of a successor. The negotiations, which lasted eleven months, ultimately issued in the election of Gebhard of Eichstädt, a relative of the emperor, who up to that time had followed a distinctly antipapal policy, but who, immediately after his reception and consecration at Rome as Victor II. (13th April, 1055), became as entirely a tool in the hand of Hildebrand as Leo had been. It was during this pontificate that Hildebrand, as papal legate, attended the French synods held for the purpose of repressing the heresy of Berengarius. On the election of Pope Stephen IX. (X.), Hildebrand was again sent to Germany to defend the choice before the empress Agnes; in this mission, which was ultimately successful, several months were spent. Again, in 1058, he succeeded in defeating the hostile party of Benedict X. and in securing the tiara for Nicholas II.; and once more, in 1061, he successfully labored for the election of Alexander II. to the papal chair. At length, in 1073, on the death of Alexander, Hildebrand was himself as it were compelled by the tumultuous demands of the mob to accept the vacant tiara (22d April); but he refused to receive consecration until the sanction of the emperor had been obtained. This did not arrive for more than a month, although meanwhile he had been practically exercising many of the papal functions; finally, however, he was ordained to the priesthood, and some days afterwards (30th June) solemnly consecrated pope by the title of Gregory VII., a name which he chose in testimony of his veneration for the memory and character of his earliest patron, Gregory VI.[1] Once firmly established on the papal throne, Gregory lost no time in giving the utmost possible practical effect to the two leading ideas of his life, the establishment of the supremacy of the papacy within the church, and the effective assertion of the supremacy of the church over the state. In March, 1074, a synod was held in Rome which condemned the simony that had grown so prevalent throughout the church, and also enacted the old stringent laws of celibacy which had become almost a dead letter, especially in Germany and in the north of Italy; simoniacal or married priests were declared to be deposed and their priestly functions invalid. The resistance of the clergy to these decrees was utterly in vain; papal legates visited every country, and, supported by the popular voice, compelled submission. At a second synod held in Rome in February, 1075, the decrees of the first were confirmed, and the first blow was struck which afterwards resulted in the long protracted wars of investitures. At that synod it was determined that any ecclesiastic who in future should accept office from the hands of a layman incurred the penalty of deposition, while the secular lord who bestowed investiture was to be excommunicated. The decree was aimed immediately at certain German bishops, Henry's personal advisers, but hardly less directly at Henry himself. The emperor, finding his hands at the moment fully occupied with the suppression of a revolt among the Saxons, was politic enough to conceal his resentment for the time, and to dismiss his advisers; but as soon as the war had been brought to a close, his defiance found ample expression. Meanwhile Gregory was not unopposed even in Italy, and during the Christmas festivities of 1075 a revolt in Rome itself was organized by Cencius, who had placed himself at the head of those nobles who were opposed to reform; the pope, however, had the popular enthusiasm on his side, and ultimately the insurgents were compelled to fly. A papal embassy was next sent, early in 1076, to Henry at Goslar, citing him to appear personally at Rome at a council to be held in the second week of Lent, and there answer for his simony, sacrilege, and oppression. Henry's rage at this knew no bounds; he dismissed the legates with insult, and at a diet held at Worms (24th January, 1076) replied by declaring Gregory deposed on charges of tyranny, magic, and adultery, by sending notification of this fact to the Roman clergy, and by taking steps for appointing a successor to the dethroned pontiff. Gregory now lost no time in excommunicating all the bishops who had attended the diet of Worms, in solemnly deposing and excommunicating the emperor, and in absolving his subjects from their oath of allegiance (22d February, 1076). This counter action produced a powerful effect upon the German princes and people, many of whom had had good cause to resent Henry's tyrannies; one by one the bishops who had announced their withdrawal from Gregory's obedience now signified their contrition, and at a diet held at Tribur (September, 1076) the election of a new emperor began to be discussed. Resistance being in the mean time impossible, Henry resolved upon humbling himself to the utmost; in the dead of winter he set out to make his submission. Gregory was in waiting for him at Canossa, where (25th to 27th January, 1077) that famous penance which Europe has not yet forgotten was imposed (see vol. x. p. 438). Absolved only on condition of his not assuming the royal dignity till his case had been investigated and decided, Henry had no sooner left the papal presence than he began to plot his revenge. Throwing himself upon the generosity of his Lombard vassals, he took courage to face the papal excommunication which was renewed in November 1078; and in the wars which ensued his arms were finally successful. Rudolf of Swabia having died soon after the battle of Merseburg in 1080, the emperor proceeded with a powerful army to escort into Italy Guibert of Ravenna, who had been chosen at Brixen (June, 1080) as Gregory's successor. In three successive summers the attack on Rome was renewed, but it was not until 1084 (March 21) that the treachery of some of the nobles of the city opened the gate to the invader. Gregory was now at last compelled to take refuge in the castle of St. Angelo, while Guibert was established on the pontifical throne as his successor with the title of Clement III. After receiving coronation from Clement, Henry determined to return at once to Germany, especially as Robert Guiscard was known to be approaching. Released accordingly by the arrival of the Norman duke, Gregory excommunicated once more both Henry and Clement; but not deeming himself secure at Rome, where he had reason to know that his power was no longer what it once had been, he in May, 1084, placed himself under Robert's protection at Salerno, where he died, May 25, 1085, after a comparatively brief pontificate of not much more than ten years. His last words are reported to have been, "I have loved righteousness and hated iniquity, and therefore I die in exile." His festival (duplex) is observed throughout the Roman Church on the anniversary of his death. His successor was Victor III.

The lifework of Hildebrand may be thus summed up in the words of Sir James Stephen:—"He found the papacy dependent on the empire; he sustained her by alliances almost commensurate with the Italian peninsula. He found the papacy electoral by the Roman people and clergy; he left it electoral by a college of papal nomination. He found the emperor the virtual patron of the holy see; he wrested that power from his hands. He found the secular clergy the allies and dependents of the secular power; he converted them into the inalienable

[1] Apart from the rich historical associations connected with the name of Gregory, its etymology (from ἐγρήγορα), so suggestive of sleepless vigilance, had probably something to do with its selection by this and so many other popes.

auxiliaries of his own. He found the higher ecclesiastics in servitude to the temporal sovereigns; he delivered them from that yoke to subjugate them to the Roman tiara. He found the patronage of the church the mere deseerated spoil and merchandise of princes; he reduced it within the dominion of the supreme pontiff. He is celebrated as the reformer of the impure and profane abuses of his age; he is more justly entitled to the praise of having left the impress of his own gigantic character on the history of all the ages which have succeeded him."

Unlike Gregory the Great, Hildebrand was no author; his literary remains are all comprised in eleven books or "Registers" of letters, which have often been printed. The *XXVII dictatus* often attributed to him are not now regarded as genuine. Among the numerous earlier biographies may be mentioned those of Paul of Bernried, Pandulf of Pisa, Nicolas of Aragon, and Cardinal Bruno; among later monographs the most important are those of Voigt (*Hildebrand als Gregor VII. u. sein Zeitalter*, 1815; 2d ed. 1846; French translation, with introduction and notes, by Jager, 1834; 4th ed. 1854), Bowden (*The Life and Pontificate of Gregory VII.*, 1840), Sötl (*Gregor VII.*, 1847), Helfenstein (*Gregor's VII. Bestrebungen nach den Streitschriften seiner Zeit*, 1856), Gfrörer (*Papst Gregor VII. u. sein Zeitalter*, 7 vols., 1859–61), Villemain (*Histoire de Gregoire VII.*, 1873; English translation by Brockley, 1874), Langeron (*Gregoire VII. et les origines de la politique ultramontane*, 1874), and Meltzer (*Gregor VII. u. die Bischofswahlen*, 1876). The events of the period are also very fully treated by W. Giesebrecht in his *Geschichte der deutschen Kaiserzeit*, and in other works. For the epistles, see *S. Gregorii VII. epistolæ et diplomata pontificia, acc. vita ejusdem pontificis et appendices amplissimæ veterum et recentiorum monumenta perplurima Gregorii VII. apologetica complectentes* (1877).

GREGORY VIII. (Albert de Mora), who as papal legate had in 1172 attended the council of Avranches, which absolved Henry II. of England from the guilt of the murder of Thomas à Beckett, was consecrated pope in room of Urban III. October 25th, 1187, and died of fever on December 17th of the same year. Clement III. was his successor.

GREGORY IX., pope from 1227 to 1241, the successor of Honorius III., fully inherited the traditions of Gregory VII. and of his uncle Innocent III., and zealously gave himself up to the perpetuation of their policy. One of the first acts of his pontificate was to suspend the emperor Frederick II., then lying sick at Otranto, for dilatoriness in carrying out his promised crusade; the suspension was followed by excommunication and threats of deposition after Frederick had written to the sovereigns of Europe complaining of his treatment. A consequent invasion of the patrimony of St. Peter at the instance of Frederick in 1228 having proved unsuccessful, the emperor was constrained to give in his submission and beg for absolution. Although peace was thus secured (August, 1230) for a season, the Roman people were far from satisfied; driven by a revolt from his own capital in July, 1232, the pope was compelled to take refuge at Anagni and invoke the aid of Frederick. A new outbreak of hostility led to a fresh excommunication of the emperor in 1239, and to a prolonged war which was only terminated by the death of Gregory (August 22, 1241). This pope, who was a remarkably skilful and learned lawyer, caused to be prepared in 1234 the well known *Nova Compilatio Decretalium*, printed at Mainz in 1473. He it was who canonized Saints Elizabeth, Dominic, and Antony of Padua, and also Francis of Assisi, of whom he had been a personal friend. His encroachments upon the rights of the English Church during the ignominious reign of Henry III. are well known; but similar attempts against the liberties of the national church of France only served to call forth the celebrated Pragmatic Sanction of St. Louis. Gregory IX. was succeeded by Celestine IV.

GREGORY X., pope from 1271 to 1276, succeeded Clement IV. after the papal chair had been three years vacant; his election occurred while he was engaged in a pilgrimage to Saint Jean-d'Acre. On his arrival at Rome his first act was to summon the council which met at Lyons in 1274 for the purpose of considering the Eastern schism, the condition of the Holy Land, and the abuses of the Catholic Church. It was while returning from that council that he died at Arezzo on the 10th of January, 1276. To him is due the bull which, subsequently incorporated into the code of canon law, continues to regulate all conclaves for papal elections. He was succeeded by Innocent V.

GREGORY XI. (Pierre Roger de Beaufort), pope from 1370 to 1378, born in Limousin in 1336, succeeded Urban V. in 1370 as one of the Avignon popes. During his pontificate vigorous measures were taken against the "heresies" which had broken out in Germany, England, and other parts of Europe; a sincere effort was also made to bring about a reformation in the various monastic orders. The nineteen propositions of Wickliffe and the thirteen articles of the "Sachsenspiegel" were formally condemned by him in 1373. His energy was largely stimulated by the stirring words of Catherine of Siena (see vol. v. p. 201), to whom in particular the transference of the papal see back to Italy, January 27, 1377, was almost entirely due. He did not long survive this removal, dying on March 27, 1378. His successor was Urban VI., but the antipope Clement VII. also received much support, and the schism lasted forty years.

GREGORY XII. (Angelo Corario or Corraro), pope from 1406 to 1409, born at Venice about 1326, succeeded Innocent VII. on 30th November, 1406, having been chosen at Rome by a conclave consisting of only fifteen cardinals, under the express condition that, should Benedict XIII. of Avignon renounce all claim to the papacy, he also would renounce his, so that a fresh election might be made by the no longer divided church. Along with Benedict he was deposed by the council of Pisa in March, 1409, as schismatical, heretical, perjured, and scandalous; but it was not till after the council of Constance had set aside John XXIII. (1415) that through his ambassador he formally renounced the title and dignity of lawful pope. The rest of his life was spent in peaceful obscurity as cardinal-bishop of Porto and legate of the mark of Ancona. He died October 18, 1417, having been succeeded in 1409 by Alexander V.

GREGORY XIII. (Ugo Buoncompagno), pope from 1572 to 1585, was born February 7, 1502, at Bologna, where he studied law and graduated in 1530, and afterwards taught jurisprudence for some years, Alexander Farnese and Charles Borromeo being among his pupils. At the age of thirty-six he was summoned to Rome by Paul III., under whom he held successive appointments as first judge of the capital, abbreviator, and vice-chancellor of the campagna; by Paul IV. he was attached as datarius to the suite of Cardinal Carafa; and by Pius IV. he was created cardinal priest and sent to the council of Trent. On the death of Pius V. in May, 1572, the choice of the conclave fell upon Buoncompagno, who assumed the name of Gregory XIII. His intervention in the affairs of Britain through Ireland and by means of his tool Philip II., and also the league which he sought to cement against France (the massacre of the St. Bartholomew had taken place in September, 1572), are matters which belong to the history of those countries. In order to raise funds for these and similar objects, he confiscated a large proportion of the houses and properties throughout the states of the church, —a measure which enriched his treasury, indeed, for a time, but by alienating the great body of the nobility and gentry, revived old factions, created new ones, and ultimately plunged his temporal dominions into a state bordering upon anarchy. Such was the position of matters at the time of his death, which took place on the 10th of April, 1585. He was a liberal patron of the Jesuit order, for which he founded many new colleges; the new and greatly improved edition of the *Corpus juris canonici* was also due to his care; but the work with which the name of Gregory XIII. is most intimately and honorably associated is that of the reformation of the calendar, which has been already described under that heading (vol. iv. p. 595). Gregory XIII. was succeeded by Sixtus V.

GREGORY XIV. (Niccolo Sfondrato), pope from 1590 to 1591, a native of Cremona, succeeded Urban VII., 5th December, 1590. As a monk he had been eminent for the decency and sobriety of his life; but his brief pontificate was marked by no important occurrence, except that, instigated by the king of Spain and the duke of Mayenne, he excommunicated Henry IV. of France, declaring him, as a heretic and persecutor, to be deprived of his dominions, and also levied an army for the invasion of France. The history of that country records how this proceeding was regarded alike by clergy, parliament, and people. The biographers mention as a curious personal trait of Gregory XIV. a nervous tendency to laughter which occasionally became irresistible, and which manifested itself even at his coronation. He was succeeded by Innocent IX.

GREGORY XV. (Alessandro Ludovisio), pope from 1621 to 1623, born at Bologna in 1554, succeeded Paul V. on the 9th of February, 1621. Beyond assisting the German emperor against the Protestants, and the king of Poland against the Turks, he interfered little in European politics. He was a learned divine and manifested a reforming spirit; and his pontificate was marked by the canonization of St. Theresa, Francis Xavier, Ignatius Loyola, and Philip Neri. He died on the 18th of July, 1623, and was succeeded by Urban VIII.

GREGORY XVI. (Bartolommeo Alberto Cappellari), pope from 1831 to 1846, was born at Belluno on September 18, 1765, and at an early age entered the order of the Camaldoli, among whom he rapidly gained distinction for his theological and linguistic acquirements. His first appearance before a wider public was in 1799, when he published against the Italian Jansenists a controversial work entitled *Trionfo della Santa Sede*, which, besides passing through several editions in Italy, was translated into several European languages. In 1800 he became a member of the Academy of the Catholic Religion, founded by Pius VII., to which he contributed a number of memoirs on theological and philosophical questions. When Pius VII. was carried off from Rome in 1809, Cappellari withdrew to the monastery of San Michele at Murano, near Venice, and in 1814, with some other members of his order, he removed to Padua; but soon after the restoration of the pope he was recalled to Rome, where he received successive appointments as vicar-general of the Camaldoli, councillor of the Inquisition, prefect of the Propaganda, and examiner of bishops. In March, 1825, he was created cardinal by Leo XII., and shortly afterwards was entrusted with an important mission to adjust a concordat regarding the interests of the Catholics of Belgium and the Protestants of Holland. On the 2d February, 1831, he was, after sixty-four days' conclave, unexpectedly chosen to succeed Pius VIII. in the papal chair. The revolution of 1830 had just inflicted a severe blow on the ecclesiastical party in France, and it seemed as if similar disasters to the papal cause were imminent in other parts of Europe, when Gregory XVI. entered upon his fifteen years' pontificate. Almost the first act of the new Government of France was to unfurl the tricolor at Ancona; and the immediate effect was to throw all Italy, and particularly the Papal States, into a state of excitement such as seemed to call for strongly repressive measures. In the course of the struggle which ensued, the temporal reign of Gregory was marked accordingly by executions, banishments, imprisonments, to an extent which makes it impossible for the candid reader to absolve him from the charges of cruelty and bigotry which were so frequently raised at the time. The embarrassed financial condition in which he left the States of the Church also makes it doubtful how far his lavish expenditure in architectural and engineering works, and his magnificent patronage of learning in the hands of Mai, Mezzofanti, and others, were for the real benefit of his subjects. The years of his pontificate were marked by the steady development and diffusion of those ultramontane ideas which were ultimately formulated under the presidency of his successor Pius IX. by the council of the Vatican. He died 1st June, 1846.

GREGORY, St., the Illuminator (in Armenian *Gregor Lusarovitch*, in Greek *Gregorios Phoster* or *Photistes*), the founder and patron saint of the Armenian Church, was born about 257 A. D. He belonged to the royal race of the Arsacides, being the son of a certain Prince Anak, who assassinated Chosroes of Armenia, and thus brought ruin on himself and his family. His mother's name was Okohe, and the Armenian biographers tell how the first Christian influence he received was at the time of his conception, which took place near the monument raised to the memory of the holy apostle Thaddeus. Educated by a Christian nobleman, Euthalius, in Cæsarea in Cappadocia, Gregory sought, when he came to man's estate, to introduce the Christian doctrine into his native land. At that time Tiridates I., a son of Chosroes, sat on the throne, and, influenced partly it may be by the fact that Gregory was the son of his father's enemy, he subjected him to much cruel usage, and imprisoned him for fourteen years. It would be useless to relate the various forms of torture which the orthodox accounts represent the saint to have endured without permanent hurt; almost any one of his twelve trials would have been certain death to an ordinary mortal. But vengeance and madness fell on the king, and at length Gregory was called forth from his pit to restore his royal persecutor to reason by virtue of his saintly intercession. The cause of Christianity was now secured; king and princes and people vied with each other in obedience to Gregory's instruction, and convents, churches, and schools were established. Gregory in 302 received consecration as patriarch of Armenia from Leontius of Cæsarea, and in 318 he appointed his son Aristax to be his successor. About 331 he withdrew to a cave in the mountain Sebuh in the province of Daranalia in Upper Armenia, and there he died a few years afterwards unattended and unobserved. When it was discovered that he was dead his corpse was removed to the village of Thordanum or Thortan. The remains of the saint were scattered far and near in the reign of Zeno. His head is said to be now in Italy, his right hand at Etchmiadzin, and his left at Sis. It is almost impossible to get at Gregory's real personality through the tangled growth of ecclesiastical legend; but he would appear to have possessed some of that consideration for expediency which is so frequently of service to the reformer. While he did his best to undermine their system, he left the pagan priests in enjoyment of their accustomed revenues.

A number of homilies, possibly spurious, several prayers, and about thirty of the canons of the Armenian Church are ascribed to Gregory. The homilies appeared for the first time in a work called *Haschachapadum* at Constantinople in 1737; a century afterwards a Greek translation was published at Venice by the Mekhitarists; and they have since been edited in German by J. M. Schmid (Ratisbon, 1872). The original authorities for Gregory's life are Agathangelos, whose *History of Tiridates* was published by the Mekhitarists in 1835; Moses of Chorene, *Historiæ Armenicæ;* and Simeon Metaphrastes. A *Life of Gregory* by the vartabed Matthew, published in Armenian at Venice in 1749, was translated into English by Rev. S. C. Malan, 1868. See also Bonucci, *Istoria della vita di S. Gregorio*, 1717; Neumann, *Gesch. der Armenischen Literatur*, 1835; and Dulaurier, *Hist. des dogmes, etc., de l'église Armenienne*, 1859.

GREGORY, St., of Nazianzus, surnamed Theologus, one of the four great fathers of the Eastern Church, was born about the year 329 A. D., at or near Nazianzus, Cappadocia. His father, also named Gregory, a convert from Hypsistarianism, had lately become bishop of the diocese; his mother Nonna, an eminently pious woman, by whom he was dedicated to the service of God from his birth, appears to have exercised a powerful influence over the religious convictions of both father and son. In pursuit of a more liberal and extended culture than could be procured in the insignificant town of Nazianzus, Gregory visited successively the two Cæsareas, Alexandria, and Athens, as a student of grammar, mathematics, rhetoric, and philosophy; at the last-named seat of learning, where he prolonged his stay until he had entered his thirtieth year, he enjoyed the society and friendship of Basil, who afterwards became the famous bishop of Cæsarea; the prince Julian, destined soon afterwards to play so prominent a part in the world's history, was also a fellow-student. Shortly after his return to his father's house at Nazianzus (about the year 360) Gregory received baptism, and renewed his dedication to the service of religion; he still continued, however, for some time, and indeed more or less throughout his whole life, in a state of hesitation as to the form which that service ought to take. Strongly inclined by nature and education to a contemplative life spent among books and in the society of congenial friends, he was yet continually urged by outward circumstances, and doubtless also by some inward call, to active pastoral labor. The spirit of refined intellectual monasticism, which clung to him through life and never ceased to struggle for the ascendency, was about that time strongly encouraged by his intercourse with Basil, who was then revelling in the exalted pleasures of his retirement in Pontus; the preparation of the φιλοκαλία, a sort of chrestomathy compiled by the two friends from the writings of Origen, belongs to this period. But the events which were at that time stirring the political and ecclesiastical life of Cappadocia, and indeed of the whole Roman world, made a career of learned leisure difficult if not impossible to a man of Gregory's position and temperament. The emperor Constantius, having by a course of artful intrigue and intimidation succeeded in thrusting a semi-Arian formula upon the Western bishops assembled at Ariminum in Italy, had next attempted to follow the same course with the Eastern episcopate. The aged bishop of Nazianzus having yielded to the imperial threats,

a great storm arose among the monks of the diocese, which was only quelled by the influence of the younger Gregory, who shortly afterwards (about 361) was ordained to the priesthood. After a vain attempt to evade his new duties and responsibilities by flight, he appears to have continued to act as a presbyter in his father's diocese without interruption for some considerable time; and it is probable that his two *Invectives* against Julian are to be assigned to this period. Subsequently (about 372), under a pressure which he somewhat resented, he allowed himself to be nominated by Basil as bishop of Sasima, a miserable little village some 32 miles from Tyana; but he seems hardly, if at all, to have assumed the duties of this diocese, for after another interval of "flight" we find him once more (about 372–3) at Nazianzus, assisting his aged father, on whose death (374) he retired to Seleucia in Isauria for a period of some years. Meanwhile a more important field for his activities was opening up. Towards 378–9 the small and depressed remnant of the orthodox party in Constantinople sent him an urgent summons to undertake the task of resuscitating the catholic cause, so long persecuted and borne down by the Arians of the capital. With the accession of Theodosius to the imperial throne, the prospect of success to the Nicene doctrine had dawned, if only it could find some courageous and devoted champion. The fame of Gregory as a learned and eloquent disciple of Origen, and still more of Athanasius, pointed him out as such a defender; nor could he resist the appeal made to him, although he took the step sorely against his will. Once arrived in Constantinople, he labored so zealously and well that the orthodox party speedily gathered strength; and the small apartment in which they had been accustomed to meet was soon exchanged for a vast and celebrated church which received the significant name of Anastasia, the Church of the Resurrection. Among the hearers of Gregory were to be found, not only churchmen like Jerome and Evagrius, but also heretics and heathens; and it says much for the sound wisdom and practical tact of the preacher that from the outset he set himself less to build up and defend a doctrinal position than to urge his flock to the cultivation of the loving Christian spirit which cherishes higher aims than mere heresy hunting or endless disputation. Doctrinal, nevertheless, he was, as is abundantly shown by the famous five discourses on the Trinity, which earned for him the distinctive appellation of *θεολόγος* (*θεολογία* being here used in the stricter sense to designate the doctrine of Christ's divinity, as distinguished from *οἰκονομία*, which denotes the doctrine of His incarnation). He continued to labor in the Eastern capital till the arrival of Theodosius, and the visible triumph of the orthodox cause; the metropolitan see was then conferred upon him, and after the assembling of the second œcumenical council in 381 he received consecration from Meletius. In consequence, however, of a spirit of discord and envy which had manifested itself in connection with this promotion, he soon afterwards, in an oration, not without some bitterness of tone, resigned his dignity, and withdrew into comparative retirement. The rest of his days were spent partly at Nazianzus, where he appears still to have mixed himself in ecclesiastical affairs, and partly on his patrimonial estate at Arianzus, where he devoted himself to his favorite literary pursuits, and especially to poetical composition, until his death, which occurred in 389 or 390. His festival is celebrated in the Eastern Church on January 25th and 30th, in the Western on 9th May (duplex).

His extant works consist of poems, epistles, and orations. The poems, which include epigrams, elegies, and an autobiographical sketch, have been frequently printed, the *editio princeps* being the Aldine (1504). Other editions are those of Tollius (1696) and Muratori (1709); a volume of *Carmina Selecta* also has been edited by Dronke (1840). The tragedy entitled *χριστὸς πάσχων* usually included is certainly not genuine. Of Gregory's poetry there is not much to be said. His best energies were not devoted to it; it was adopted in his later years as a recreation rather than as a serious pursuit; thus it is occasionally delicate, graphic, beautiful, as could not fail to be the case with a writer of his culture and power, but it is not sustained. Of the hymns none have passed into ecclesiastical use. The letters are entitled to a higher place in literature. They are always easy and natural; and there is nothing forced in the manner in which their acute, witty, and profound sayings are introduced. As an orator he is held to have surpassed all his contemporaries "in the purity of his words, the nobleness of his expressions, the ornaments of his discourse, the variety of his figures, the justness of his comparisons, the beauty of his reasonings, and the sublimity of his thoughts." Thus, though possessed neither of Basil's gift of government nor of Gregory of Nyssa's power of speculative thought, he worthily takes a place in that triumvirate of Cappadocians whom the Catholic Church gratefully recognizes as having been, during the critical struggles in the latter half of the 4th century, the best defenders of its faith. The *Opera Omnia* were first published by Hervagius (Basel, 1550); the subsequent editions have been those of Billius (Paris, 1609, 1611; aucta ex interpretatione Morelli, 1630), of the Benedictines (begun in 1778, but interrupted by the French Revolution and not completed until 1840, Caillau being the final editor), and of Migne.

Scattered notices of the life of Gregory Nazianzen are to be found in the writings of Socrates, Sozomen, Theodoret, and Rufinus, as well as in his own letters and poems. The data derived from these sources do not always harmonize with the account of Suidas. The earlier modern authorities, such as Tillemont (*Mem. Eccl.*, t. ix.) and Leclerc (*Bib. Univ.* t. xviii.) have been made use of by Gibbon in his brief but able sketch of his father. Among recent monographs may be mentioned those of Ullmann (*Gregorius von Nazianz, der Theologe*, 1825; Eng. transl. by G. F. Cox, M. A., 1857), Benoit (*St. Grégoire de Nazianze; sa vie, ses œuvres, et son époque*, 1877), and Montaut (*Revue critique de quelques questions historiques se rapportant à St. Grégoire de Nazianze*, 1879).

GREGORY, St., of Nyssa, one of the great Cappadocians, and designated by one of the later œcumenical councils as "a father of fathers," was a younger brother of St. Basil, and was born (probably) at Neocæsarea about 331 A. D. For his education, which was the best that could be got at that time, he appears to have been chiefly indebted to his elder brother. At a comparatively early age he entered the church, and held for some time the office of anagnost or reader; subsequently he manifested a desire to devote himself to the secular life as a rhetorician; but this impulse was checked by the earnest remonstrances of Gregory Nazianzen. Finally, in 371 or 372 he was ordained by his brother Basil to the bishopric of Nyssa, a small town in Cappadocia. Here he is usually said (but on inadequate data) to have adopted the opinion then gaining ground in favor of the celibacy of the clergy, and to have separated from his wife Theosebia, who became a deaconess in the church. His strict orthodoxy on the subject of the Trinity and the Incarnation, together with his vigorous eloquence, combined to make him peculiarly obnoxious to the Arian faction, which was at that time in the ascendant through the protection of the emperor Valens; and in 375, on the ground of alleged irregularities in his election, and in the administration of the finances of his diocese, he was driven into exile, whence he did not return till the publication of the edict of Gratian in 378. Shortly afterwards he took part in the proceedings of the synod which met at Antioch in Caria, principally in connection with the Meletian schism. At the great œcumenical council held at Constantinople in 381, he was a conspicuous champion of the orthodox faith; according to Nicephorus, indeed, the additions made to the Nicene creed were entirely due to his suggestion, but this statement is of doubtful authority. That his eloquence was highly appreciated is shown by the facts that he pronounced the discourse at the consecration of Gregory of Nazianzus, and that he was chosen to deliver the funeral oration on the death of Meletius the first president of the council. In the following year, moreover (382), he was commissioned by the council to inspect and set in order the churches of Arabia, in connection with which mission he also visited Jerusalem. The impressions he gathered from this journey may, in part at least, be gathered from his famous letter *De Euntibus Hierosolyma*, in which an opinion strongly unfavorable to pilgrimages is expressed. In 383 he was probably again in Constantinople; where in 385 he pronounced the funeral orations of the princess Pulcheria and afterwards of the empress Placilla. Once more we read of him in 394 as having been present in that metropolis at the synod held under the presidency of Nectarius to settle a controversy which had arisen among the bishops of Arabia; in the same year he assisted at the consecration of the fine new church of the apostles at Chalcedon, on which occasion there is reason to believe that his discourse commonly but wrongly known as that *εἰς τὴν ἑαυτοῦ χειροτονίαν* was delivered. The exact date of his death is unknown; some authorities refer it to 396, others to 400. His festival is observed by the Greek Church on January 10th; in the Western martyrologies he is commemorated on March 9th.

Gregory of Nyssa is generally admitted to have excelled both his brother Basil and Gregory of Nazianzus alike in the natural vigor of his intellect and in the wide extent of his acquirements. His teaching, though strictly trinitarian, shows considerable free-

dom and originality of thought; in many points his mental and spiritual affinities with Origen show themselves with advantage; though in one particular—namely, in his doctrine of ἀποκατάστασις or final restoration—his views have since been repudiated by the orthodox. His style has been frequently praised by competent authorities for sweetness, richness, and elegance. His numerous works may be classified under five heads:—(1.) Treatises in doctrinal and polemical theology. Of these the most important is that *Against Eunomius* in twelve books. Its doctrinal thesis (which is supported with great philosophic acumen and rhetorical power) is the divinity and consubstantiality of the Word; incidentally the character of Basil, which Eunomius had aspersed, is vindicated, and the heretic himself is held up to scorn and contempt. This is the work which, most probably in a shorter draft, was read by its author when at Constantinople before Gregory Nazianzen and Jerome in 381 (Jerome, *De Vir. Ill.*, 128). To the same class belong the treatise *To Ablavius*, against the tritheists; *On Faith*, against the Arians; *On Common Notions*, in explanation of the terms in current employment with regard to the Trinity; *Ten Syllogisms*, against the Manichæans; *To Theophilus*, against the Apollinarians; an *Antirrhetic* against the same; *Against Fate*, a disputation with a heathen philosopher, the *Oratio Catechetica Magna*; and the dialogue *De Anima et Resurrectione*. (2.) Practical treatises. To this category belong the tracts *On Virginity* and *On Pilgrimages*; as also the *Canonical Epistle* upon the rules of penance. (3.) Expository and homiletical works, including the *Hexaëmeron*, and several series of discourses *On the Workmanship of Man*, *On the Inscriptions of the Psalms*, *On the Sixth Psalm*, *On the first three Chapters of Ecclesiastes*, *On Canticles*, *On the Lord's Prayer*, and *On the Eight Beatitudes*. (4.) Biographical, consisting chiefly of funeral orations. (5.) Letters. The only complete editions of the whole works are those by Fronton le Duc (Fronto Ducæus, Paris, 1615; with additions, 1618 and 1638) and by Migne. Of the new edition projected by F. Oehler only the first volume, containing the *Opera Dogmatica*, has appeared (1865). There have been numerous editions of several single treatises, as for example of the *Oratio Catechetica*, *De Precatione*, and *De Anima et Resurrectione*. See the monograph by Rupp (*Gregors, des Bischofs von Nyssa, Leben und Meinungen*, Leipsic, 1834), and compare Heyns (*Disputatio historico-theologica de Greg. Nyss.*, 1835), Möller (*Gregorii Nyss. doctrinam de hominis natura et illustravit et cum Origeniana comparavit*, 1854), and Stigler, *Die Psychologie des h. Gregors von Nyssa* (Ratisbon, 1857).

GREGORY, St., surnamed in later ecclesiastical tradition Thaumaturgus (the miracle-worker), was born of noble and wealthy heathen parents at Neocæsarea, towards the beginning of the 3d century of the Christian era. His original name was Theodorus. Destined by his parents for the bar, he studied civil law at Athens, Alexandria, and Berytus, it is said; he afterwards (about 231) accompanied his sister to Cæsarea in Palestine, where he became the pupil and finally the convert of Origen. In returning to Cappadocia some five years after his conversion, it had been his original intention to live a retired ascetic life (Euseb., *H. E.*, vi. 30); but this wish he was not permitted to gratify. Urged by Origen, and at last almost compelled by Phædimus of Amasia, his metropolitan, neither of whom was willing to see so much learning, piety, and masculine energy practically lost to the church, he, after many attempts to evade the dignity, was consecrated bishop of his native town (about 240). His episcopate, which lasted some thirty years, was characterized by great zeal, and by so much success that, according to the (doubtless somewhat rhetorical) statement of Gregory of Nyssa, whereas at the outset of his labors there were only seventeen Christians in the city, there were at his death only seventeen persons in all who had not embraced Christianity. This result he achieved in spite of the Decian persecution (250), during which he had felt it to be his duty to absent himself from his diocese, and notwithstanding the demoralizing effects of an irruption of barbarians who laid waste the diocese in 260. Gregory, although he has not always escaped the charge of Sabellianism, now holds an undisputed place among the fathers of the church; and although the turn of his mind was practical rather than speculative, he is known to have taken an energetic part in most of the doctrinal controversies of his time. He was active at the synods of Antioch which investigated and condemned the heresies of Paul; and the rapid spread in Pontus of a Trinitarianism approaching the Nicene type is attributed in large measure to the weight of his influence. Gregory is believed to have died in the reign of Aurelian, about the year 270, though some accounts place his death six years earlier. His festival (semiduplex) is observed by the Church of Rome on the 17th of November. For the facts of his biography our earliest and best authority is the *Life* or rather *Panegyric* by Gregory of Nyssa; but there are also incidental notices of him in the writings of Basil the Great. Both these writers represent him as having wrought miracles of a very startling description; but nothing related by them comes near the astounding narratives given in the *Martyrologies*, or even in the *Breviarium Romanum*, in connection with his name.

The principal works of Grogory Thaumaturgus are the *Panegyricus in Origenem* (εἰς Ὠριγένην πανηγυρικὸς λόγος), which he wrote when on the point of leaving the school of that great master; a *Metaphrasis in Ecclesiasten*, characterized by Jerome as "short but useful;" and an *Epistola Canonica*, which treats of the discipline to be undergone by those Christians who under pressure of persecution had relapsed into paganism, but desired to be restored to the privileges of the church. An *Expositio Fidei*, usually attributed to Gregory, and traditionally alleged to have been received by him immediately in vision from the apostle John himself, is of doubtful authenticity. There have been several editions of the works of this father; of these may be mentioned that of Gerard Voss, in Greek and Latin (Mainz, 1604); the Paris edition of 1622; and that contained in the third volume of Galland's *Bibliotheca Patrum* (Paris, 1788). They are also to be found in a Latin translation in Migne's *Patrologia Græca*, vol. vii. A separate reprint of the *Panegyricus in Origenem* was published by Bengel in 1722. The life of Gregory has been written by Pallavicini (Rome, 1644) and by Boye (Jena, 1703).

GREGORY, St., of Tours (*c.* 540–594), historian of the Franks, was born at Clermont, Auvergne, not earlier than 539 and not later than 543 A. D. He was the youngest son of Florentius, a provincial senator, and head of one of the oldest and most powerful Christian families in the country; at his baptism he received the name of George, that of Gregory not having been assumed until his consecration at least thirty years afterwards. He received his education under the superintendence of his uncle Gallus, at that time bishop of Clermont, and afterwards under Avitus, who succeeded to that see. Having been ordained a deacon on attaining the canonical age, the youthful Georgius Florentius for a time attended in some ecclesiastical capacity the court of Sigebert of Austrasia; and when in 573 a vacancy occurred in the see of Tours, which had been occupied by many of his kindred, his reputation for piety and wisdom led to his being immediately designated as a suitable successor to that bishopric. Circumstances soon occurred which brought into great prominence his peculiar fitness for this post; first in 575, when Guntram had taken refuge from Chilperic in the sanctuary of St. Martin, and afterwards in 577, when Pretextatus of Rouen had been unjustly condemned by the rest of his brethren. The firmness and courage which he showed on these and other occasions brought upon him the bitter hostility of the strong-minded Queen Fredegond, who caused him to be summoned before a council at Braine on a charge of treason, of which, however, he was acquitted. In 581 he took a leading part in adjusting that arrangement between Chilperic and Childebert which gave peace to France for many years. During the later years of his life he used his political influence and prestige, which were now immense, with singular unselfishness and judgment in the interest alike of his diocese and of the whole country. He died at Tours on the 17th of November, 594, and subsequently attained the honors of beatification and canonization, his day in the calendar (semiduplex) being November 17th.

Of his writings, besides the *Historia Francorum* in ten books, we possess a treatise *De Miraculis* in seven books, containing the miracles of Christ and his apostles, those of Julian, of Martin, and also of others. Other treatises which he mentions have perished. The *De Miraculis* appears to have occupied him at intervals during the whole of his prelacy; of the *Historia Francorum* he is supposed to have written as far as to about the middle of the fifth book by 577; the eighth book was completed before 585, and the tenth about 591, the epilogue being of still later date. This work, which gives Gregory of Tours a just title to be called the father of French history, has no pretensions to elegance or even grammatical accuracy of style; it is wholly uncritical, and betrays in every page the prejudice and ignorance of the age to which it belongs. But it is honestly and truthfully written from the point of view of one whose avowed intention was to trace "the wars of kings with hostile nations, of martyrs with pagans, of churches with heretics;" and as an original source for the period of 174 years which it covers it is

still, notwithstanding the unfavorable judgment which Gibbon has expressed, invaluable.

The edition of the works of Gregory of Tours, which appeared at Paris in 1511–12, has been entirely superseded by that of Ruinart (Paris, 1699). It includes the not very valuable life of the saint by Odo. The 71st volume of Migne's *Patrology* adds to a reprint of Ruinart an *Historia Septem Dormientium* which is sometimes (but improperly) attributed to Gregory. Translations by Bonnet, Guizot, and others into French have been frequently reprinted; a German version appeared at Würzburg in 1847–49; it was followed by Giesebrecht's in 1851. See Kries, *De Greg. Tur. episc. vita et scriptis* (Breslau, 1839); Löbell, *Gregor v. Tours u. seine Zeit* (Breslau, 1839; 2d ed. Leipsic, 1869); and an article in the *Mémoires de l'Académic*, t. xxvi.

GREGORY, the name of a Scottish family, many members of which attained high eminence in various departments of science, sixteen having held professorships. Of the most distinguished of their number a notice is given below.

I. David Gregory (1628–1720), eldest son of the Rev. John Gregory of Drumoak, Aberdeenshire, was born in 1628. For some time he was connected with a mercantile house in Holland, but on succeeding to the family estate of Kinardie he returned to Scotland, and occupied most of his time in scientific pursuits, freely giving his poorer neighbors the benefit of his medical skill. He is said to have been the first possessor of a barometer in the north of Scotland; and on account of his success by means of it in predicting changes in the weather, he was accused of witchcraft before the presbytery of Aberdeen, but he succeeded in convincing that body of his innocence. He died in 1720.

II. James Gregory (1638–1675), the author of important discoveries in mathematics and optics, younger brother of the preceding, was born in 1638. He was educated at the grammar school of Aberdeen and at Marischal College of that city. At an early period he manifested a strong inclination and capacity for mathematics and kindred sciences; and before completing his twenty-third year he published his famous treatise *Optica Promota*, in which he made known his great invention the Gregorian reflecting telescope. About 1665 he went to the university of Padua, where he studied for some years, and in 1667 published *Vera Circuli et Hyperbolæ Quadratura*, in which he propounded his method of an infinitely converging series for the areas of the circle and hyperbola. In the following year he published also at Padua *Geometriæ Pars Universalis*, in which he laid down a series of rules for the transmutation of curves and the measurement of their solids of revolution. On his return to England in this year he was elected a member of the Royal Society; in the following year he became professor of mathematics in the university of St. Andrews; and in 1674 he was transferred to the chair of mathematics in Edinburgh. In October, 1675, while showing the satellites of the planet Jupiter to some of his students through one of his telescopes, he was suddenly struck with blindness; and he died a few days afterwards at the early age of thirty-seven.

Besides the works already mentioned Gregory is the author of *Exercitationes Geometricæ*, 1668, and, it is alleged, of a satirical tract entitled *The Great and New Art of Weighing Vanity*, intended to ridicule certain fallacies of a contemporary writer on hydraulics, and published at Glasgow in 1672, professedly by "Patrick Mathers, archbeadle of the university of St. Andrews."

III. David Gregory (1661–1708), nephew of the preceding and son of the David Gregory above mentioned, was born in Aberdeen in 1661. He was educated partly in his native city and partly in Edinburgh, where at the age of twenty-three he became professor of mathematics. In 1691 he was appointed Savilian professor of astronomy at Oxford, an office which he held till his death in 1708. His principal works are *Exercitatio Geometrica de dimensione figurarum* (1684), *Catoptricæ et Dioptricæ Sphæricæ Elementa* (1695), and *Astronomiæ Physicæ et Geometricæ Elementa* (1702),—the last a work highly esteemed by Newton, of whose system it is an illustration and a defence. A *Treatise on Practical Geometry* which he left in manuscript was translated from the Latin and published in 1745. He was succeeded in the chair of mathematics in Edinburgh by his brother James; another brother, Charles, was in 1707 appointed professor of mathematics in the university of St. Andrews; and his eldest son, David, became professor of modern history at Oxford, and canon and latterly dean of Christ Church.

IV. John Gregory (1724–1773), professor of medicine in the university of Edinburgh, grandson of James Gregory, the inventor of the Gregorian telescope, and youngest son of Dr. James Gregory, professor of medicine in King's College, Aberdeen, was born at Aberdeen, June 3, 1724. After studying at the grammar school of Aberdeen, and completing his literary course at King's College in that city, he attended the medical classes at Edinburgh university. In 1745 he went to Leyden to complete his medical studies, and during his stay there he received without solicitation the degree of doctor of medicine from King's College, Aberdeen. On his return from Holland he was elected professor of philosophy at King's College, but in 1749 he resigned his professorship on account of its duties interfering too much with his practice as a physician. In 1754 he proceeded to London, where he made the acquaintance of many persons of distinction, and the same year was chosen fellow of the Royal Society. On the death in November, 1755, of his brother, Dr. James Gregory, who had succeeded his father as professor of medicine in King's College, Aberdeen, he was appointed to that office. In 1764 he removed to Edinburgh in the hope of obtaining a more extensive field of practice as a physician, and in 1766 he was appointed professor of the practice of physic in the university of Edinburgh, to whose eminence as a medical school he largely contributed. From his eighteenth year Dr. Gregory had been subject at irregular intervals to attacks of gout, and on the morning of February 10th, 1773, he was found dead in bed apparently from the results of this disease.

He is the author of *A Comparative View of the State and Faculties of Man with those of the Animal World*, 1765; *Observations on the Duties, Offices, and Qualifications of a Physician*, 1772; *Elements of the Practice of Physic*, 1772; and *A Father's Legacy to his Daughters*, 1774. His *Whole Works*, with a life by Mr. Tytler (afterward Lord Woodhouselee), were published at Edinburgh in 1788.

V. James Gregory (1753–1821), professor of the practice of medicine in the university of Edinburgh, eldest son of the preceding, was born at Aberdeen in 1753, and received there the rudiments of his education. He accompanied his father to Edinburgh in 1764, and after going through the usual course of literary studies at that university, he was for a short time a student at Christ Church, Oxford. It was there probably that he acquired that taste for classical learning which afterwards distinguished him. He then entered on the study of medicine at Edinburgh, and, after graduating doctor of medicine in 1774, spent the greater part of the next two years in Holland, France, and Italy. Shortly after his return to Scotland he was appointed in 1776 to the chair his father had formerly held, and in the following year he also entered on the duties of teacher of clinical medicine in the Royal Infirmary. On the illness of Dr. Cullen in 1790 he was appointed joint-professor of the practice of medicine; he became sole professor on the death of Dr. Cullen in the same year; and he continued to deliver lectures on that subject, to audiences almost regularly increasing, until his last illness in 1821. He died on the 2d April of that year. As a medical practitioner Dr. Gregory was for the last ten years of his life decidedly at the head of the profession in Scotland; and as a professor his quickness and commanding energy of intellect, his power of perspicuous and elegant exposition, and his genuine sense of humor gave him a remarkable ascendency over the minds of his pupils.

Besides his *Conspectus Medicinæ Theoreticæ*, published in 1788 as a text-book for his lectures on the institutes, Dr. Gregory was the author of "A Theory of the Moods of Verbs," published in the *Edin. Phil. Trans.*, 1787, and of *Literary and Philosophical Essays*, published in two volumes in 1792.

VI. William Gregory (1803–1858), son of the preceding, was born 25th December, 1803. In 1837 he became professor of chemistry at the Andersonian Institution, Glasgow, in 1839 at King's College, Aberdeen, and in 1844 at Edinburgh University. He died April 24, 1858. Gregory was one of the first in England to advocate the theories of Liebig, and translated several of his works. He is also the author of *Outlines of Chemistry*, 1845, and an *Elementary Treatise on Chemistry* reprinted from the *Encyclopædia Britannica*, 1855.

VII. Duncan Farquharson Gregory (1813–1844), brother of the preceding, was born 13th April, 1813. After studying at the university of Edinburgh he in 1833 entered Trinity College, Cambridge, where he was for a

time assistant professor of chemistry, and was one of the founders of the chemical society. He latterly devoted his chief attention to mathematics, in which he made some important discoveries. He died 23d February, 1844.

The *Cambridge Mathematical Journal* was originated, and for some time edited, by Gregory; and he also published a *Collection of Examples of Processes in the Differential and Integral Calculus*, 1841. *A Treatise on the Application of Analysis to Solid Geometry*, which he left unfinished, was completed by W. Walton, and published posthumously in 1846. His *Mathematical Writings*, edited by W. Walton, with a biographical memoir by Robert Leslie Ellis, appeared in 1865.

GREGORY, Olinthus, LL.D. (1774–1841), was born 29th January, 1774, at Yaxley, in Huntingdonshire. He was only nineteen when he published *Lessons Astronomical and Philosophical* (1793), and soon after, by a manuscript on the "Use of the Sliding Rule," he was fortunate enough to excite the interest of Dr. Hutton, professor of mathematics at the Royal Military Academy of Woolwich. Having settled at Cambridge in 1798, Gregory first acted as subeditor of a provincial newspaper, and then opened a bookseller's shop; but before long he found that he would be better off as a private teacher of mathematics. In 1802 he obtained an appointment as mathematical master at Woolwich through the influence of Hutton; and when Hutton resigned in 1807, Gregory succeeded him in the professorship. Failing health obliged him to retire in 1838, and he died at Woolwich, 2d February, 1841.

Of Gregory's numerous mathematical works it is enough to mention *Hints for the Use of Teachers of Elementary Mathematics* (1840; new edition, 1853), and *Mathematics for Practical Men* (1825), which was revised and enlarged by Henry Law in 1848, and again by J. R. Young in 1862. His *Letters on the Evidences of Christianity* (1815) have been several times reprinted, and an abridgment was published by the Religious Tract Society in 1853. He will probably be longest remembered for his *Biography of Robert Hall*, which first appeared in the collected edition of Hall's Works, was published separately in 1833, and has since passed through several editions. The minor importance of his *Memoir of John Mason Good* (1828) is due to the narrower fame of the subject. Gregory was one of the founders of the Royal Astronomical Society. In 1802 he was appointed editor of the *Gentlemen's Diary*, and in 1818 editor of the *Ladies' Diary* and superintendent of the almanacs of the Stationers' Company.

GREIFENBERG, the chief town of a circle in the Prussian province of Pomerania and government of Stettin, is situated on the Rega, 45 miles N. E. of Stettin. It possesses a royal gymnasium and a higher girls' school. Agriculture, linen-weaving, and the manufacture of stoves are the principal industries. Greifenberg possessed town rights as early as 1262, and in the 14th and 15th centuries had a considerable shipping trade, but lost much of its prosperity during the Thirty Years' War. Including the garrison, the population in 1905 was 7207. See Riemann, *Geschichte der Stadt Greifenberg in Pommern*, 1862.

GREIFENHAGEN, the chief town of a circle in the Prussian province of Pomerania and government of Stettin, is situated on the Reglitz, 12 miles S. S. W. of Stettin. Its prosperity depends chiefly on agriculture, and it has a considerable cattle trade. There are also linen manufactories and saw-mills. Greifenhagen was built in 1230, and was raised to the rank of a town and fortified in 1262. In the Thirty Years' War it was taken both by the imperialists and the Swedes, and in 1675 it was captured by the Brandenburgers, into whose possession it came finally in 1679. The population in 1905 was 6,583.

GREIFSWALD, or Greifswalde, the chief town of a circle in the Prussian province of Pomerania and government of Stralsund, is situated on the Ryck, 3 miles from its mouth in the Baltic, and 20 miles S. by E. of Stralsund. It has wide and regular streets, and is surrounded by promenades formed out of its old ramparts. It is the seat of a court of appeal for the government district of Stralsund. The university, founded in 1456, is attended by nearly 1,000 students, about one-half of whom belong to the medical faculty; connected with it are an anatomical theatre, an infirmary, a chemical laboratory, a pathological institute, and a library containing nearly 140,000 volumes. The principal other buildings are the church of St. Nicholas (with a tower 330 feet high and a valuable library), the old town-house, the theatre, the gymnasium, the orphanage, and the lunatic asylum. There is a considerable shipping trade in Pomeranian corn with England, France, and the Mediterranean ports. Fish-curing, shipbuilding, and the manufacture of machines, railway wagons, needles, soap, tobacco, and oil, are the principal other industries. The population in 1905 was 23,767.

Greifswald was founded about 1240 by mechanics and merchants from the Netherlands. In 1250 it received a town constitution and Lübeck rights from Duke Wratislaus of Pomerania. In 1270 it formed a league with the Hanse towns, Stralsund, Rostock, Wismar, and Lübeck; and it took part in the wars which they carried on against the kings of Denmark and Norway. During the Thirty Years' War it was formed into a fortress by the imperialists, but they vacated it in 1631 to the Swedes, in whose possession it remained after the peace of Westphalia. In 1678 it was captured by the elector of Brandenburg, but it was restored to the Swedes in the following year; in 1713 it was desolated by the Russians; in 1715 it came into the possession of Denmark; and in 1721 it was again restored to Sweden, under whose protection it remained till 1815, when, along with the whole of Swedish Pomerania, it came into the possession of Prussia. See Kosegarten, *Geschichte der Universität Greifswald*, 1856; and Gesterding, *Beitrag zur Geschichte der Stadt Greifswald*, 3 vols., 1827–29.

GREIZ, or Greitz (formerly *Grewitz* or *Grewz*), a town of Germany, capital of the principality of Reuss-Greiz, is situated in a pleasant valley on the right bank of the White Elster, near the borders of Saxony, and 14 miles W. by S. of Zwickau. It is surrounded by walls, and is tolerably well built. The principal buildings are the prince's palace surrounded by a fine park, the old "residence" castle on a rock overlooking the town, the summer palace with a fine garden, the old town church dating from 1225 and possessing a beautiful tower, the town-house, the city school buildings, the normal seminary for the principality, and the lower city school. The industries include dyeing, tanning, and the manufacture of woollen, cotton, and silk cloth, shawls, coverlets, and paper. The population in 1905 was 23,118.

Greiz is apparently of Slavic origin. From the 12th century it was governed by bailiffs, but in 1236 it came into the possession of Gera, and in 1550 of the younger line of the house of Plauen. It was wholly destroyed by fire in 1494, and almost wholly in 1802. See Wilke, *Greiz und seine Umgebung*, 1875.

GRENADA, the most southern island of the Antilles, lies between 11° 58′ and 12° 30′ N. lat. and 61° 20′ and 61° 35′ W. long. It is 30 leagues S. W. of Barbados, and about 60 miles from the nearest point of South America. Its length from north to south is about 24 miles, and its greatest breadth is 12 miles. The area is 133 square miles.

Grenada is rendered highly picturesque by ridges of hills covered with trees and brushwood, and by an irregular but continuous range of mountains which traverses the island from north to south, in some parts rising to 3000 feet above the level of the sea. Lesser ridges branch off, forming rich and picturesque valleys. The mountains and some parts of the lowlands consist of red and gray sandstone, greywacke, hornblende, and argillaceous schist. The strata are much diversified and irregular. Sulphur and fuller's earth are found. Porphyry, limestone, and basaltic rocks occur at certain places. Rivers are numerous, but not large. In the centre of the island, 1740 feet above the level of the sea, is the Grand Étang, a circular lake 2 miles in circumference and 14 feet deep, feeding numerous small rivers. Lake Antoine is another remarkable natural feature. There are several hot chalybeate and sulphurous springs. Along the coast are numerous excellent bays and harbors. The waters abound with fish; game and birds of various species are found. Hurricanes are comparatively unfrequent, but earthquake shocks are sometimes experienced. The average temperature is 82° Fahr., but the higher parts are cooler. Considerable rain falls. The soil is extraordinarily fertile; but cotton, indigo, and tobacco are not now cultivated. Fruits and some kinds of European vegetables grow luxuriantly. Sugar cultivation is not extending, but cocoa is now making rapid strides. The island is divided into six parishes. Formerly it had a house of assembly, but is now a crown colony under the general government of the Windward Islands. It has a lieutenant-governor and a council consisting of officials and members nominated by the crown. Population in 1901, 63,438.

The capital, St. George's (population about 5000), is

built upon a peninsula projecting into a spacious bay on the west side of the island, near the southern extremity. The houses are of brick or stone, and stand on high ground which rises from the bay. The town is divided by a ridge running into the sea, forming on one side the careenage, a large basin of water, where ships lie landlocked, close to wharves and stores. A saluting battery, Fort George, overlooks the entrance. On the left, the land rises to the fortifications of Hospital Hill; and a long ridge connects this fort with Richmond Heights, which form the background of the scene and are also fortified. The ridge which connects Fort George with Hospital Hill separates the careenage from the larger portion of the town, which contains an extensive market-place, and looks upon the bay. Besides the careenage, there is a spacious sheet of water called the lagoon, separated from the former by a reef passable only by boats.

Between Grenada and St. Vincent there are several small islands called Grenadines, some being included in the government of Grenada. Of these Carriacou is the most important. It is about 19 miles in circumference, and contains 3071 inhabitants. Ground provisions, live stock, and some cocoa are cultivated.

The exports in 1877 were—cocoa, 1244 tons; whale oil, 6720 galls.; rum, 53,609 galls.; sugar, 2792 tons. The cocoa exports in 1878 were 1900 tons, an amount considerably exceeded in 1879. The total value of imports amounted in 1877 to £127,204,—including £60,201 from the United Kingdom, and £46,724 from the British West Indies. The value of exports to the United Kingdom was £122,821, and to other countries, £23,085;—total, £145,906. The revenue was £29,084, of which customs produced £13,460, and the expenditure was £29,581. Population (1877), 41,355. About 400 Coolie immigrants were introduced in 1877. Considerable immigration takes place from Barbados. The legislature grants £1200 annually for education, distributed among 30 schools,—16 Anglican, 5 Wesleyan, 9 Roman Catholic,—with 2908 scholars.

Grenada was discovered by Columbus in 1498. The Spaniards, however, did not form a settlement there. The island is one of the "Caribbees" granted to the earl of Carlisle in 1627; but it was inhabited only by warlike Caribs until 1650–51, when Du Parquet, governor of Martinique, organized two expeditions to it. The Frenchmen were at first well received by the natives, but great cruelty was exercised in the extirpation of the latter. The island made little progress until after 1700. In 1714 the French West India Company acquired their property in Grenada; commercial intercourse sprang up with Martinique; and when the company was dissolved the island became vested in the crown of France. In 1753 it contained 1262 whites, 11,991 slaves, and 83 sugar plantations. In 1762 Grenada capitulated to the British forces, and it was formally ceded in the treaty of peace of 1763. It was, however, retaken by the French in 1779, and not finally restored to Great Britain in 1783 till the general peace.

Plan of Grenoble.

1. Church of St. Laurence.
2. Church of St. Marie.
3. Palais de Justice.
4. Theatre.
5. Church of St. André.
6. Notre Dame.
7. Market.
8. College.
9. Museum and Library
10. School of Artillery.
11. New Prefecture.
12. New Prison.

GRENOBLE, a fortified city of France, formerly the chief town of Dauphiné and now of the department of the Isère, lies 58 miles E. of Lyons, in 45° 11′ 57″ N. lat. and 5° 43′ 29″ E. long. Few of the cities of France have a finer situation. The Isère unites with the Drac a few miles further down, and the broad and fertile valley through which the rivers flow is encompassed by a fine panorama of hills and mountains. From the botanic gardens, for example, the eastward view comprises the Savoy Alps with the summit of Mont Blanc, and the westward the mountains of St. Nizier, while more to the north the hills rise directly above the town, and are crowned by the fort of the Bastille. The beauty of the Isère itself is enhanced by fine bridges and quays. With the exception of its more modern portions, the town of Grenoble is characterized by the tortuous and crowded streets usual in places that have long been confined within strong fortifications. The cathedral of Notre Dame, a vast brick building of various periods from the 10th to the 17th century, the foundation of which is traditionally ascribed to Charles the Great; the church of St. Laurence, with a remarkable crypt of the 11th century, long believed to be an old temple of Æsculapius; and the church of St. André, founded by the dauphin Guigues André about 1220, and frequently visited for the sake of the tomb of Bayard removed thither in 1822, are the most noteworthy of the ecclesiastical edifices. The palais de justice is a striking erection of the 15th and 16th centuries occupying the site of the old castle of the dauphins, and in front is a statue of Bayard dating from 1823. The old town-hall has nothing remarkable about it; but the new prefecture, built at a cost of 1,404,000 francs about 1867, is a handsome structure. Besides its university or academy, with the three faculties of law, science, and literature, Grenoble possesses a lyceum, an episcopal seminary, a school of artillery of the first class, two normal schools, and a great variety of special educational institutions. The library, which since 1868 has been located along with the museum in a building which cost more than 1,500,000 francs, is a noble collection of upwards of 178,875 volumes, on which the town has expended 2,000,000 francs.[1] Among the numerous societies of Grenoble it is enough to mention the *Académie delphinale* (1772), the statistical society, the society of the friends of the arts, the society of agriculture, and the zoological society of the Alps, which maintains zoological gardens. At the head of the benevolent institutions is the general hospital, originally founded by Aimon Chissay in 1424, and now comprising civil and military departments, an orphanage, and an asylum for the aged and infirm. It was in Grenoble that the first mutual benefit society was founded in 1803, and the number of such associations in the town was upwards of 40 about 1870. In 1836 M. Berriat Saint Prix established a society for the extinction of mendicity, and in 1851 M. Frédéric originated an *association alimentaire* for the purpose of providing the poorer classes with good food at the cheapest possible rate. The staple industry of Grenoble is the making of gloves; 115 establishments, employing 2000 workmen and 20,000 needlewomen in the town and neighborhood, turn out annually 850,000 dozen pairs. Liqueurs, leather, straw hats, paper, lime, and cement hold a principal place among the miscellaneous products. The population of Grenoble was 26,852 in 1851, 35,280 in 1872, and 54,918 in 1901.

Grenoble occupies the site of Cularo, a village of the Allobroges which first became of importance when it was fortified by Diocletian and Maximian. Its present name is a corruption of Gratianopolis, a title assumed in honor of Gratian, who had strengthened the walls. From the Burgundians who gained possession in 467 the little town passed under the Franks, and on the dismemberment of the empire of Charles the Great it was included in the limits of Cisjuran Burgundy. After the 10th century its bishops grew into power, but they were finally supplanted in the 13th century by the counts of Albon, afterwards known as the Dauphins. Though it was ceded in 1349

[1] See Gariel, *La Bibliothèque de Grenoble, 1772–1878*, Paris, 1878.

to France along with Dauphiné, the city continued to enjoy special privileges. In 1563 it was sacked by the Baron des Adrets, but in 1572 the energy of its governor De Gorde saved it from sharing in the massacre of St. Bartholomew. Lesdiguières (Roi des Montagnes) took the town by siege in 1590 in name of Henry IV., and he afterwards made his governorship memorable by his fortifications, quays, and other serviceable enterprises. In the close of the 18th century the name of Grenoble appears in the van of the revolutionary movement; the attempt of the Government to substitute a new judicial régime for that of the too-indcpendent provincial parliament roused the people to arms and the "day of the tiles" (7th June, 1788) is memorable for the defeat of the royal forces. Grenoble was the first town to open its gates to Napoleon on his return from Elba in 1815, but a few months afterwards it was obliged to surrender to the Austrians. Owing to its situation Grenoble is subject to inundations; in 1219 it was almost swept away, and from that date to 1856 no fewer than 15 similar disasters are enumerated. The great flood of 1778 is known as the "Déluge de la Saint Crépin." In 1859 the water was 3 feet deep throughout the town. Among the celebrated natives of Grenoble are Vaucanson, Mably, Condillac, Beyle (Stendhal), Barnave, and Casimir Perier.

See Champollion Figeac, *Antiquités de Grenoble*, (Grenoble, 1807); Pitot, *Hist. de Grenoble et de ses environs* (Grenoble, 1829).

GRENVILLE, George (1712–1770), an English statesman, second son of Richard Grenville and Hester Temple, afterwards Countess Temple, was born October 14, 1712. He was educated at Eton and at Christ Church, Oxford, and in his twenty-fifth year was called to the bar. The habits of industry, the technical knowledge, and the intellectual discipline which he acquired in connection with his legal training were of great advantage to him in his political career, and for a considerable period sufficiently compensated for the absence of every oratorical gift except inexhaustible fluency, and of all but the merest rudimentary qualities of statesmanship. He entered Parliament in 1741 as member for Buckingham, and continued to represent that borough till his death in 1770. In December, 1744, he became a lord of the admiralty, in June, 1747, a lord of the treasury, and in 1754, treasurer of the navy and privy councillor. He remained in office in 1761, when his brother Lord Temple and his brother-in-law Pitt resigned upon the question of the war with Spain, and in the administration of Lord Bute he was entrusted with the leadership of the House of Commons. In May, 1762, he was appointed secretary of state, and in October, first lord of the admiralty; and in April, 1763, he became first lord of the treasury and chancellor of the exchequer. The most prominent measures of his administration were the prosecution of Wilkes and the passing of the American Stamp Act, which led to the first symptoms of alienation between America and the mother country. During the latter period of his term of office he was on a very unsatisfactory footing with the young king George III., who gradually came to feel a kind of horror of the interminable persistency of his conversation, and whom he endeavored to make use of as the mere puppet of the ministry. The king made various attempts to induce Pitt to come to his rescue by forming a ministry, but without success, and at last had recourse to the marquis of Rockingham, on whose agreeing to accept office Grenville was dismissed July, 1765. He never again held office, and died 13th November, 1770. In 1749 he was married to Elizabeth, daughter of Sir William Wyndham, by whom he had a large family. His son, the second Earl Temple, was created Marquis, and his grandson Duke, of Buckingham.

A contemptuous application by Pitt to Grenville of the lines "Gentle Shepherd, tell me where," caused him to be dubbed the "gentle shepherd" for the remainder of his life; and this would seem to indicate a deficiency in the personal characteristics which insure any high degree of general respect. Exemplary in the observance of all the decencies of private life, and upright and honorable in all his political relations, he yet possessed none of those attractive or commanding qualities which are sometimes found an advantageous substitute for strict moral integrity, and which the possessor of moral integrity cannot afford to despise. He was moreover under the dominion of an ambition ludicrously out of proportion to his abilities, and the self-confidence with which he pursued his own purposes can be attributed only to the narrow range of his political vision. Though few excelled him in a knowledge of the forms of the House or in mastery of administrative details, his tact in dealing with men and with affairs was so defective that there is perhaps no one who has been at the head of an English administration to whom a lower place can be assigned as a statesman. *The Grenville Papers, being the Correspondence of Richard Grenville, Earl Temple, K. G., and the Right Hon. George Grenville, their Friends and Contemporaries*, was published at London in 1852.

GRENVILLE, William Wyndham Grenville, Lord (1759–1834), English statesman, son of the preceding, was born 25th October, 1759. He was educated at Eton and Oxford, and for some time studied at the Inns of Court, but never practised at the bar. In February, 1782, he was elected a member of parliament for the county of Buckingham, and in September following he became secretary to his brother the marquis of Buckingham, who had been named lord-lieutenant of Ireland. On the overthrow of the cabinet of Lord Shelburne in the following year he returned to England, and in December he was appointed by his cousin Pitt paymaster-general of the forces. In 1789 he was chosen speaker of the House of Commons, but he vacated the chair in the same year, and was transferred to the Upper House with the title of Lord Grenville, on being appointed secretary of state. He exchanged this office in 1791 for that of secretary of foreign affairs, being regarded by Pitt as the person best fitted to carry out his policy in reference to France. Along with Pitt he resigned office in 1801, on account of the king declining to grant any concessions to the Catholics; and when Pitt, on accepting office in 1804, did not stipulate for Catholic emancipation he declined to join his ministry, and entered into a close alliance with Fox. On the death of Pitt in 1806 he became the nominal head of the Government of "All the Talents," whose military projects resulted very unsuccessfully, but which deserves to be remembered with honor on account of the Act for the abolition of the slave trade. Its influence was, however, considerably weakened by the death of Fox; and as the king in March, 1807, demanded from Grenville an assurance that he would initiate no measures for the relief of the Catholics he and his colleagues found it necessary to resign. His colleagues were not unanimous in approving of his conscientiousness, and Sheridan expressed the opinion of more than himself when he remarked: "I have known many men knock their heads against a wall, but I never before heard of a man collecting bricks and building a wall for the express purpose of knocking out his own brains against it." Lord Grenville never again held office. He continued to be one of the principal supporters of Catholic emancipation, and during the remainder of his political career generally voted with the Whigs, although in 1815 he separated himself from Lord Grey and supported the warlike policy of Lord Liverpool. In 1819, when the marquis of Lansdowne brought forward his motion for an inquiry into the cause of the distress and discontent in the manufacturing districts, Grenville delivered an alarmist speech in which he advocated the adoption of severely repressive measures. He died at his residence, Dropmore, Buckinghamshire, 12th January, 1834.

Though the talents of Lord Grenville were not of a high order, his straightforwardness, great industry, political knowledge, firmness of mind, and moderate opinions secured him considerable political influence. He can also lay claim to be enrolled among those English statesmen who have distinguished themselves in literature. Besides editing the letters of the earl of Chatham to his nephew Thomas Pitt, afterwards Lord Camelford, he printed for private circulation an edition of Homer with annotations and also a small volume entitled *Nugæ Metricæ*, consisting of translations into Latin from Greek, English, and Italian. In 1809 he was chosen chancellor of the university of Oxford. He married in 1792 Anne Pitt, daughter of Lord Camelford, but had no issue, and the title became extinct.

GRESHAM, Sir Thomas (1519–1579), a London merchant, the founder of the Royal Exchange and of Gresham College, London, was born in 1519. Descended from an old Norfolk family, he was the only son of Sir Richard Gresham, a leading London merchant, who for some time held the office of lord mayor and for his services as agent of Henry VIII. in negotiating loans with foreign merchants received the honor of knighthood. Though his father intended him to follow his own profession, he nevertheless sent him for some time to Caius College, Cambridge, but there is no information as to the duration of his residence. It is uncertain also whether it was before or after this that he was apprenticed to his uncle Sir John

Gresham, who was also a merchant, but we have his own testimony that he served an apprenticeship of eight years. In 1543 at the age of twenty-four he was admitted a member of the Mercers' Company, and in the same year he went to the Low Countries, where, either on his own account or on that of his father or uncle, he both carried on business as a merchant and acted in various matters as an agent for Henry VIII. In 1544 he married the widow of William Read, a London merchant, but he still continued to reside principally in the Low Countries, having his headquarters at Antwerp. When in 1551 the mismanagement of Sir William Dansell, "king's merchant" in the Low Countries, had brought the English Government into great financial embarrassment, Gresham was called in to give his advice, and chosen to carry out his own proposals. Their leading feature was the adoption of various methods—highly ingenious, but quite arbitrary and unfair—for raising the value of the pound sterling on the "bourse" of Antwerp, and it was so successful that in a few years nearly all King Edward's debts were discharged. The advice of Gresham was likewise sought by the Government in all their money difficulties, and he was also frequently employed in various diplomatic missions. He had no stated salary, but in reward of his services received from Edward various grants of lands, the annual value of which at that time was ultimately about £400 a year. On the accession of Mary the council resolved on his recall, but before the letter was sent they changed their opinion; and as he professed his zealous desire to serve the queen, and manifested great adroitness both in negotiating loans and in smuggling money, arms, and foreign goods, not only were his services retained throughout her reign, but besides his salary of twenty shillings *per diem* he received grants of church lands to the yearly value of £200. Under Queen Elizabeth, besides continuing to act as financial agent of the crown, he was for some time ambassador at the court of the duchess of Parma. In 1559 he received the honor of knighthood. By the outbreak of the war in the Low Countries he was compelled to leave Antwerp on the 19th March, 1567; but, though he spent the remainder of his life in London, he continued his business as merchant and financial agent of the Government in much the same way as formerly. Elizabeth also found him useful in a great variety of other ways, among which was that of acting as jailer to Lady Mary Grey, who, as a punishment for marrying Thomas Keys the sergeant porter, remained a prisoner in his house from June, 1569, to the end of 1572. In 1565 Gresham made a proposal to the court of aldermen of London to build at his own expense a bourse or exchange, on condition that they purchased for this purpose a piece of suitable ground. In this proposal he seems to have had an eye to his own interest as well as to the general good of the merchants, for by a yearly rental of £700 obtained for the shops in the upper part of the building he received a sufficient return for his trouble and expense. Gresham died suddenly, apparently of apoplexy, 21st November, 1579. His only son predeceased him, and his illegitimate daughter Anne he married to Sir Nicolas Bacon, brother of the great Lord Bacon. With the exception of a number of small sums bequeathed to the support of various charities, the bulk of his property, consisting of estates in various parts of England of the annual value of more than £2300, was bequeathed to his widow and her heirs with the stipulation that after her decease his residence in Bishopsgate Street, as well as the rents arising from the Royal Exchange, should be vested in the hands of the corporation of London, and the Mercers' Company, for the purpose of instituting a college in which seven professors should read lectures successively,—one each day of the week,—on astronomy, geometry, physic, law, divinity, rhetoric, and music. The lectures were begun in 1597, and were delivered in the original building until 1768, when, on the ground that the trustees were losers by the gift, it was made over to the crown for a yearly rent of £500, and converted into an excise office. From that time a room in the Royal Exchange was used for the lectures until in 1843 the present building was erected at a cost of £7000. It contains a large library, professors' rooms, and a theatre capable of holding 500 persons.

A notice of Gresham is contained in Fuller's *Worthies* and Ward's *Gresham Professors;* but the fullest account of him, as well as of the history of the Exchange and Gresham College, is that by J. M. Burgon in his *Life and Times of Sir Thomas Gresham*, 2 vols., 1839. See also a *Brief Memoir of Sir Thomas Gresham*, 1833; and *The Life of Sir Thomas Gresham, Founder of the Royal Exchange*, 1845.

GRESSET, Jean Baptiste (1709–1777). The literary history of Gresset might be dismissed with the simple statement that he wrote *Vert Vert.* By that one poem he is remembered. His life is, however, interesting from another fact, that he, who almost alone among French poets wrote nothing of which a moralist need be ashamed, spent the last twenty-five years of his life in regretting the frivolity which enabled him to produce the most charming of poems. He was born at Amiens, and brought up by the Jesuits of that place. As a boy he displayed such great promise that, according to the usual custom of the society, the fathers resolved to receive him among themselves. He was accepted as a novice at the age of sixteen, and sent to pursue his studies at the Collége Louis le Grand in Paris. After completing his course he was appointed, being then under twenty years of age, to a post as professor or assistant master in a college at Rouen. He was, it must be remembered, a son of the society of Jesus; as such he had been drilled and disciplined to perfect obedience; in every point except that of orders he was an ecclesiastic. Probably it was not the intention of the society that he should become a priest. They reckoned upon his continuing a lay brother, and helping the cause by his position as a teacher. From such a mind so trained, so taught to regard everything from the priestly point of view, devoted to the most severe studies, occupied in the grave and responsible work of teaching, what literary fruit was to be expected? Perhaps a treatise on a Greek particle, an essay on Latin style, a grammatical thesis, anything but that which really appeared,—the graceful, pleasant poem by which he will ever be remembered. He published *Vert Vert* at Rouen, being then twenty-four years of age. It is a story, in itself exceedingly humorous, showing how a parrot, the delight of a convent, whose talk was all of prayers and pious ejaculations, was conveyed to another convent as a visitor to please the nuns. On the way he falls among bad companions, forgets his convent language, and shocks the sisters on arrival by profane swearing. He is sent back in disgrace, punished by solitude and plain bread, presently repents, reforms, and is killed by kindness. The story, however, is nothing. The treatment of the subject, the atmosphere which surrounds it, the delicacy in which the little prattling ways of the nuns, their jealousies, their tiny trifles, are presented, takes the reader entirely by surprise. The poem stands absolutely unrivalled, even among French *contes en vers.*

Gresset found himself famous. He left Rouen, went up to Paris, where he found refuge in the same garret which had sheltered him when a boy at the Collége Louis le Grand, and there wrote his second poem, *Ma Chartreuse.* Then trouble came upon him; complaints were made to the fathers of the alleged licentiousness of verses which were as innocent as any school-girl's novel, the real cause of complaint being the ridicule which *Vert Vert* seemed to throw upon the whole race of nuns. An example, it was urged, must be made; Gresset was expelled the order. Men of robust mind would have been glad to get rid of such a yoke. Gresset, who had never been taught to stand alone, went forth weeping. He became a man of letters; he wrote many other poems, none of which made any mark. He never in fact attained the same level as *Vert Vert.* He wrote two or three comedies. One, called *Le Méchant,* still keeps the stage, though it is difficult to assign it much merit. He was admitted to the Academy. And then, still young, he retired to Amiens, where he fell into the hands of the priests, and became their abject slave. His brief relapse from the discipline of the church became the subject of the deepest remorse. He repented of his poems, and even went so far as to address to the bishop an abjuration of his title of dramatist, and to implore pardon of the Virgin for having written plays. The history of French literature presents many examples of poets in old age repenting the sins of their youth; the example of Gresset is unique as beginning, while in full manhood, a senile repentance for having even in so pleasant and innocent a way brought into ridicule the institutions of the church.

GRÉTRY, André Ernest Modeste (1741–1813), a celebrated composer of French opera, was born at Liége, February 11, 1741. He received his first musical education in the *maîtrise* of the college of St. Denis, where his father, a poor musician, occasionally acted as violinist. Leclerc and Renekin were his early masters. But of greater

importance was the practical tuition he received by attending the performance of an Italian opera company. Here he heard the operas of Galuppi, Perogolese, and other masters; and the desire of completing his own studies in Italy was the immediate result. To find the necessary means he composed in 1759 a mass which he dedicated to the canons of the Liége cathedral, who in return sent him to the Collége de Liége at Rome, founded by a citizen of Liége for the benefit of his townsmen studying in Rome. Here Grétry resided for five years, studiously employed in completing his musical education under Casali. His proficiency in harmony and counterpoint was, however, according to his own confession, at all times very moderate. Neither was any deep scholarship required for the style of composition to which he soon exclusively devoted himself. His first great success was achieved by an Italian intermezzo or operetta, *Le Vendemiatrici*, composed for the Aliberti theatre in Rome, and received with universal applause. It is said that the study of the score of one of Monsigny's operas, lent to him by a secretary of the French embassy in Rome, decided Grétry to devote himself to French comic opera. On New-Year's Day, 1767, he accordingly left Rome, and after a short stay at Geneva (where he made the acquaintance of Voltaire, and produced another operetta) went to Paris. There for two years he had to contend with the difficulties incident to poverty and obscurity. He was, however, not without friends, and by the intercession of one of these, Count Creutz, the Swedish ambassador, Grétry obtained a libretto from the celebrated Marmontel, which he set to music in less than six weeks, and which, on its performance in August, 1768, met with unparalleled success. The name of the opera was *Le Huron*. Two others, *Lucile* and *Le Tableau Parlant*, soon followed, and thenceforth Grétry's position as the leading composer of comic opera was safely established. Of the fifty operas which embody his musical activity only two or three have survived, and perhaps as many more are worth remembering. His masterpieces are *Zémire et Azor* and *Richard Cœur de Lion*,—the first produced in 1771, the second in 1784. The latter in an indirect way became connected with a great historic event. In it occurs the celebrated romance, *O Richard, ô mon roi, l'univers, t'abandonne*, which was sung at the banquet—"fatal as that of Thyestes," remarks Carlyle—given by the bodyguard to the officers of the Versailles garrison on October 3, 1789. The *Marseillaise* not long afterwards became the reply of the people to the expression of loyalty borrowed from Grétry's opera. The composer himself was not uninfluenced by the great events he witnessed, and the titles of some of his operas, such as *La Rosière Républicaine* and *Le Fête de la Raison* sufficiently indicate the epoch to which they belong; but they are mere *pièces de circonstance*, and the republican enthusiasm displayed is not genuine. Little more successful was Grétry in his dealings with classical subjects, and none of his operas belonging to that class are worth remembering. His genuine power lies in the delineation of character, and in the expression of tender and typically French sentiment. For the first-named purpose the careful and truly admirable fidelity with which his music is wedded to the words is invaluable. In this respect Grétry's works are indeed representative of French operatic music at its best. The structure of his concerted pieces on the other hand is frequently flimsy, and his instrumentation so feeble that the orchestral parts of some of his works had to be rewritten by other composers, in order to make them acceptable to modern audiences. Of his deficiencies of harmonization Grétry himself was well aware, and his confessions in this respect are strangely at variance with the self-sufficient tone which pervades his literary effusions on musical and even on political and social topics. During the Revolution Grétry lost much of his property, but the successive Governments of France vied in favoring the composer, regardless of political differences. From the old court he received distinctions and rewards of all kinds; the republic made him an inspector of the Conservatoire; Napoleon granted him the cross of the legion of honor and a pension. Grétry died September 24, 1813, at the Hermitage in Montmorency, formerly the house of Rousseau. Fifteen years later his heart was transferred to his birthplace, permission having been obtained after a tedious lawsuit. In 1842 Grétry's colossal statue in bronze was inaugurated at Liége.

GREUZE, Jean Baptiste (1725–1805), in the full tide of the 18th century, when professional distinction appeared to be reserved exclusively for those who devoted themselves to the production of historical or allegorical subjects, achieved an immense reputation as a painter of scenes of domestic life. He was born at Tournus in 1725, and is generally said to have formed his own talent; this is, however, true only in the most limited sense, for at an early age his inclinations, though thwarted by his father, were encouraged by a Lyonnese artist named Grandon or Grondom who enjoyed during his lifetime considerable reputation as a portrait-painter. Grandon not only persuaded the father of Greuze to give way to his son's wishes, and permit the lad to accompany him as his pupil to Lyons, but when at a later date he himself left Lyons for Paris—where his son-in-law Grétry the celebrated composer enjoyed the height of favor—Grandon carried young Greuze with him. Settled in Paris, Greuze worked from the living model in the school of the Royal Academy, but did not attract the attention of his teachers; and when he produced his first picture, Le Père de Famille expliquant la Bible à ses Enfants, considerable doubt was felt and shown as to his share in its production. By other and more remarkable works of the same class Greuze soon established his claims beyond contest, and won for himself the notice and support of the well-known connoisseur La Live de Jully, the brother-in-law of Madame d'Epinay. In 1755 Greuze exhibited his Aveugle Trompé, upon which, presented by Pigalle the sculptor, he was immediately *agréé* by the Academy. Towards the close of the same year he left France for Italy, in company with the Abbé Louis Gougenot, who had deserted from the magistrature,—although he had obtained the post of "conseillier au Châtelet,"—in order to take the "petit collet." Gougenot had some acquaintance with the arts, and was highly valued by the Academicians,—who, during his journey with Greuze elected him an honorary member of their body—on account of his studies in mythology and allegory; his acquirements in these respects are said to have been largely utilized by them, but to Greuze they were of doubtful advantage, and he lost rather than gained by this visit to Italy in Gougenot's company. He had undertaken it probably in order to silence those who taxed him with ignorance of "great models of style," but the Italian subjects which formed the entirety of his contributions to the Salon of 1757 showed that he had been put on a false track, and he speedily returned to the source of his first inspiration. In 1759, 1761 (L'Accordée de Village, —Louvre), and 1763 Greuze exhibited with ever increasing success; in 1765 he reached the zenith of his powers and reputation. In that year he was represented with no less than thirteen works, amongst which may be cited La Jeune Fille qui pleure son Oiseau mort, La Bonne Mère, Le Mauvais Fils puni (Louvre), and La Malédiction Paternelle (Louvre). The Academy took occasion to press Greuze for his diploma picture, the execution of which had been long delayed, and forbade him to exhibit on their walls until he had complied with their regulations. "J'ai vu la lettre," says Diderot, "qui est un modèle d'honnêteté et d'estime; j'ai vu la réponse de Grenze qui est un modèle de vanité et d'impertinence: il fallait appuyer cela d'un chef-d'œuvre, et c'est ce que Greuze n'á pas fait." Greuze wished to be received as an historical painter, and produced a work which he intended to vindicate his right to despise his qualifications as a *peintre de genre*. This unfortunate canvas,—Sevère et Caracalla (Louvre),—was exhibited in 1769 side by side with Greuze's portrait of Jeaurat (Louvre), and his admirable Petite Fille au Chien Noir. The Academicians received their new member with all due honors, but at the close of the ceremonies the Director addressed Greuze in these words—"Monsieur, l'Académie vous a reçu, mais c'est comme peintre de genre; elle a eu égard à vos anciennes productions, qui sont excellentes, et elle a fermé les yeux sur celle-ci, qui n'est digne ni d'elle ni de vous." Greuze, greatly incensed, quarrelled with his *confrères*, and ceased to exhibit until, in 1804, the Revolution had thrown open the doors of the Academy to all the world. In the following year, on 4th March, 1805, he died in the Louvre in great poverty. He had been in receipt of considerable wealth, which he had dissipated by extravagance and bad management, so that during his closing years he was forced even to solicit commissions which his enfeebled powers no longer enabled him to carry out with success. The brilliant reputation which Greuze acquired seems to have been due, not to his acquirements as a painter,—for his practice is evidently that current in his own day,—but to the character

of the subjects which he treated. That return to nature which inspired Rousseau's attacks upon an artificial civilization demanded expression in art. Diderot in *Le Fils Natural et le Père de Famille* tried to turn the vein of domestic drama to account on the stage; that which he tried and failed to do, Greuze, in painting, achieved with extraordinary success, although his works, like the plays of Diderot, were affected by that very artificiality against which they protested. The touch of melodramatic exaggeration, however, which runs through them finds an apology in the firm and brilliant play of line, in the freshness and vigor of the flesh tints, in the enticing softness of expression (often obtained by almost an abuse of *méplats*), by the alluring air of health and youth, by the sensuous attractions, in short, with which Greuze invests his lessons of bourgeois morality. As Diderot said of La Bonne Mère, "ça prèche la population;" and a certain piquancy of contrast is the result which never fails to obtain admirers. La Jeune Fille à l'Agneau fetched, indeed, at the Pourtalis sale in 1865 no less than 1,000,200 francs. One of Greuze's pupils, Madame Le Doux, imitated with success the manner of her master; his daughter and granddaughter, Madame de Valory, also inherited some traditions of his talent. Madame de Valory published in 1813 a Comédie-vaudeville, *Greuze, ou l'Accordée de Village*, to which she prefixed a notice of her grandfather's life and works, and the *Salons* of Diderot also contain, besides many other particulars, the story at full length of Greuze's quarrel with the Academy. Four of the most distinguished engravers of that date, Massard père, Flipart, Gaillard, and Levasseur, were specially entrusted by Greuze with the reproduction of his subjects, but there are also excellent prints by other engravers, notably by Cars and Le Bas.

(E. F. S. P.)

GREVILLE, Charles Cavendish Fulke (1794–1865), a great-grandson by his father of the fifth earl of Warwick, and son of Lady Charlotte Bentinck, daughter of the duke of Portland, formerly a leader of the Whig party, and first minister of the crown. Greville was born 2d April, 1794. Much of his childhood was spent at his grandfather's house at Bulstrode. He was one of the pages of George III., and was educated at Eton and Christ Church, Oxford; but he left the university early, having been appointed private secretary to Earl Bathurst before he was twenty. The interest of the duke of Portland had secured for him the secretaryship of the island of Jamaica, which was a sinecure office, the duties being performed by a deputy, and the reversion of the clerkship of the council. Greville entered upon the discharge of the duties of clerk of the council in ordinary in 1821, and continued to perform them for nearly forty years. He therefore served under three successive sovereigns,—George IV., William IV., and Victoria,—and although no political or confidential functions are attached to that office, it is one which brings a man into habitual intercourse with the chiefs of all the parties in the state. Well-born, well-bred, handsome, and accomplished, Greville led the easy life of a man of fashion, taking an occasional part in the transactions of his day and much consulted in the affairs of private life. But the celebrity which now attaches to his name is entirely due to the posthumous publication of a portion of a Journal or Diary which it was his practice to keep during the greater part of his life. These papers were given by him to his friend Mr. Reeve a short time before his death (which took place on the 18th January, 1865), with an injunction that they should be published, as far as was feasible, at not too remote a period after the writer's death. The journals of the reigns of George IV. and William IV. (extending from 1820 to 1837) were accordingly so published in obedience to his directions about ten years after that event. Few publications have been received with greater interest by the public; five large editions were sold in little more than a year, and the demand in America was as great as in England. These journals were regarded as a faithful record of the impressions made on the mind of a competent observer, at the time, by the events he witnessed and the persons with whom he associated. Their characteristic is the love of truth, of justice, and of sincerity. The court was irritated at the scornful disclosure of the vices and follies of former sovereigns, and fashionable society was annoyed at the writer's absolute indifference to its pretensions. But Greville did not stoop to collect or record private scandal. His object appears to have been to leave behind him some of the materials of history, by which the men and actions of his own time would be judged. He records not so much public events as the private causes which led to them; and perhaps no English memoir-writer has left behind him a more valuable contribution to the history of this century. Greville published anonymously, in 1845, a volume on the policy of England to Ireland, in which he advocated the payment of the Roman Catholic clergy; and he was also the author of several pamphlets on the events of his day.

GREW, Nehemiah (1628–1711), the earliest vegetable anatomist and physiologist of England, was the son of Obadiah Grew, nonconformist divine of St. Michael's Coventry. At the Restoration, his father being ejected from his living, he went to a foreign university, where he took the degree of doctor of physic. Returning to Coventry, his native town, he commenced a series of observations on the physiology of plants, communicating the results to the Royal Society, by which they were so well received that he was induced to remove to London (1672). There he acquired an extensive practice as a physician. He was elected a fellow of the Royal Society on the recommendation of Bishop Wilkins, and in 1677 he succeeded Mr. Oldenburg as secretary, in which capacity he prepared a descriptive catalogue of the rarities preserved at Gresham College (1681). The following year appeared his celebrated work on the *Anatomy of Plants*, in which he displayed great originality as an investigator, especially in pointing out the sex-differences of plants. Linnæus named a genus of plants *Grewia* (natural family of *Tiliaceæ*) in his honor.

He edited the *Philosophical Transactions*, begun in 1665, and wrote treatises on *Sea-Water made Fresh*, which passed through several editions, and on the *Nature and Use of the Salt contained in Epsom and such other Waters* (1697), a rendering of the *Tractatus de Salis*, etc., *Usu* (1695). Besides the *Anatomy of Plants*, he wrote a *Comparative Anatomy of Trunks* (1675), and an *Idea of a Phytological History* (1673), as well as *Cosmologia Sacra* (1701). There is also a *Disputatio de liquore nervoso* by him (1672), and *Recueil d'expériences . . . sur le combat qui procède du mélange des corps* (1679).

GREY, Earl (1764–1845). Charles, second Earl Grey, was the eldest surviving son of General Sir Charles Grey, afterwards first Earl Grey. He was born at his father's residence, Fallodon, near Alnwick, March 13, 1764. General Grey, who was a younger son of the house of Grey of Howick, one of the most considerable territorial families in Northumberland, had already begun a career of active service which, like the political career of his son, covered nearly half a century. Before the latter was born, General Grey had served on the staff of Prince Ferdinand of Brunswick in the Seven Years' War, and had been wounded at Minden. While the son was making verses at Eton, the father was serving against the revolted colonists in Pennsylvania and New Jersey, and while the young member for Northumberland was denouncing Pitt's war against the Convention, the veteran soldier was destroying the remnant of the French colonial empire by the capture of Martinique and Guadaloupe. When Napoleon threatened an invasion, General Grey took the command of the southern district, and at the peace of Amiens he was rewarded with a peerage. His elder brother, Sir Henry Grey of Howick, the head of the family, had supported the Government in parliament. But the political career of young Grey, who was heir-presumptive to the family estates, took a different complexion, which needs to be explained by the circumstances in which it began.

Young Grey expected to reoccupy the seat which had been his uncle's; and his early years were spent in preparation for a parliamentary career. He was sent to Eton, and proceeded thence to Cambridge. William Pitt, a youth five years older, was then in residence as a master of arts, studiously paying court to the Whigs of the university; and at the general election of 1780 he came forward as a candidate for the academical seat. His name stood last on the poll, but he was brought in elsewhere, and his first speech proved him a man of the first mark. The unparalleled successes which followed portended grave changes. Pitt's elevation to the premiership, his brilliant and hard-fought battle in the house, and his complete rout of the Whig party at the general election of 1784, when he came in for Cambridge at the head of the poll, threatened the great territorial interest with nothing less than extinction. It was to this interest that Grey belonged; and hence, when at length returned for Northumberland in 1786, he at once came forward as a vigorous assailant of the Government of Pitt.

He was hailed by the opposition, and associated with Fox, Burke, and Sheridan as a manager in the Hastings impeachment. During the nineteen years which remained of the career of Fox, he followed the great Whig statesman with absolute fidelity, and succeeded him as leader of the party. The shortcomings of Fox's statesmanship were inherited by Grey. Both were equally devoid of political originality, shunned the severer labors of the politician, and instinctively feared any deviation from the traditions of their party. Such men cannot save a party in its decadence, and the history of Fox and Grey has been aptly termed the history of the decline and fall of Whiggism.

The stunning blow of 1784 was the first incident in this history. Its full significance was not at once perceived. An opposition, however weak in the beginning, generally has a tendency to revive, and Grey's early successes in the house helped to revive the Foxites. The European situation became favorable to this revival. The struggle in France for popular rights, culminating in the great Revolution, was watched by Fox with interested sympathy. He affected to regard the domination of Pitt as the domination of the crown, and as leading logically to absolutism, and saw in that popular sympathy for the French Revolution which naturally arose in England an instrument which might be employed to overthrow this domination.

But Pitt gathered the fruits of the windfall. The spread of "Jacobinism," or "French principles," became the pretext on which the stronger half of the opposition went over to the Government. Burke led the movement in the Commons, the duke of Portland and Lord Fitzwilliam in the Lords, and with this second incident in the Whig decline began the difficulties of Grey's career. The domination of the premier had already stirred the keenest resentment in the younger and more ambitious members of the Whig party. Freed from the restraint of the steadier politicians under Burke and Portland, the residuum under Fox fell into a series of grave mistakes. Of this residuum Grey became the moving spirit, for though Fox did not check their activity, he disclaimed the responsibility of their policy. Fox had refused to condemn "French principles," and denounced the war with France; but he would take no part in exciting agitation in England. It was otherwise with the restless spirits among whom Grey was found. Enraged by the attitude of Pitt, which was grounded on the support of the constituencies as they then stood, the residuum plotted an ill-timed agitation for parliamentary reform.

The demand for parliamentary reform was as yet in a rudimentary stage. Forty years later it had become the demand of an unenfranchised nation, disabused by a sudden spread of political and economical knowledge. It was as yet but the occasional instrument of the scheming politician. Chatham had employed the cry in this sense. The Middlesex agitators had done the same; even the premier of the time, after his accession to power, had sought to strengthen his hands in the same way. But Pitt's hands were now strengthened abundantly; whereas the opposition had nothing to lose and much to gain by such a measure. The cry for reform thus became their natural expedient. Powerless to carry reform in the House, they sought to overawe parliament by external agitation, and formed the Society of the Friends of the People, destined to unite the forces of all the "patriotic" societies which already existed in the country, and to pour their violence irresistibly on a terrified parliament. Grey and his friends were enrolled in this portentous association, and presented in parliament its menacing petitions. Such petitions, which were in fact violent impeachments of parliament itself, proceeding from voluntary associations having no corporate existence, had been hitherto unknown in the English parliament. They had been well-known in the French assembly. They had heralded and furthered the victory of the Jacobins, the dissolution of the constitution, the calling of the Convention, and the fall of the monarchy.

The Society of the Friends of the People was originally an after-dinner folly, extemporized at the house of a man who afterwards gained an earldom by denouncing it as seditious. Fox discountenanced it, though he did not directly condemn it; but Grey was overborne by the fierce Jacobinism of Lauderdale, and avowed himself the parliamentary mouthpiece of this dangerous agitation. But Pitt, strong in his position, cut the ground from under Grey's feet by suppressing the agitation with a strong hand. The suspension of the Habeas Corpus Act, the Gagging Acts, and the state prosecutions form a painful historical episode. But the discredit belongs as much to Grey and Lauderdale as to Pitt. Grey always spoke regretfully of his share in the movement. "One word from Fox," he said, "would have kept me out of all the mess of the Friends of the People. But he never spoke it."

It was Grey who moved the impeachment of Pitt, and he next promoted the equally foolish "Secession." Since the parliament did not properly represent the nation, and refused to reform itself or to impeach the minister, nothing remained but to disown it; and the opposition announced their intention of "seceding," or systematically absenting themselves from their places in parliament. This futile movement was originated by Grey, Lauderdale, and the duke of Bedford. It obtained a somewhat wider support. It suited the languor of some dispirited politicans, like Fox, and the avarice of some lawyers in large practice, like Erskine; but sensible politicians at once condemned it. It directly ignored parliamentary government, and amounted to nothing but a pettish threat of revolution. "Secession," said Lord Lansdowne, with characteristic shrewdness, "either means rebellion, or it is nonsense." Pitt easily dashed this feeble weapon from the hands of his opponents. He roused jealousy in the absent by praising the parts and the patriotism of the rest, and thus gradually brought them back. Grey himself reappeared to protest against the union with Ireland.

When Pitt died in 1806, nothing could prevent the reunited opposition from coming into power, and thus the Broad-bottom ministry was formed under Fox. On his death, Grenville became premier, and Grey, now Lord Howick, Foreign Secretary, and leader of the House of Commons. Disunion, always the bane of English Liberalism, lurked in the coalition, and the Foxites and Grenvillites were only ostensibly at one. Grey opposed the war policy of Grenville; and this policy was not more successful than it had been in the hands of Pitt. And the change from the leadership of Fox to that of Grenville was only too perceptible. Both in court and country Grenville affected the role of Pitt, and assumed a stiff and peremptory attitude which ill became him. An ill-advised dissolution weakened their majority; they lost ground by the "delicate investigation" into the conduct of the Princess of Wales; Lord Henry Petty's budget was too specious to command confidence; and the king, fully aware of their weak situation, resolved to get rid of them. When they proposed to concede a portion of the Catholic claims, George refused, and demanded of them an undertaking never to propose such a measure again. This was refused, and the Grenville-Grey cabinet retired in March, 1807. In the same year Grey's father died, and Grey went to the Upper House. Opposition united Grey and Grenville for a time, but the parties finally split on the old war question. When Napoleon returned from Elba in 1815, and once more seized the government of France, the same question arose which had arisen in 1792, Was England to go to war for the restoration of the Bourbons? Grenville followed the traditions of Pitt, and supported the ministry in at once renewing hostilities. Grey followed those of Fox, and maintained the right of France to choose her own governors, and the impossibility of checking the reaction in the emperor's favor. The victory of Waterloo put an end to the dispute, but the disruption became permanent. The termination of the war, and the cessation of all action in common, reduced the power of the opposition to nothing. Grenville retired from public life, and his adherents reinforced the ministry. Little remained for the Whigs to do. But the scandalous persecution of the queen afforded an opportunity of showing that the ministry were not omnipotent; and the part taken on that occasion by Grey won him at once the increased respect of the nation and the undying aversion of George IV. It sealed the exclusion of himself and his few friends from office during the king's life; and when in 1827 Grey came forth to denounce the ministry of Canning, he declared that he stood alone in the political world. His words were soon justified, for when Lord Goderich resigned, the remnant which had hitherto supported Grey hastened to support the ministry of the duke of Wellington. Thus was the original Whig party dissolved, after a series of struggles which had begun with the longest reign upon record, and had outlasted it.

We now reach the principal episode in Grey's career. In

1827 he seemed to stand forth the solitary and powerless relic of an extinct party. In 1832 we find that party restored to its old numbers and activity, supreme in parliament, popular in the nation, and Lord Grey at its head. The duke of Wellington's foolish declaration against parliamentary reform, made in a season of great popular excitement, suddenly deprived him of the confidence of the country, and a coalition of the Whigs and Canningites became inevitable. The Whigs had in 1827 supported the Canningites; the latter now supported the Whigs, of whom Grey remained the traditional head. George IV. was dead, and no obstacle existed to Grey's elevation. Grey was sent for by William IV. in November, 1830, and formed a coalition cabinet, pledged to carry on the work in which the duke of Wellington had faltered. But Grey himself was the mere instrument of the times. An old-fashioned Whig, he had little personal sympathy with the popular cause, though he had sometimes indicated a certain measure of reform as necessary. When he took office, he guessed neither the extent to which the Reform Act would go, nor the means by which it would be carried. That he procured for the country a measure of constitutional reform for which he had agitated in his youth was little more than a coincidence. In his youth he had put himself at the head of a frantic agitation against parliament, because he there found himself powerless. In his old age the case was reversed. Suddenly raised to a position of authority in the country, he boldly stood between parliament, as then constituted, and the formidable agitation which now threatened it, and by a forced reform saved it from revolution. In his youth he had assailed Pitt's administration because Pitt's administration threatened with extinction the political monopoly of that landed interest to which he belonged. In his old age, on the contrary, unable to check the progress of the wave, he swam with it, and headed the movement which compelled that landed interest to surrender its monopoly.

The second reading of the first Reform Bill was carried in the Commons by a majority of one. This was equivalent to a defeat, and further failures precipitated a dissolution. The confidence which the bold action of the ministry had won was soon plainly proved, for the second reading was carried in the new parliament by a majority of 136. When the bill had at length passed the Commons after months of debate, it was Grey's task to introduce it to the Lords. It was rejected by a majority of 41. The safety of the country now depended on the prudence and courage of the ministry. The resignation of Grey and his colleagues was dreaded even by the opposition, and they remained in office with the intention of introducing a third Reform Bill in the next session. The last months of 1831 were the beginning of a political crisis such as England had not seen since 1688. The two extreme parties, the Ultra-Radicals and the Ultra-Tories, were ready for civil war. Between them stood the ministry and the majority of intelligent peace-loving Englishmen; and their course of action was soon decided. The bill must be passed, and there were but two ways of passing it. One was to declare the consent of the House of Lords unnecessary to the measure, the other to create, if necessary, new peers in sufficient number to outvote the opposition. These two expedients did not in reality differ. To swamp the house in the way proposed would have been to destroy it. The question whether the ministry should demand the king's consent to such a creation, if necessary, was debated in the cabinet in September. Brougham proposed it, and gradually a majority of the cabinet were won over. Grey had at first refused to employ even the threat of so unconstitutional a device as a means to the proposed end. But his continued refusal would have broken up the ministry, and the breaking up of the ministry must now have been the signal for revolution. The second reading in the Commons was passed in December by a majority of 162, and on New-Year's Day, 1832, the majority of the cabinet resolved on demanding power to carry it in the Lords by a creation of peers. Grey carried the resolution to the king. Some time still remained before the bill could be committed and read a third time. It was not until the 9th of April that Grey moved the second reading in the Lords. A sufficient number of the opposition temporized; and the second reading was allowed to pass by a majority of nine. Their intention was to mutilate the bill in committee. The Ultra-Tories, headed by the duke of Wellington, had entered a protest against the second reading, but they were now politically powerless. The struggle had become a struggle on the one hand for the whole bill, to be carried by a creation of peers, and on the other for some mutilated measure. Grey's instinct divined that the crisis was approaching. Either the king must consent to swamp the house, or the ministry must cease to stand in the breach between the peers and the country. The king, a weak and inexperienced politician, had in the mean time been wrought upon by the temporizing leaders in the Lords. He was induced to believe that if the Commons should reject the mutilated bill when it was returned to them, and the ministry should consequently retire, the mutilated bill might be reintroduced and passed by a Tory ministry. He was deaf to all representations of the state of public opinion; and to the surprise of the ministry, and the terror and indignation of every man of sense in the country, he rejected their proposal, and accepted their resignation, May 9, 1832. The duke of Wellington undertook the hopeless task of constructing a ministry which should pass a restricted or sham Reform Bill. The only man who could have made the success of such a ministry even probable was Peel, and Peel's conscience and good sense forbade the attempt. He refused, and after a week of the profoundest agitation throughout the country, the king, beaten and mortified, was forced to send for Grey and Brougham. On being told that his consent to the creation of peers was the only condition on which they could undertake the Government, he angrily and reluctantly yielded. The chancellor, with cool forethought, demanded this consent in writing. Grey thought such a demand harsh and unnecessary. "I wonder," he said to Brougham, when the interview was over, "you could have had the heart to press it." But Brougham was inexorable, and the king signed the following paper:—"The king grants permission to Earl Grey, and to his chancellor, Lord Brougham, to create such a number of peers as will be sufficient to ensure the passing of the Reform Bill, first calling up peers' eldest sons.—WILLIAM R., Windsor, May 17, 1832." This brief paper may be called the Magna Charta of responsible government. It established the right of a ministry to break down, by some convenient means, a factious opposition in the Lords; and this right has never since been practically disputed.

Grey had now won the game. There was no danger that he would have to resort to the expedient which he was authorized to employ. The introduction of sixty new peers would have destroyed the opposition, but it would have been equivalent to the abolition of the house. The king's consent made known, a sufficient number of peers were sure to withdraw to enable the bill to pass, and thus the dignity of both king and peerage would be saved. The duke of Wellington headed this movement on the part of the opposition; and the third reading of the bill was carried in the Lords by a majority of 84.

It is well known that in after years both Grey and Brougham disclaimed any intention of executing their threat. If this were so, they must have merely pretended to brave a danger which they secretly feared to face, and intended to avoid; and the credit of rescuing the country would belong to the duke of Wellington and the peers who seceded with him. To argue such cowardice in them from statements made when the crisis was long past, and when they were naturally willing to palliate the rough policy which they were forced to adopt, would be to set up a needless and unjustifiable paradox. Nothing else in the career of either Grey or Brougham leads us to suppose them capable of the moral baseness of yielding up the helm of state, in an hour of darkness and peril, to reckless and unskilled hands. Such would have been the result if they had lacked the determination to carry out their programme to the end. The influence of every statesman in the country would then have been extinguished, and the United Kingdom would have been absolutely in the hands of O'Connell and Orator Hunt.

Grey took but little part in directing the legislation of the reformed parliament. Never anxious for power, he had executed the arduous task of 1831–2 rather as a matter of duty than of inclination, and wished for an opportunity of retiring. Such an opportunity very shortly presented itself. The Irish policy of the ministry had not conciliated the Irish people, and O'Connell denounced them with the greatest bitterness. On the renewal of the customary

Coercion Bill, the ministry was divided on the question whether to continue to the lord-lieutenant the power of suppressing public meetings. Mr. Littleton, the Irish secretary, was for abolishing it; and with the view of conciliating O'Connell, he informed him that the ministry intended to abandon it. But the result proved him to have been mistaken, and O'Connell, with some reason supposing himself to have been duped, called on Mr. Littleton to resign his seat in the cabinet. It had also transpired in the discussion that Lord Althorp, the leader of the House of Commons, was privately opposed to retaining those clauses which it was his duty to push through the house. Lord Althorp therefore resigned, and Grey, who had lately passed his seventieth year, took the opportunity of resigning also. It was his opinion, it appeared, which had overborne the cabinet in favor of the public meeting clauses; and his voluntary withdrawal enabled Lord Althorp to return to his post, and to proceed with the bill in its milder form. Grey was succeeded by Lord Melbourne; but no other change was made in the cabinet. Grey took no further part in politics. During most of his remaining years he continued to live in retirement at Howick, where he died on the 17th of July, 1845, in his eighty-second year. By his wife Mary Elizabeth, only daughter of the first Lord Ponsonby, whom he married November 18, 1794, he became the father of ten sons and five daughters, of whom eight sons and four daughters survived him.

In public life, Grey could always be upon occasion bold, strenuous, and self-sacrificing; but he was little disposed for the active work of the politician. He was not one of those who took the statesman's duty "as a pleasure he was to enjoy." A certain stiffness and reserve ever seemed in the popular eye to hedge him in; nor was his oratory of the kind which stirs enthusiasm and delight. A tall, stately figure, fine voice, and calm aristocratic bearing reminded the listener of Pitt rather than of Fox, and his speeches were constructed on the Attic rather than the Asiatic model. Though simple and straightforward, they never lack either point or dignity; and they were admirably adapted to the audience to which they were addressed. The scrupulous uprightness of Grey's political and private character completed the ascendency which he gained; and no politician could be named who, without being a statesman of the highest class, has left a name more enviably placed in English history. (E. J. P.)

GREY, Lady Jane (1537–1554), a person remarkable no less for her accomplishments than for her misfortunes, was the great-granddaughter of Henry VII. of England. Her descent from that king was traced through a line of females. His second daughter Mary, after being left a widow by Louis XII. of France, married Charles Brandon, duke of Suffolk, who was a favorite with her brother King Henry VIII. Of this marriage came two daughters, the elder of whom, Lady Frances Brandon, was married to Henry Grey, marquis of Dorset; and their issue, again, consisted of daughters only. Lady Jane, the subject of this article, was the eldest of three whom the marquis had by Lady Frances. Thus it will appear that even if the crown of England had ever fallen into the female line of descent from Henry VII., she could not have put in a rightful claim unless the issue of his elder daughter, Margaret, had become extinct. But Margaret had married James IV. of Scotland; and though her descendant, James VI., was ultimately called to the English throne, Henry VIII. had placed her family after that of his second sister in the succession; so that failing the lawful issue of Henry himself, Lady Jane would, according to this arrangement, have succeeded. It was to these circumstances that she owed her exceptional position in history, and became the victim of an ambition which was not her own.

She was born at her father's seat named Broadgate in Leicestershire, about the year 1537. Her parents, though severe disciplinarians, bestowed more than ordinary care upon her education, and she herself was so teachable, and delighted so much in study, that she became the marvel of the age for her acquirements. She not only excelled in needlework and in music, both vocal and instrumental, but while still very young she had thoroughly mastered Latin, Greek, French, and Italian. She was able to speak and write both Greek and Latin with an accuracy that satisfied even such critics as Ascham and her tutor Dr. Aylmer, afterwards bishop of London. She had also acquired some knowledge of at least three Oriental tongues, Hebrew, Chaldee, and Arabic. In Ascham's *Schoolmaster* is given a touching account of the devotion with which she pursued her studies and the harshness she experienced from her parents. The love of learning was her solace; in reading Demosthenes and Plato she found a refuge from domestic unhappiness. After the fashion of those days she was, when about ten years old, placed for a time in the household of Thomas, Lord Seymour, who induced her parents to let her stay with him by promising to marry her to his nephew King Edward VI. Lord Seymour, however, was attainted of high treason and beheaded in 1549, and his brother, the duke of Somerset, made some overtures to the marquis of Dorset to marry her to his son the earl of Hertford. These projects, however, came to nothing. The duke of Somerset in his turn fell a victim to the ambition of Dudley duke of Northumberland, and was beheaded three years after his brother. Meanwhile the dukedom of Suffolk having become extinct by the deaths of Charles Brandon and his two sons, the title was conferred upon the marquis of Dorset, Lady Jane's father. Northumberland, who was now all-powerful, fearing a great reverse of fortune in case of the king's death, whose health soon began visibly to decline, endeavored to strengthen himself by marriages between his family and those of other powerful noblemen, especially of the new-made duke of Suffolk. His three eldest sons being already married, the fourth, who was named Lord Guildford Dudley, was accordingly wedded to Lady Jane Grey about the end of May, 1553. The match received the full approval of the king, who furnished the wedding apparel of the parties by royal warrant. But Edward's state of health warned Northumberland that he must lose no time in putting the rest of his project into execution. He persuaded the king that if the crown should descend to his sister Mary, the work of the Reformation would be undone and the liberties of the kingdom would be in danger. Besides, both Mary and her sister Elizabeth had been declared illegitimate by separate Acts of Parliament, and the objections to Mary Queen of Scots did not require to be pointed out. Edward was easily persuaded to break through his father's will and make a new settlement of the crown by deed. The document was witnessed by the signatures of all the council and of all but one of the judges; but those of the latter body were not obtained without difficulty by threats and intimidation.

Edward VI. died on the 6th July, 1553, and it was announced to Lady Jane that she was queen. She was then but sixteen years of age. The news came upon her as a most unwelcome surprise, and for some time she resisted all persuasions to accept the fatal dignity; but at length she yielded to the entreaties of her father, her father-in-law, and her husband. The better to mature their plans the cabal had kept the king's death secret for some days, but they proclaimed Queen Jane in the city on the 10th. The people received the announcement with manifest coldness, and a vintner's boy was even so bold as to raise a cry for Queen Mary, for which he next day had his ears nailed to the pillory and afterwards cut off. Mary, however, had received early intimation of her brother's death, and, retiring from Hunsdon into Norfolk, gathered round her the nobility and commons of those parts. Northumberland was despatched thither with an army to oppose her; but after reaching Newmarket he complained that the council had not sent him forces in sufficient numbers, and his followers began to desert. News also came that the earl of Oxford had declared for Queen Mary; and as most of the council themselves were only seeking an opportunity to wash their hands of rebellion, they procured a meeting at Baynard's Castle, revoked their former acts as done under coercion, and caused the lord mayor to proclaim Queen Mary, which he did amid the shouts of the citizens. The duke of Suffolk was obliged to tell his daughter that she must lay aside her royal dignity and become a private person once more. She replied that she relinquished most willingly a crown that she had only accepted out of obedience to him and her mother; and her ten days' reign was over.

The leading actors in the conspiracy were now called to answer for their deeds. Northumberland was brought up to London a prisoner, tried and sent to the block, along with some of his partisans. The duke of Suffolk and Lady Jane were also committed to the Tower; but the former, by the influence of his duchess, procured a pardon. Lady Jane and her husband Lord Guildford Dudley were also

tried, and received sentence of death for treason. This, however, was not immediately carried out; on the contrary the queen seems to have wished to spare their lives, and mitigated the rigor of their confinement. Unfortunately, owing to the general dislike of the queen's marriage with Philip of Spain, Sir Thomas Wyatt soon after raised a rebellion in which the duke of Suffolk and his brothers took part, and on its suppression the queen was persuaded that it was unsafe to spare the lives of Lady Jane and her husband any longer. On hearing that they were to die, Lady Jane declined a parting interview with her husband lest it should increase their pain, and prepared to meet her fate with Christian fortitude. She and her husband were executed on the same day, February 12, 1554, her husband on Tower Hill, and herself within the Tower an hour afterwards, amidst universal sympathy and compassion.

See Ascham's *Schoolmaster*; *Biog. Brit.*; Burnet's *History of the Reformation*; Howard's *Lady Jane Grey*; Nicolas's *Literary Remains of Lady Jane Grey*. (J. GA.)

GREYHOUND. See Dog, vol. vii. p. 284, and Coursing.

GREYTOWN, or more correctly San Juan del Norte, a small town of Nicaragua, worthy of note as the only port of the republic on the coast of the Atlantic and as the eastern terminus proposed for the Nicaraguan inter-oceanic canal. According to the survey of Commanders Hatfield and Lull, U. S. N., in 1872–3, the church is situated in 10° 55′ 14″ N. lat. and 83° 42′ 18″ W. long. The town lies along the seaward side of a narrow peninsula formed by the windings of the San Juan river, and most of its buildings are insignificant erections raised 2 or 3 feet on piles. Though it is still a port of call for mail steamers, and monopolizes the export and import trade of Nicaragua, Greytown is in a decadent condition. Its fine harbor has become almost useless. Between 1832 and 1848 the Arenas Point, which formed one of its boundaries, advanced westward nearly a nautical mile, and now the whole seaward frontage of the bay is a moving sand-bank. In 1853 the channel of entrance was still about one-third of a mile in width and had 23 to 25 feet of water on the bar, so that even vessels of war were able to take shelter within the harbor; but by 1801 the channel was only 100 yards wide and 12 feet deep, and in 1875 the passage was sometimes practically closed, with at the most only 5 feet of water. The inhabitants of the town, however, have increased from 955 in 1863 to about 1200 in 1875. As the vicinity of their town is unfitted for agriculture, they are almost entirely dependent for provisions on supplies from the interior or abroad, and sometimes the commonest articles of consumption are exceedingly scarce. In terms of the treaty of 1860 trial by jury is maintained in all civil and criminal cases, and there is perfect freedom of religious worship, both private and public. The seventh article, however, by which Greytown was to remain a free port has become a dead letter. A duty of 5 per cent. was allowed by the merchants on all imports consumed in the place in order to provide means for constructing a lighthouse; and in 1863 the central Government of the republic imposed another 5 per cent., so that all goods really pay 10 per cent. *ad valorem*. The imports in 1875 and 1876 respectively were £25,350 and £105,000, and the exports £60,500 and £145,000.

The harbor of San Juan, first discovered by Columbus, was brought into further notice by Captain Diego Machuca, who in 1529 sailed down the river from the Lake of Nicaragua. The date of the first Spanish settlement on the spot is not known, but in the 17th century there were fortifications at the mouth of the river. In 1796 San Juan was made a port of entry by royal charter, and new defences were erected in 1821. The patriots of Nicaragua seized the place at the revolution, but they were expelled in January, 1848, by the British, who, claiming the district in name of the "king of the Mosquito Indians," continued in possession till the treaty of 1860. In 1854 the town was bombarded by the United States forces for an alleged insult.

GRIBOYEDOFF, Alexander Sergueevich (1795–1829), was born in 1795 at Moscow, where he studied at the university from 1810 to 1812. He then obtained a commission in a hussar regiment, but resigned it in 1816. Next year he entered the civil service, and in 1818 was appointed secretary of the Russian legation in Persia, whence he was transferred to Georgia. There he began the drama which has made him famous. He had commenced writing early, and had produced on the stage at St. Petersburg in 1816 a comedy in verse, translated from the French, called *The Young Spouses*, which was followed by some other pieces of the same kind. But neither these, nor the essays and verses which he wrote for periodicals, would have been long remembered, but for the immense success gained by his comedy in verse, *Gorê ot uma*, or "Misfortune from Intelligence." A satire upon Russian society, or, as a high official styled it, "A pasquinade on Moscow," its plot is slight, its merits consisting in its accurate representation of certain social and official types,—such as Famousoff, the lover of old abuses, the hater of reforms; his secretary, Molchanin, servile fawner upon all in office; the aristocratic young liberal and Anglomaniac, Repetiloff; contrasted with whom is the hero of the piece, Tchatsky, the ironical satirist, just returned from the west of Europe, who exposes and ridicules the weaknesses of the rest, his words echoing that outcry of the young generation of 1820 which reached its climax in the military insurrection of 1825, and was then sternly silenced by Nicholas. Griboyedoff spent the summer of 1823 in Russia, completed his play, and took it to St. Petersburg. There it was rejected by the censorship. Many copies were made and privately circulated, but Griboyedoff never saw it published. The first edition was printed in 1833, four years after his death. Only once did he see it on the stage, when it was acted by the officers of the garrison at Erivan. Soured by disappointment he returned to Georgia, made himself useful by his linguistic knowledge to his relative Count Paskieviteh-Erivansky during a campaign against Persia, and was sent to St. Petersburg with the treaty of 1828. Brilliantly received there, he thought of devoting himself to literature, and commenced a romantic drama, *A Georgian Night*. But he was suddenly sent to Persia as minister-plenipotentiary. Soon after his arrival at Teheran a tumult arose, caused by the anger of the populace against some Georgian and Armenian captives,—Russian subjects,—who had taken refuge in the Russian embassy. It was stormed, Griboyedoff was killed (February 11, 1829), and his body was for three days so ill-treated by the mob that it was at last recognized only by an old scar on the hand, due to a wound received in a duel. It was taken to Tiflis, and buried in the monastery of St. David. There a monument was erected to his memory by his widow, to whom he had been but a few months married. But his memory is best preserved by his play *Gorê ot uma*, which has since his death been repeatedly published and performed, and will always be quoted as one of the masterpieces of Russian literature. An English translation by N. Benardaky appeared in London in 1857.

GRIESBACH, Johann Jakob (1745–1812), one of the most distinguished of the band of scholars to whom the modern science of New Testament textual criticism owes its origin, was born at Butzbach, a small town of Hesse-Darmstadt, where his father was pastor, on the 4th of January, 1745. He received his school education at Frankfort-on-the-Main, and carried on his university studies at Tübingen and Leipsic, but especially at Halle, where he became one of Semler's most ardent disciples. At the close of his undergraduate career, he undertook a literary tour which, apart from the advantages of stimulative contact with many of the most distinguished scholars of England, France, and Holland, as well as of his own country, was of great utility to him in providing him with materials for the great work of his subsequent life. On his return to Halle, he acted for some time as "privat-docent," but in 1773 was appointed to a professorial chair; in 1775 he was translated to Jena, where the remainder of his life was spent in ever-increasing usefulness and honor, and where he died 24th March, 1812.

Griesbach's critical edition of the New Testament first appeared at Halle, in three volumes, in 1774–75. The first volume contained the first three gospels, synoptically arranged; the second, the fourth gospel and the Acts of the Apostles. All the historical books were reprinted in one volume in 1777, the synoptical arrangement of the gospels having been abandoned as inconvenient. Of the second edition, very considerably enlarged and improved, the first volume appeared in 1796 and the second in 1806 (Halle and London). Of a third edition, edited by Schulz, only the first volume, containing the four gospels, has appeared (1827).

For the construction of his critical text Griesbach took as his basis the Elzevir edition, from which he departed only when valid reasons seemed to require it. In all such cases he placed

the Elzevir reading on the inner margin along with such other readings as he thought worthy of special consideration (these last, however, being printed in smaller type). To all the readings on this margin he attached special marks indicating the precise degree of probability in his opinion attaching to each. In weighing these probabilities he proceeded upon a particular theory which in its leading features he had derived from Bengel and Semler, dividing all the MSS. into three great families or recensions—the Alexandrian, the Western, and the Byzantine. The Alexandrian recension had (as the name implied) originated in Alexandria, and thence had spread over Egypt and the East; it is characterized by a general tendency to tone down all Hebraisms, inelegancies, and inaccuracies. The Western on the other hand had retained the Hebraisms unimpaired, but had incorporated many glosses, as well as interpolations from parallel passages, with the purpose of making the text more intelligible (Grammaticum egit Alexandrinus censor, interpretem occidentalis). The Byzantine he regarded as much later, and as combining and exaggerating the peculiarities of both the others. A reading that was supported by only one recension he considered as having only one witness in its favor; those readings on the other hand which were supported by all the three recensions, or even by two of them, especially if these two were the Alexandrian and the Western, he unhesitatingly accepts as genuine. Only when each of the three recensions gives a different reading does he proceed to discuss the question on other grounds. See his *Symbolæ criticæ ad supplendas et corrigendas variarum Novi Testamenti lectionum collectiones: accedit multorum N. T. codicum Græcorum descriptio et examen*, 2 vols. (Halle, 1785, 1793), and his *Commentarius criticus in textum Græcum N. T.*, which extends to the end of Mark, and discusses the more important various readings with great care and thoroughness (Jena, 1798–1811). Among the other works of Griesbach (which are comparatively unimportant, however) may be mentioned his university thesis *De codicibus quatuor evangelistarum Origenianis* (Halle, 1771) and a work upon systematic theology (*Anleitung zur Kenntniss der populären Dogmatik*, Jena, 1779). His *Opuscula*, consisting chiefly of university "programs" and addresses, were edited by Gabler, in 2 vols. (Jena, 1824).

GRIFFIN, or Gryphon (*gryphus*, *γρύψ*), in the natural history of the ancients, the name of an imaginary rapacious creature of the eagle species, represented with four legs, wings, and a beak,—the fore part resembling an eagle, and the hinder a lion. In addition, some writers describe the tail as a serpent. This animal, which was supposed to watch over gold mines and hidden treasures, and to be the enemy of the horse, was consecrated to the Sun; and the ancient painters represented the chariot of the Sun as drawn by griffins. According to Spanheim, those of Jupiter and Nemesis were similarly provided. The griffin of Scripture is probably that species of the eagle called in Latin *Ossifraga*, or osprey. The griffin is related to inhabit Asiatic Scythia, where the lands abound in gold and precious stones; and when strangers approach to gather these the creatures leap upon them and tear them in pieces, thus showing their use in chastising human avarice and greed. The one-eyed Arimaspi wage constant war with them, according to Probus and Servius. The celebrated Sir John de Mandeville, in his *Travels*, described a griffin as eight times larger than a lion. The griffin is frequently seen on early seals and medals, and is still borne as a favorite device on seals and as a charge in heraldry. Papworth, in his laborious *Ordinary of British Armorials*, ascribes this creature to several hundred family coats, as a single charge, and in connection with other heraldic devices the griffin was constantly borne in English and especially in Welsh armory. Berry in his *Encyclopædia Heraldica* declares that the combination of the eagle and lion signified strength and swiftness conjoined; if this be so, the reason of its almost universal adoption as an emblem by a military and chivalric people is not far to seek. The seals of Baldwin de Redvers, second earl of Devon (1137–1155), and his son William de Vernun, sixth earl, exhibit two most curious examples of the griffin, and being anterior to the consolidation of heraldic rules and a succession of heraldic devices from father to son, are yet proofs that particular devices or emblems were in use with powerful lords of the 12th and 13th centuries, and retained by the members of the family as carefully and as conventionally as the true heraldic bearings of the following century were. Guillim blazons this monster as *rampant*, alleging that any very fierce animal may be so blazoned as well as a lion; but Sylvester, Morgan, Burke, Berry, and other writers upon heraldic subjects, use the term *segreant*, *i.e.*, *se greant*, pluming or arranging himself by lifting himself up and flapping his wings, as all birds do occasionally, instead of rampant. Palliot, one of the most interesting of all writers on arms, his *Vraye et Parfaite Science des Armoires*, describes this creature as generally rampant, and points out its connection with the Minotaur, Centaurs, and Chimæra, "fronte Leo, postremo Draco, medioque Chimæra." The same writer, in reference to the possibility of such productions of nature, describes a curious monster of similar character, called a *hippocervus*, presented in 1534 by Frederick, duke of Mantua, to Francis the Great, the fore part being that of a horse, the hind part that of a stag, which could be saddled and bridled, but always threw his rider and trampled on him. Much might be written on the subject of hybrids and fabulous monsters such as these, but the various aspects of natural history and archæology which they illustrate have never been yet worked out. The griffin was also an architectural ornament among the Greeks, and was copied from them, with other architectural embellishments, by the Romans A fine example of the Assyrian griffin occurs on the sculptured slabs from Kouyunjik, now in the British Museum The *Dictionary of Early Drawings and Illuminations*, by W de Gray Birch and H. Jenner, gives a collection of references to the finest examples of these creatures among the manuscripts from the Saxon age to the close of the 15th century.

GRIFFIN, Gerald (1803–1840), an Irish novelist and dramatic writer, was descended from a family of good position, and was born at Limerick 12th December, 1803. He was the youngest of nine sons. After attending for some time the school of an eccentric preceptor in Limerick, he, on the removal of the family in 1810 to Fairy Lawn, a country place on the banks of the Shannon, was placed under the instruction of a private tutor, but in 1814 he returned to Limerick to attend a classical school. In his youth his devotion seems to have been pretty equally divided between books and out-door recreations with the rod and gun. His parents and a portion of the family emigrated in 1820 to America, but he and some others were left with an elder brother who was settled as a medical practitioner at Adare near Limerick, and under his direction Gerald made some progress in medical studies with the view of adopting that profession. It would appear, however, that very soon his intentions underwent a change, for, besides devoting a large part of his time to literary composition, he as early as his eighteenth year undertook for a short time the editorship of a newspaper in Limerick. Having completed a tragedy, *Aguire*, which was highly lauded by his friends, he finally in 1823 set out for London with the purpose of "revolutionizing the dramatic taste of the time by writing for the stage." Notwithstanding, however, the efforts and recommendations of the novelist Banim, who showed him great kindness, he found no manager willing to accept any of his plays; and for a considerable period he had such a hard and wearisome struggle with poverty and disappointment as permanently to injure his health. For some time he barely supported himself by reporting trials for the newspapers and by various kinds of hack work; but his prospects began to brighten a little when he obtained occupation as a parliamentary reporter, and gradually the *Literary Gazette*, the *News of Literature*, and other periodicals of standing began to look upon his contributions with favor. Some of his dramatic pieces were accepted also by one of the theatres; and the publication in 1827 of a series of tales under the title of *Holland Tide* was so successful that he at once set about the preparation of a similar series, which appeared the same year in two volumes under the title of *Tales of the Munster Festivals*, and were still more popular. In 1828 appeared the *Collegians*, afterwards so successfully adapted for the stage under the title of the *Colleen Bawn*. It is said to have been the favorite novel of O'Connell; and, besides exhibiting that masterly delineation of both the pathetic and the humorous features of Irish character already shown in his other works, it was written with a verve and a dramatic intensity and realism far surpassing all his previous or subsequent efforts. His principal other works are *The Invasion*, *The Rivals*, *Tracey's Ambition*, and *The Tales of Five Senses*. He is also the author of a number of lyrics which are generally pervaded by a tender and sad cast of sentiment. When Griffin appeared to have achieved the literary success for which he had had such a hard struggle, he began to feel a growing distaste for his profession. He became doubtful as to the moral influence of his writings, and as to whether on that account he had not been "misspending his time;" and ultimately he came

to the conclusion that his true sphere of duty was to be found within the walls of a monastery,—a resolve doubtless partly attributable to the state of his health. He was admitted into a Dublin monastery in September, 1838, under the name of Brother Joseph, and in the following summer he removed to Cork, where he died of typhus fever 12th June, 1840. Previous to adopting the monastic habit he burned all his manuscripts: but *Gisippus*, a tragedy which he had composed in his twenty-fifth year, accidentally escaped destruction, and in 1842 was put on the Drury Lane stage by Mr. Macready, and acted with great success. The collected works of Gerald Griffin were published in 1843 in eight volumes, with a memoir by his brother. See also *Dublin University Magazine* for February, 1844.

GRILLPARZER, Franz (1791–1872), a distinguished German dramatist, was born in Vienna on the 15th January, 1791. His father, a respectable advocate, destined him for his own profession; but on the conclusion of his legal studies, in 1811, Grillparzer became a tutor in a noble family, and two years afterwards accepted a subordinate post in the civil service. He rose slowly in his profession, but in 1833 was made director of the archives in the court chamber (Hofkammer). He retired in 1856, receiving the title of Hofrath, a title which was replaced in 1861 by the higher one of Reichsrath. In 1847 he was made a member of the Academy of Sciences. From early youth he displayed a strong literary impulse. He devoted especial attention to the Spanish drama, and nearly all his writings bear marks of the influence of Calderon. When he began to write, the German stage was dominated by the wild plays of Werner, Müllner, and other authors of the so-called "fate-tragedies." His first play, *Die Ahnfrau* (The Ancestress), published in 1816, was penetrated by their spirit. A lady, who has been slain by her husband for infidelity, is doomed to visit "the glimpses of the moon" till her house is extinguished, and this end is reached in the tragedy amid scenes of violence and horror. Some of Grillparzer's admirers draw a sharp distinction between this play and the works with which it is usually classed, and in doing so they follow his own example. But its general character is exactly similar to that of Werner's dramas; it only differs from them in containing individual passages of much force and beauty. It at once became extremely popular, and Grillparzer was encouraged to write a second tragedy, *Sappho* (1819), the most artistically finished of his productions. An Italian rendering of this play fell into the hands of Lord Byron, who, although the translation was very bad, expressed his conviction that the author's name would be held in reverence by posterity. It is full of the aspiration of the Romantic school, but its form is classic, and its chastened style presents a striking contrast to the noise and fury of the *Ahnfrau*. The problem of the play has some resemblance to that of Goethe's *Torquato Tasso*, for in both we find the struggles of a poetic nature which is unable to reconcile itself to the conditions of the actual world. Grillparzer's conceptions are not so clearly defined as Goethe's, nor is his diction so varied and harmonious; but the play has the stamp of genius, and ranks as one of the best of those works in which an attempt has been made to combine the passion and sentiment of modern life with the simplicity and grace of ancient masterpieces. Another and more ambitious work in the classic style was *Das goldene Vlies* (The Golden Fleece), a trilogy published in 1822. Of its three parts the greatest is *Medea*, which some critics consider his highest achievement. There is delicate art in the delineation of the mingled fascination and repulsion which Medea and Jason feel for each other, and when at last repulsion becomes the dominant force, the dramatist gives splendid utterance to the rage of the disappointed wife and mother. In *Des Meeres und der Liebe Wellen* (Waves of the Sea and of Love), which appeared in 1840, Grillparzer again formed his work on classic models; but in this instance his feeling is so distinctly modern that it does not find adequate expression in his carefully measured verse. The subject is the story of Hero and Leander, and it has never been more happily treated than in some passages, which, however, are marked rather by lyrical than dramatic qualities.

In 1825 Grillparzer published *König Ottokar's Glück und Ende* (King Ottocar's Fortune and End). It appealed strongly to the patriotic sympathies of Vienna, dealing as it does with one of the proudest periods of Austrian history,—the time of Rudolf I., the founder of the house of Hapsburg. In a harsh criticism of Grillparzer, which appeared in the *Foreign Review* in 1829, and is now included in his *Miscellanies*, Mr. Carlyle said that Schiller's *Piccolomini* differed from *Ottokar* as "a living rose [differs] from a mass of dead rose leaves, or even of broken Italian gum-flowers." This judgment has not been confirmed by later criticism. It cannot, indeed, be said that the materials of the play are welded into a compact whole, but the characters are vigorously conceived, and there is a fine dramatic contrast between the brilliant, restless, and unscrupulous Ottocar and the calm, upright, and ultimately triumphant Rudolf. Another historical play, *Ein treuer Diener seines Herrn* (A faithful Servant of his Lord), appeared in 1830, and brought down upon the author a storm of abuse from the liberals, who accused him of servility. On the other hand, the play displeased the court, and its representation was stopped. It hardly deserved to be made the subject of so much contention, for it is one of the least powerful of Grillparzer's later dramas. A more pleasing work was the dramatic study *Der Traum, ein Leben* (The Dream, a Life), which is to some extent a direct imitation of Calderon, and has something of his brilliance and charm. In the same year in which this was issued (1840) Grillparzer published *Wehe dem der lügt* (Woe to him who Lies), a comedy. It was so badly received that he wrote no more for the stage. Several dramatic fragments, however, composed at a later time, appeared among his posthumous writings.

Grillparzer was a lyrical as well as a dramatic poet. He used to say that all his lyrics were written for the purpose of obtaining relief from feelings by which he happened to be oppressed. The same thing was said of himself by Goethe; but Goethe's emotion in passing into verse was purified and generalized; Grillparzer's remained for the most part strictly personal, and rarely touches the deepest sympathies. He is more successful in epigram, in which he often gives sharp expression to a keen, biting humor. He wrote also several prose tales, one of which, *Der Spielmann* (The Musician), is marked by delicate and graceful fancy. His autobiography, which was written in 1853 and brings down the narrative of his life to 1836, is a model of clear, simple, and elegant prose; and it throws much interesting light both on his personal character and on the tendencies of his time. Among his posthumous writings are many fragments of literary, philosophic, and political criticism, all of them indicating a strong and independent spirit, not invariably just, but distinct, penetrating and suggestive. It is characteristic of him that he expresses extreme dislike of Hegel's philosophy on the ground that its terms are unintelligible. On the other hand, he gives evidence of careful and sympathetic study of Kant. Of modern literary critics Gervinus was most repugnant to him, mainly because of the tendency of this writer to attribute moral aims to authors who created solely for art's sake. He rather maliciously says that Gervinus had one advantage and one disadvantage in writing his history of German Literature,—the advantage of common sense, the disadvantage of knowing nothing of his subject.

Of a quiet contemplative nature, Grillparzer shunned general society. He never married. To a stranger he seemed cold and distant, but in conversation with any one he liked his real disposition revealed itself; his manner became animated, his eyes brightened, and a sarcastic but not ill-natured smile would play upon his lips. It was one of his sayings that the art of writing poetry can neither be taught nor learned, but he also held that inspiration will not visit a poet who neglects to make himself master of his subject. Hence before writing a play he worked hard, striving to comprehend the spirit of the age he wished to represent. He was exceedingly fond of travel, and at different times visited all the leading European countries. After 1840, when his solitary comedy was rejected by the public, he almost passed from the memory of his contemporaries. Fortunately for him, Heinrich Laube, an admirer of his genius, settled in Vienna in 1849 as artistic director of the court theatre. By and by Laube reintroduced on the stage some of the forgotten works, and their success was immediate and profound. To his own surprise, Grillparzer became the most popular author of the day; he was ranked with Goethe and Schiller, and lauded as the national poet of Austria. On the eightieth anniversary of his birthday all classes from the court downwards united to do him honor; never, probably, did Vienna exert herself so much to prove her respect for a private citizen. He died on the

21st January, 1872, and was buried with an amount of ceremony that surpassed even the pomp displayed at Klopstock's funeral. A monument of him has recently been erected at Baden, near Vienna.

After his death an admirable edition of his works, in ten volumes, was issued by Heinrich Laube and J. Weilen. There are several English renderings of *Sappho*, and *Medea* has also been translated. For biographical and critical notices see Kuh, *Zwei Dichter Oesterreichs* (Pesth, 1872); Betty Paoli, *Grillparzer und seine Werke* (Stuttgart, 1875); and Gottschall, "Franz Grillparzer," and "Franz Grillparzers Nachlass," in *Unsere Zeit* for 1872 and 1873. (J. SI.)

GRIMALDI, Giovanni Francesco (1606–1680), an architect and painter, named Il Bolognese from the place of his birth, was a relative of the Caracci family, under whom it is presumed he studied first, and afterwards under Albano. He went to Rome, and was appointed architect to Pope Paul V., and patronized by succeeding popes also. Towards 1648 he was invited to France by Cardinal Mazarin, and for about two years was employed in buildings for that minister and for Louis XIV., and in fresco-painting in the Louvre. His color was strong, somewhat excessive in the use of green; his touch light. He painted at once history, portraits, and landscape,—the last with predilection, especially in his advanced years,—and executed engravings and etchings from his own landscapes, and from those of Titian and the Caracci. Returning to Rome, he was made president of the Academy of St. Luke; and in that city he died on 28th of November, 1680, in high repute not only for his artistic skill but for his upright and charitable deeds as well. His son Alessandro assisted him both in painting and in engraving. Paintings by Grimaldi are preserved in the Quirinal and Vatican palaces, and in the church of S. Martino a' Monti; there is also a series of his landscapes in the Colonna Gallery.

GRIMM, Friedrich Melchior, Baron von (1723–1807), the author of the celebrated *Correspondance littéraire*, was, though a naturalized Frenchman, both of German descent and a native of Germany, having been born of poor parents at Ratisbon, 26th December, 1723. He studied at the university of Leipsic, where he had as professor the celebrated Ernesti, to whom he was doubtless in no small degree indebted for his critical appreciation of classical literature. On completing his studies he made his literary début by a tragedy which was received with ridicule by the audience and by the critics, including Lessing, and which is now forgotten even in Germany. In all probability it was this disappointment which led him to think of seeking his fortune in Paris, whither he accompanied the count of Schönberg as tutor to his sons, and where afterwards, at a small salary, he was for some time reader to the young hereditary prince of Saxe-Gotha. In 1749 he made the acquaintanceship of J. J. Rousseau, which, through a mutual sympathy in regard to musical matters, soon ripened into intimate friendship. Through Rousseau he was introduced to the Encyclopedists, and about the same time he became secretary to Count Friesen, nephew of Marshal Saxe, which gained him admission to the most brilliant society of Paris. Endowed with more than average intellectual abilities, thoroughly versed in all current topics of interest in literature, science, and art, gifted with remarkable insight into character, possessing engaging manners and great social tact, and actuated in all his conduct by a keen regard to his own interest, he won almost immediately general appreciation and respect. He rapidly obtained a thorough knowledge of the French language, and acquired so perfectly the tone and sentiments of the society in which he moved that all marks of his foreign origin and training seemed completely effaced. A witty pamphlet entitled *Le petit Prophète de Boehmischbroda*, written by him on the respective merits of the Italian and French operas, a subject which at that time greatly exercised the society of Paris and on which he sided with the Italian section, at once firmly established his literary reputation. It is possible that the origin of the pamphlet is partly to be accounted for by his admiration of Mdlle. Fel, the *prima donna* of the Italian company. This admiration quickly developed into a passion so vehement that he was seized with a kind of catalepsy which continued for several days, but from which he suddenly awoke completely recovered both in body and mind. In 1753 Grimm was engaged by the Abbé Raynal to aid him in conducting his literary correspondence with German sovereigns; and this opened up to him that sphere for his ambition which perhaps was most in accordance with his peculiar tastes, and in which his abilities best fitted him to excel. Although from the beginning he had the principal share in the work, it was probably conducted until 1759 in the name of the Abbé Raynal. With the aid of friends during his temporary absences from France, he carried it on until 1790, and it latterly extended to six sovereigns, including the empress of Russia, the king of Sweden, and the king of Poland. It was probably in 1754 that Grimm was introduced by Rousseau to Madame d'Épinay, his relations with whom led to an irreconcilable rupture between him and Rousseau. The exact amount of Grimm's blameworthiness it is impossible to determine, and the whole matter would be of little consequence but for the fact that Rousseau allowed his resentment to gain such a complete possession of his mind as to induce him to give in his *Confessions* a wholly mendacious portrait of Grimm's character, by which his reputation was for a considerable time injuriously affected. After the death of Count Friesen Grimm obtained the patronage of the duke of Orleans, through whom he was appointed secretary to Marshal d'Estrées during the campaign of Westphalia in 1756–57. Subsequently he was named minister of Saxe-Gotha at the court of France, but he was deprived of that office on account of having criticised rather caustically certain French ministers in a despatch that was intercepted by Louis XV. His introduction to Catherine II. of Russia took place in 1773, when he accompanied the suite of the landgrave of Hesse-Darmstadt to St. Petersburg on occasion of the marriage of a daughter of that prince to the only son of Catherine. After the Revolution Grimm retired to Gotha, and in 1792 he emigrated to Russia, where he enjoyed high favor at the court of Catherine, and had assigned him the nominal and agreeable duty of entertaining her for so many hours a day by his conversation. This state of things came, however, to an end in 1795, when, notwithstanding his supplications to be retained at court, if only as one of her majesty's dogs, he was appointed minister of Russia at Hamburg. He died at Gotha, 19th December, 1807.

The correspondence of Grimm forms perhaps the most valuable of existing records of any important literary period. It embraces nearly the whole period from 1750 to 1790, and although parts of it during his absence from France were written by Diderot, Madame d'Épinay, and others, the work as a whole may be regarded as substantially his. At first he contented himself with enumerating in the simplest manner the chief current views in literature and art, and indicating only very slightly the contents of the principal new books, but gradually his criticisms became more extended and trenchant, and he touched on nearly every subject—political, literary, artistic, social, and religious—which interested the Parisian society of the time—his narrative, which moves lightly and easily from one theme to another, being frequently seasoned by piquant anecdotes or witty reflections. Not only, however, did he aim to give a truthful and just account of the subjects on which he wrote; his purpose extended considerably beyond that of affording a few hours' amusement to his royal patrons, and his descriptions and criticisms were fitted to satisfy more than a superficial curiosity. His notices of contemporaries are somewhat severe, and he exhibits in all the nakedness of truth the foibles and selfishness of the society in which he moved; but he appears to have been unbiassed in his literary judgments, and such is their justness and penetration that time has only served to confirm them. In style and manner of expression he is thoroughly French. He is generally somewhat cold in his appreciation, but his literary taste is delicate and subtle; and it is the opinion of Sainte-Beuve that the quality of his thought in his best moments will compare not unfavorably even with that of Voltaire. His religious and philosophical opinions were entirely negative, and his references to Christianity generally assume the form of either a sneer or a witticism.

Grimm's *Correspondance littéraire, première partie de 1753 à 1770*, was published at Paris in 1813 in 6 vols. 8vo; *deuxième partie de 1771 à 1782*, in 1812 in 5 vols. 8vo; and *troisième partie, pendant une partie des années 1775 et 1776, et pendant les années 1782 à 1790 inclusivement*, in 1813 in 5 vols. 8vo. A supplementary volume appeared in 1814; the whole correspondence was collected and published by M. Jules Taschereau in a *Nouvelle édition, revue et mise dans un meilleur ordre, avec des notes et des éclaircissements, et où se trouvent rétablies pour la*

première fois les phrases supprimées par la censure impériale, Paris, 1829–1831, 15 vols. 8vo; and the *Correspondance inédite, et recueil de lettres, poésies, morceaux, et fragments retranchés par la censure impériale en 1812 et 1813* was published in 1829. Grimm's *Mémoire historique sur l'origine et les suites de mon attachement pour l'impératrice Catherine II. jusqu' au décès de sa majesté impériale*, and Catherine's correspondence with Grimm to September, 1774, have been published in the *Collection* of the Russian Imperial Historical Society. She treats him very familiarly, and calls him Heraclite, George Dandin, etc. He signs himself "Pleureur." See also Mme. d'Épinay's *Mémoires;* Rousseau's *Confessions;* the notice by Galgues in the introduction to the second part of the *Correspondance*, and that by Taschereau in the introduction to the new edition; Sainte-Beuve, *Causeries du lundi*, vol. vii.

GRIMM, Jacob Ludwig Carl (1785–1863), was born on the 4th of January, 1785, at Hanau, in Hesse-Cassel. His father, who was a lawyer, died while he was still a child, and the mother was left with very small means; but her sister, who was lady of the chamber to the landgravine of Hesse, helped to support and educate her numerous family. Jacob with his younger brother Wilhelm (born on the 24th of February, 1786) was sent in 1798 to the public school at Cassel. In 1802 he proceeded to the university of Marburg, where he applied himself to the study of law, a profession for which he had always been destined by his father, and which seemed to offer the best prospect of speedy independence. His brother joined him at Marburg a year later, having just recovered from a long and severe illness, and likewise began the study of law. Up to this time Grimm had been actuated only by a general thirst for knowledge and the instinct of intellectual activity, and his energies had not found any aim beyond the practical one of making himself a position in life. The first definite impulse came from the lectures of Savigny, the celebrated investigator of Roman law, who, as Grimm himself says (in the preface to the *Deutsche Grammatik*), first taught him to realize what it meant to study any science, whether that of law or any other. Savigny's lectures at the same time awakened in him that love for historical and antiquarian investigation which forms the basis of all his work. Then followed personal acquaintance, and it was in Savigny's well-provided library that Grimm first turned over the leaves of Bodmer's edition of the Old German minnesingers and other early texts, and felt an eager desire to penetrate further into the obscurities and half-revealed mysteries of their language. In the beginning of 1805 he received an invitation from Savigny, who had removed to Paris to continue his researches among the libraries there, to join him and help him in his literary work. This offer was joyfully accepted by young Grimm, who passed a very happy time in Paris, enjoying the society of Savigny, and strengthening his taste for the literatures of the Middle Ages by his studies in the Paris libraries. Towards the close of the year he returned to Cassel, where his mother and Wilhelm had settled, the latter having finished his studies. The next year he obtained a situation in the war office with the very small salary of 100 thalers. One of his grievances was, as he himself tells us in his autobiography, that he had to exchange his stylish Paris suit for a stiff uniform and pigtail. But he had full leisure for the prosecution of his studies. In 1808, soon after the death of his mother, he was appointed superintendent of the private library of Jerome Buonaparte, king of Westphalia, into which Hesse-Cassel had been incorporated by Napoleon. He was treated with marked favor by the king, who appointed him an auditor to the state council, while he still retained his other post. His salary was increased in a short interval from 2000 to 4000 francs, which removed all anxiety as to the means of subsistence, and his official duties were hardly more than nominal. After the expulsion of Jerome, and the reinstalment of an elector, Grimm was appointed in 1813 secretary of legation, to accompany the Hessian minister to the headquarters of the allied army. In 1814 he was sent to Paris to demand restitution of the books carried off by the French, and in 1814–15 he attended the congress of Vienna as secretary of legation. On his return he was again sent to Paris on the same errand as before. Meanwhile Wilhelm had received an appointment in the Cassel library, and in 1816 Jacob was made second librarian under Völkel. On the death of Völkel in 1828 the brothers expected to be advanced to the first and second librarianships respectively, and were much dissatisfied when the first place was given to Rommel, keeper of the archives. So they removed next year to Göttingen, where Jacob received the appointment of professor and librarian, Wilhelm that of under-librarian. Jacob Grimm lectured on legal antiquities, historical grammar, literary history, and diplomatics, explained Old German poems, and commented on the *Germania* of Tacitus. At this period he is described as small and lively in figure, with a harsh voice, speaking a broad Hessian dialect. His powerful memory enabled him to dispense with the "heft" which most German professors rely on, and he spoke extempore, referring only occasionally to a few names and dates written on a slip of paper. He himself regretted that he had begun the work of teaching so late in life, and as a lecturer he was not successful; he had no idea of digesting his facts and suiting them to the comprehension of his hearers; and even the brilliant, terse, and eloquent passages which abound in his writings lost much of their effect when jerked out in the midst of a long array of dry facts. In 1837, being one of the seven professors who signed a protest against the king of Hanover's abrogation of the constitution which had been established some years before, he was dismissed from his professorship, and banished from the kingdom of Hanover. He returned to his native Cassel together with his brother, who had also signed the protest, and remained there till, in 1840, they accepted an invitation from the king of Prussia to remove to Berlin, where they both received professorships, and were elected members of the Academy of Sciences. Not being under any obligation to lecture, Jacob very seldom did so, but together with his brother worked at the great dictionary, the plan of which had already been partly developed. During their stay at Cassel Jacob regularly attended the meetings of the academy, where he read papers on the most varied subjects. The best known of these are those on Lachmann, Schiller, and his brother Wilhelm (who died in 1859), on old age, and on the origin of language. He also described his impressions of Italian and Scandinavian travel, interspersing his more general observations with linguistic details, as is the case in all his works. He died in 1863, working up to the last.

Grimm's physical constitution was an excellent one. He possessed in the highest degree that Teutonic energy and endurance which is as essential to the sedentary student as to the pioneer in other regions of human activity. He was never ill, and worked on all day, without haste and without pause. He himself (in his biography) speaks of his "iron industry." He was not at all impatient of interruption, but seemed rather to be refreshed by it, returning to his work without effort. He wrote for press with great rapidity, and hardly ever made corrections. He never revised what he had written, remarking with a certain wonder of his brother, "Wilhelm reads his manuscripts over again before sending them to press!" He often started on a journey which he had determined upon only the day before. His temperament was uniformly cheerful, and he was easily amused. He took a keen interest in politics, and when the newspapers arrived, he would often read them through at once, breaking off his work for the purpose. Outside his own special work he had a marked taste for botany, and always liked to have flowers about him while working, a taste which was shared by his brother. The spirit which animated his work is best described by himself at the end of his autobiography. "Nearly all my labors have been devoted, either directly or indirectly, to the investigation of our earlier language, poetry, and laws. These studies may have appeared to many, and may still appear, useless; to me they have always seemed a noble and earnest task, definitely and inseparably connected with our common fatherland, and calculated to foster the love of it. My principle has always been in these investigations to undervalue nothing, but to utilize the small for the illustration of the great, the popular tradition for the elucidation of the written monuments." We may, in fact, sum up Grimm's tendencies by saying that he was inspired by an intense enthusiasm for research, guided into definite channels by a not less enthusiastic love and veneration for everything German,—this word including, in its widest sense, all the great brotherhood of the Teutonic nations,—and limited by his decided predilection for history and antiquities. It will be observed that, whenever he refers to living dialects or traditions, it is in order to throw light on the past, not the reverse. Even in his great German dictionary the historical tendency strongly predominates.

The purely scientific side of Grimm's character developed

itself but slowly, and it was long before he applied to the study of etymology and inflections the system and method Savigny had taught him to develop in legal history. He seems to have felt the want of definite principles of etymology without being able to discover them, and indeed even in the first edition of his grammar (1819) he seems to be often groping in the dark, and to have but a vague idea of the necessity of rigorous principles of letter-comparison. As early as 1815 we find A. W. Schlegel reviewing the *Altdeutsche Wälder* (a periodical published by the two brothers) very severely, condemning the lawless etymological combinations it contained, and insisting on the necessity of strict philological method and a fundamental investigation of the laws of language, especially in the correspondence of sounds. This criticism is said to have had a considerable influence on the direction of Grimm's studies.

The first work he published, *Ueber den altdeutschen Meistergesang* (1811), was of a purely literary character. But even here we see the difference between the more passive contemplation of the æsthetic literary critic and the activity of the investigator who is always seeking definite results and definite laws. In this essay Grimm showed that *Minnesang* and *Meistersang* were really one form of poetry, of which they merely represented different stages of development, and also announced his important discovery of the invariable division of the *Lied* into three strophic parts.

His text-editions were mostly prepared in common with his brother. In 1812 they published the two ancient fragments of the *Hildebrandslied* and the *Weissenbrunner Gebet*, Jacob having discovered what till then had never been suspected—the alliteration in these poems. However, Jacob had but little taste for text-editing, and, as he himself confessed, the evolving of a critical text gave him little pleasure. He therefore left this department to others, especially Lachmann, who soon turned his brilliant critical genius, trained in the severe school of classical philology, to Old and Middle High German poetry and metre. Both brothers were attracted from the beginning by all national poetry, whether in the form of epics, ballads, or popular tales. They published in 1816–18 an analysis and critical sifting of the oldest epic traditions of the Germanic races under the title of *Deutsche Sagen*. At the same time they collected all the popular tales they could find, partly from the mouths of the people, partly from manuscripts and books, and published in 1812–15 the first edition of those *Kinder- und Haus-Märchen* which have carried the name of the brothers Grimm into every household of the civilized world, and founded the science of what is now called folk-lore. The closely allied subject of the satirical beast epic of the Middle Ages also had a great charm for Jacob Grimm, and he published an edition of the *Reinhart Fuchs* in 1834. His first contribution to mythology was the first volume of an edition of the Eddaic songs, undertaken conjointly with his brother, published in 1815, which, however, was not followed by any more. The first edition of his *Deutsche Mythologie* appeared in 1835. This great work covers the whole range of the subject, tracing the mythology and superstitions of the old Teutons back to the very dawn of direct evidence, and following their decay and loss down to the popular traditions, tales, and expressions in which they still linger.

Although by the introduction of the Code Napoléon into Westphalia Grimm's legal studies were made practically barren, he never lost his interest in the scientific study of law and national institutions, as the truest exponents of the life and character of a people. By the publication (in 1828) of his *Rechtsalterthümer* he laid the foundations of that historical study of the old Teutonic laws and constitutions which has been continued with brilliant success by Maurer and others. In this work Grimm showed the importance of a linguistic study of the old laws, and the light that can be thrown on many a dark passage in them by a comparison of the corresponding words and expressions in the other old cognate dialects. He also knew how—and this is perhaps the most original and valuable part of his work—to trace the spirit of the laws in countless allusions and sayings which occur in the old poems and sagas, or even survive in modern colloquialisms.

Of all his more general works the boldest and most far-reaching is unquestionably his *Geschichte der deutschen Sprache*, where at the same time the linguistic element is most distinctly brought forward. The subject of the work is, indeed, nothing less than the history which lies hidden in the words of the German language—the oldest national history of the Teutonic tribes determined by means of language. For this purpose he laboriously collects the scattered words and allusions to be found in classical writers, and endeavors to determine the relations in which the German language stood to those of the Getæ, Thracians, Scythians, and many other nations whose languages are known to us only by doubtfully identified, often extremely corrupted remains preserved by Greek and Latin authors. It need hardly be said that Grimm's results have been greatly modified by the wider range of comparison and improved methods of investigation which now characterize linguistic science, while, on the other hand, many of the questions raised by him will probably for ever remain obscure; but his book will always be one of the most fruitful and suggestive that have been ever written.

We now come to his purely philological work, of which his famous *Deutsche Grammatik* was the outcome. We have already seen how slowly and with what difficulty he attained a sound method of etymological and grammatical investigation. Nevertheless the time was a favorable one for his work. The persevering labors of past generations—from the humanists onwards—had collected an enormous mass of materials in the shape of text-editions, dictionaries, and grammars, although most of it was uncritical and often untrustworthy. Something had even been done in the way of comparison and the determination of general laws, and the conception of a comparative Teutonic grammar had been clearly grasped by the illustrious Englishman Hickes, at the beginning of the last century, and partly carried out by him in his *Thesaurus*. Ten Kate in Holland had afterwards made valuable contributions to the history and comparison of the Teutonic languages. Even Grimm himself did not at first intend to include all the languages in his grammar; but he soon found that Old High German postulated Gothic, that the later stages of German could not be understood without the help of the Low German dialects, including English, and that the rich literature of Scandinavia could as little be ignored. The first edition of the first part of the *Grammar*, which appeared in 1819, and is now extremely rare, treated of the inflections of all these languages, together with a general introduction, in which he vindicated the importance of a historical study of the German language against the *a priori*, quasi-philosophical methods then in vogue.

In 1822 this volume appeared in a second edition—really a totally new work, for, as Grimm himself says in the preface, it cost him little reflection to mow down the first crop to the ground. The wide distance between the two stages of Grimm's development in these two editions is significantly shown by the fact that while the first edition gives only the inflections, in the second volume phonology takes up no less than 600 pages, more than half of the whole volume. Grimm had, at last, awakened to the full conviction that all sound philology must be based on rigorous adhesion to the laws of sound-change, and he never afterwards swerved from this principle, which gave to all his investigations, even in their boldest flights, that iron-bound consistency, and that force of conviction which distinguish science from dilettanteism; up to Grimm's time philology was—as it still is in England—nothing but a more or less laborious and conscientious dilettanteism, with occasional flashes of scientific inspiration; he made it into a science. His advance must be attributed mainly to the influence of his contemporary Rask. Rask was born two years later than Grimm, but his remarkable precocity gave him somewhat the start. Even in his first edition Grimm's Icelandic paradigms are based entirely on Rask's grammar, and in his second edition he has relied almost entirely on Rask for Old English. His debt to Rask can only be estimated at its true value by comparing his treatment of Old English in the two editions; the difference is very great. Thus in the first edition he declines *dæg*, *dæges*, plural *dægas*, not having observed the law of vowel-change pointed out by Rask. There can be little doubt that the appearance of Rask's Old English grammar was a main inducement for him to recast his work from the beginning. To Rask also belongs the merit of having first distinctly formulated the laws of sound-correspondence in the different languages, especially in the vowels, those more fleeting elements of speech which had hitherto been ignored by etymologists.

This leads us to a question which has been the subject of

much controversy,—Who discovered Grimm's law? The law of the correspondence of consonants in the older Indo-Germanic, Low and High German languages respectively was first fully stated by Grimm in the second edition of the first part of his grammar. The correspondence of single consonants had been more or less clearly recognized by several of his predecessors; but the one who came nearest to the discovery of the complete law was the Swede Ihre, who established a considerable number of "literarum permutationes," such as *b* for *f*, with the examples *bœra* = *ferre*, *befwer* = *fiber*. Rask, in his essay on the origin of the Icelandic language, gives the same comparisons, with a few additions and corrections, and even the very same examples in most cases. As Grimm in the preface to his first edition expressly mentions this essay of Rask, there is every probability that it gave the first impulse to his own investigations. But there is a wide difference between the isolated permutations of his predecessors and the comprehensive generalizations under which he himself ranged them. The extension of the law to High German is also entirely his own. The only fact that can be adduced in support of the assertion that Grimm wished to deprive Rask of his claims to priority is that he does not expressly mention Rask's results in his second edition. But this is part of the plan of his work, made absolutely necessary by its enormous extent, viz., to refrain from all controversy or reference to the works of others, leaving his readers to assign to each investigator his due. In his first edition he expressly calls attention to Rask's essay, and praises it most ungrudgingly. Rask himself refers as little to Ihre, merely alluding in a general way to Ihre's permutations, although his own debt to Ihre is infinitely greater than that of Grimm to Rask or any one else. It is true that a certain bitterness of feeling afterwards sprang up between Grimm and Rask, but this was the fault of the latter, who, impatient of contradiction and irritable in controversy, refused to acknowledge the value of Grimm's views when they involved modification of his own. The importance of Grimm's generalization in the history of philology cannot be overestimated, and even the mystic completeness and symmetry of its formulation, although it has proved a hindrance to the correct explanation of the causes of the changes, was well calculated to strike the popular mind, and give it a vivid idea of the paramount importance of law, and the necessity of disregarding mere superficial resemblance. Even the lawless English etymologist bows down to the authority of Grimm's law, though it must be confessed he honors it almost as much in the breach as in the observance.

The grammar was continued in three volumes, treating principally of derivation, composition, and syntax, which last was left unfinished. Grimm then began a third edition, of which only one part, comprising the vowels, appeared in 1840, his time being afterwards taken up mainly by the dictionary. Of the grammar as a whole we can only say that it stands quite alone in the annals of science for comprehensiveness, method, and fulness of detail. Every law, every letter, every syllable of inflection in the different languages, is illustrated by an almost exhaustive mass of material, drawn from every period and every dialect. It has served as a model for all succeeding investigators. Diez's grammar of the Romance languages is founded entirely on its methods, which have also exerted a profound influence on the wider study of the Indo-Germanic languages in general.

In the great German dictionary Grimm undertook a task for which he was hardly suited. His exclusively historical tendencies made it impossible for him to do justice to the individuality of a living language; and the disconnected statement of the facts of language in an ordinary alphabetical dictionary fatally mars its scientific character. It was also undertaken on so large a scale as to make it impossible for him and his brother to complete it themselves. We may describe the dictionary, as far as it was worked out by Grimm himself, as a collection of disconnected antiquarian essays of, it need hardly be remarked, high value.

In summing up Grimm's scientific character we are struck by its combination of breadth and unity. He was as far removed from the narrowness of the specialist who has no ideas, no sympathies beyond some one author, period, or narrow corner of science, as from the shallow dabbler who feverishly attempts to master the details of half a dozen discordant pursuits, which have no central point of interest round which to rally. Even within his own special studies there is the same wise concentration; no Mezzofanti-like parrot display of useless polyglottism. The very foundations of his nature were harmonious; his patriotism and love of historical investigation received their fullest satisfaction in the study of the language, traditions, mythology, laws, and literature of his own countrymen and their nearest kindred. But from this centre his investigations were pursued in every direction as far as his unerring instinct of healthy limitation would allow. He was equally fortunate in the harmony that subsisted between his intellectual and moral nature. He made cheerfully the heavy sacrifices that science demands from its disciples, without feeling any of that envy and bitterness which often torment weaker natures; and although he lived apart from his fellow men, he was full of human sympathies, and no man has ever exercised a profounder influence on the destinies of mankind than he has—an influence which is still only in its infancy. His was the very ideal of the noblest type of German character.

The following is a complete list of his separately published works, those which he published in common with his brother being marked with a star. For a list of his essays in periodicals, etc., see vol. v. of his *Kleinere Schriften*, from which the present list is taken. His life is best studied in his own "Selbstbiographie," in vol. i. of the *Kleinere Schriften*. There is also a brief memoir by Dr. Gödeke in *Göttinger Professoren*, Gotha (Perthes), 1872.

Ueber den altdeutschen Meistergesang, Göttingen, 1811; **Kinder- und Haus-Märchen*, Berlin, 1812–15 (many editions); **Das Lied von Hildebrand und das Weissenbrunner Gebet*, Cassel, 1812; *Altdeutsche Wälder*, Cassel, Frankfort, 1813–16, 3 vols.; **Der arme Heinrich von Hartmann von der Aue*, Berlin, 1815; *Irmenstrasse und Irmensäule*, Vienna, 1815; **Die Lieder der alten Edda*, Berlin, 1815; *Silva de romances viejos*, Vienna, 1815; **Deutsche Sagen*, Berlin, 1816–18, 2d ed., Berlin, 1865–66; *Deutsche Grammatik*, Göttingen, 1819, 2d ed., Göttingen, 1822–40, reprinted 1870 by W. Scherer, Berlin; *Wuk Stephanovitsch's Kleine serbische Grammatik, verdeutscht mit einer Vorrede*, Leipsic and Berlin, 1824; *Zur Recension der deutschen Grammatik*, Cassel, 1826; **Irische Elfenmärchen, aus dem englischen*, Leipsic, 1826; *Deutsche Rechtsalterthümer*, Göttingen, 1828, 2d ed., 1854; *Hymnorum veteris ecclesiæ XXVI interpretatio Theodisca*, Göttingen, 1830; *Reinhart Fuchs*, Berlin, 1834; *Deutsche Mythologie*, Göttingen, 1835, 3d ed., 1854, 2 vols.; *Taciti Germania edidit*, Göttingen, 1835; *Ueber meine Entlassung*, Basel, 1838; (together with Schmeller) *Lateinische Gedichte des X. und XI. Jahrhunderts*, Göttingen, 1838; *Sendschreiben an Karl Lachmann über Reinhart Fuchs*, Berlin, 1840; *Weisthümer*, th. i., Göttingen, 1840 (continued, partly by others, in 5 parts, 1840–69); *Andreas und Elene*, Cassel, 1840; *Frau Aventure*, Berlin, 1842; *Geschichte der deutschen Sprache*, Leipsic, 1848, 3d ed, 1868, 2 vols.; *Das Wort des Besitzes*, Berlin, 1850; **Deutsches Wörterbuch*, bd., i., Leipsic, 1854 (still in progress); *Rede auf Wilhelm Grimm und Rede über das Alter*, Berlin, 1868, 3d ed., 1865; *Kleinere Schriften*, Berlin, 1864–70, 5 vols. (H. SW.)

GRIMM, WILHELM CARL (1786–1859). The chief events in the life of Wilhelm Grimm have been narrated in last article. The two brothers were indeed so intimately associated both in their lives and in their works that a separate biography of the younger is almost superfluous. As Jacob himself said in his celebrated address to the Berlin Academy on the death of his brother, the whole of their lives were passed together. In their school-days they had one bed and one table in common, as students they had two beds and two tables in the same room, and they always lived under one roof, and had their books and property in common. Nor did Wilhelm's marriage in any way disturb their harmony. As Cleasby said ("Life of Cleasby," prefixed to his *Icelandic Dictionary*, p. lxix.), "they both live in the same house, and in such harmony and community that one might almost imagine the children were common property." Wilhelm's character was a complete contrast to that of his brother. As a boy he was strong and healthy, but as he grew up he was attacked by a long and severe illness, which left him weak all his life. His was a less comprehensive and energetic mind than that of his brother, and he had less of the spirit of investigation in him, preferring to confine himself to some limited and definitely bounded field of work; he utilized everything that bore directly on his own studies, and ignored the rest. These studies were almost always of a literary nature, and the majority of his works, including those he carried on in common with his brother, are concerned either with literary problems, or popular traditions, or else are text-editions. It is characteristic of his more æsthetic nature that he took great delight in music, for which his brother had but a moderate liking, and had a remarkable gift of story-telling. Cleasby, in the account of his visit to the brothers, quoted above, tells that "Wilhelm read a sort of farce written in the Frankfort dialect, depicting the 'malheurs' of a rich Frankfort tradesman on a holiday jaunt on Sunday. It was very droll, and

he read it admirably." Cleasby describes him as "an uncommonly animated, jovial fellow." He was, accordingly, much sought in society, which he frequented much more than his brother.

His first work was a spirited translation of the Danish *Kæmpeviser* (Altdänische Heldenlieder), published in 1811–13, which attracted great attention, and made his name at first more widely known than that of his brother. The most important of his text-editions are—*Ruolandslied*, Göttingen, 1838; *Konrad von Würzburg's Goldene Schmiede*, Berlin, 1840; *Grave Ruodolf*, Göttingen, 1844 (2d ed.); *Athis und Prophilias*, Berlin, 1846; *Altdeutsche Gespräche*, Berlin, 1851; *Freidank*, Göttingen, 1860 (2d ed.). Of his other works the most important is *Deutsche Heldensage*, Berlin, 1868 (2d ed.). His *Deutsche Runen* (Göttingen, 1821) has now only an historical interest.

(H. SW.)

GRIMMA, a town in the circle of Leipsic, Saxony, is situated on the left bank of the Mulde, 19 miles S. E. of Leipsic. In the Middle Ages it was an important commercial town, but agriculture is now its principal industry, although its manufactures have for some time been increasing. Besides large flour-mills there are yarn-bleaching and dyeing works, and outside the town are the Golzermühle, which include an iron foundry and manufactories of paper and machinery. The principal buildings are the old castle, founded in the 12th century, in which the margraves of Meissen and the electors of Saxony often held court; the town-house, dating from 1442; the two normal seminaries; the real school of the second order; and the famous *Fürstenschule* (*Illustre Moldanum*) erected by the elector Maurice on the site of the former Augustine monastery and consecrated in 1550, having provision for 104 free scholars and 22 boarders, and a library now numbering 10,000 volumes. In the immediate neighborhood are the Cistercian monastery in which Catherine von Bora lived, and the village of Döben, with an old castle in which Albert the Proud kept his father Otto the Rich prisoner. Grimma is of Sorbian origin, and came into the possession of Germany through the emperor Henry I. The population in 1901 was 11,177.

GRIMSBY, GREAT, a municipal and parliamentary borough and seaport town of England, county of Lincoln, is situated on the south side of the estuary of the Humber nearly opposite Spurn Head, and 17 miles E. S. E. of Hull. Since the opening in 1852, under the auspices of the Manchester, Sheffield, and Lincolnshire Railway Company, of extensive docks occupying a space of 140 acres reclaimed from the sea, the shipping trade of Grimsby has largely increased. A new dock connecting the royal dock with the old dock was opened by the Prince of Wales July 22, 1879. A dock of 26 acres in extent for the accommodation of the coal and timber trade is in course of construction; and it is proposed still to supply additional dock accommodation by reclaiming 200 more acres from the Humber. In 1877 the number of British vessels that entered the port was 2837, with a tonnage of 355,218; of foreign vessels 847, with a tonnage of 258,243; the number of British vessels that cleared 2642, with a tonnage of 342,727; of foreign vessels 743, with a tonnage of 235,486. Steamers ply regularly between Grimsby and the more important Baltic ports. Until 1858 no fishing trawlers had their headquarters at Grimsby, but since that period they have so increased that in 1877 the fishing craft numbered 505, with a tonnage of 29,924; and Grimsby has now become one of the largest fishing ports in the kingdom. For the use of the fishing vessels a special dock of 12 acres in extent was constructed; and another of 11 acres has lately been finished, as well as a graving dock capable of holding ten smacks at a time. Ice companies have also been established, with steamers of their own for conveying ice from Norway for the use of the fisheries. Further particulars regarding the fishing trade of Grimsby will be found under the article FISHERIES, vol. ix. pp. 217, 218. The principal other industries are shipbuilding, iron and brass founding, brewing, and tanning. The chief buildings, besides the large warehouses extending along the docks, are the fine old parish church restored in 1859, the free grammar school, the custom-house, the mechanics' institute, the hospital, the corn exchange, and the town-hall. A statue of the Prince Consort was unveiled 22d July, 1879. The population of the municipal borough in 1861 was 11,067, and of the parliamentary borough 15,060; in 1871 the numbers were 20,244 and 26,982. The population of the municipal borough 1901 was 63,138.

Grimsby is supposed to have been the spot where the Danes landed on their first invasion of Britain. It is a borough by prescription, and one of the most ancient in the kingdom. In the reign of Edward III. it was a considerable seaport, and in 1346 it furnished that monarch with 11 ships and 170 mariners for the siege of Calais. After that period its trade fell into decay through the gradual blocking up of the harbor by the accumulation of mud and sand, until the erection of new docks about the beginning of the present century. By the act of 23d Edward I. the town obtained the privilege of returning two members to parliament, but since the Reform Act of 1832 it has returned only one.

GRINDAL, EDMUND (*c.* 1519–1583), archbishop of Canterbury, was born at Hensingham in the parish of St. Bees, Cumberland, about 1519. He was educated at Cambridge, where he became fellow of Pembroke Hall in 1538, and president in 1549. In the following year he was appointed chaplain to Bishop Ridley, in August, 1551, precentor of St. Paul's, in November chaplain to Edward VI., and in July, 1552, prebendary of Westminster. On the accession of Mary in 1553 he took refuge on the Continent, staying chiefly at Strasburg, where he acquired a competent knowledge of German, and occupied himself also in collecting the "writings and stories of the learned and pious sufferers in England,"—the result of his inquiries being afterwards communicated to John Foxe, and incorporated by him in his *Book of Martyrs*. Returning to England under the new regime in 1558, he assisted in the preparation of the new liturgy, and was also one of the eight Protestant divines chosen to hold public disputes with the popish prelates. In 1559 he was appointed to the mastership of Pembroke Hall, and in the same year he succeeded Bonner as bishop of London, in which capacity he, along with Archbishop Parker, shared in 1565 in the responsibility of suspending those of the London clergy who refused to submit to the Act of Uniformity, on which account an indignant mob of clergymen's wives appeared before his house at St. Paul's, and were with difficulty persuaded by one of the suspended clergymen to go away quietly. In 1570 Grindal was appointed to the see of York, from which he was translated to Canterbury in February, 1576. Having in the same year incurred the royal displeasure by refusing to suppress the meetings held among the clergy for "the exercise of prophesying," he was ultimately, in June, 1577, by order of the Star Chamber confined to his house and sequestered for six months. As in November he refused to make a formal submission to the queen his suspension was continued for several years; but though a petition for his restoration, which was drawn up by convocation in 1580, was not immediately granted, it would appear that in 1582 he had resumed, at least partially, the exercise of his ecclesiastical functions. About the end of this year the queen, on account of his blindness, requested him to retire on a pension, but the negotiations connected with his resignation were not completed till April, 1583, and it was only after his death at Croydon, July 6th of the same year, that Whitgift, who had been nominated his successor, entered upon the see. Though Grindal yielded to the peremptory orders of Elizabeth in regard to the clergy who refused to sign the Act of Uniformity, he seems on all other occasions, while conducting himself with great moderation and manifesting unvarying courtesy and an earnest desire to avoid every cause of offence, to have strenuously upheld the spiritual independence of his office. His aims were on the whole noble and unselfish, and he was zealous in his endeavors to reform the abuses of his predecessor, to improve the moral and intellectual status of the clergy, and as far as possible to conciliate and reclaim the Puritans. He was sincerely attached to Protestantism, and laid much stress on the function of preaching, a "gift" in which he himself is said to have excelled. Grindal is alluded to (as Algrind) in the seventh "æglogue" of Spenser's *Shepheards Calender*.

His literary remains, which are unimportant, have been published by the Parker Society, with a biographical notice by the Rev. Wm. Nicholson, 1853. See also Strype's *Life of Grindal*, London, 1710, Oxford, 1821; *A Brief and True Account of Edmund Grindal*, 1710; *Memorials regarding his Suspension*, etc., supposed by some to have been written by Sacheverel, 1710; Fuller's *Worthies*; and Hook's *Lives of the Archbishops of Canterbury*, vol. viii.

GRINDSTONE. Sandstones which possess the property of abrading steel and other hard substances are extensively

used in arts and manufactures under the name of grindstones. In its simplest form a grindstone consists of a stone disc, more or less circular, mounted on a horizontal iron spindle carried on the tops of two wooden posts fixed in the ground. A winch handle, or occasionally a rude crank with treadle, provides the means of giving a slow rotation to the stone, against the cylindrical face of which the steel or other substance which is to be ground is held. Such grindstones—possessing neither truth of figure nor the means of obtaining it—are unsuitable for any but the roughest purposes; and although by mounting them in a frame to which a rest can be attached it is possible to keep them true and tolerably efficient, they are always slow in their action.

Cutlers employ grindstones which are roughly mounted but which act well, being driven at a much higher speed by a strap from a large wheel or pulley, and they carefully preserve the truth of the cylindrical face. And in many manufacturing processes the surface speed of the face is still further increased by employing very large stones, and giving them the greatest number of revolutions per minute that is compatible with safety—this limit even being sometimes exceeded, when the centrifugal force overcomes the rather slight cohesive strength of the stones, and breaks them up into fragments which fly to great distances with disastrous results. Sandstone suitable for grindstones of various degrees of hardness and fineness is found in the coal districts of the north of England, and also in those of the midland counties. A favorite stone for tool-grinding at a low speed is quarried at Bilston in Staffordshire. The neighborhood of Sheffield also affords some useful qualities of grindstone.

Artificial grindstones closely resembling the natural stones, but of perfectly uniform texture, which the natural ones frequently are not, were made a few years ago by Mr. Ransome's ingenious process. Their manufacture has been discontinued, but artificial grindstones of another kind, made with emery instead of sand, are now effecting a complete revolution in the art of the machinist. By means of these emery grinders, to which great variety of size and form can be given so as to suit the particular purposes for which they are intended, the operation of trueing up metal surfaces by hand, whether they are large or small, curved or flat, can in very many kinds of work be entirely dispensed with—the results being superior in truth of figure, uniform in all cases, and obtained in a mere fraction of the time which the most skilful workman would require. The extensive use of these grinders in America (where the importance of labor-saving machines is properly appreciated) renders it certain that the system will gradually make its way also in England, and that hand-filing will thus to a large extent be superseded—files being costly instruments in themselves, and many times more costly in their use, owing to the skill which they demand on the part of the workman who handles them.

Artificial wheels made with emery are by no means a new invention. In India and China they have been used for centuries; but, being made with lac and similar fusible materials, such wheels are not capable of being run at the high rate of speed which is a first essential to their efficiency. Others, however, which were not liable to these objections were made and patented in England more than thirty years ago; and it is surprising that these have not been more generally used. The chief advantage of those now made—some of which are manufactured in the United States, some on the continent of Europe, and some in England—is that they can be obtained of large size—up to about 3 feet in diameter—and that they are strong enough to be driven at a very high speed without breaking. At a surface speed of 5000 or 6000 feet per minute these wheels cut tempered steel readily, when used either wet or dry, and by their means it can be shaped, if necessary, in its hardest condition, with a facility previously unattainable. As in the case of common grindstones, truth of form is most important to their efficient working, and it is therefore desirable that the work under treatment should be held perfectly rigid, by means of some form of sliding rest, or otherwise. When so used the wear of the emery wheel, which is exceedingly slow, keeps it constantly true without attention. If from any cause this truth of figure be lost, or if it be desired to alter the form of the face, recourse must be had to turning it up with a diamond, nothing else in nature being sufficiently hard for the purpose.

GRINGOIRE, or GRINGON, PIERRE (*c.* 1480–1544), was the last of the mediæval poets. He lived to see the old methods which he was taught to believe unchangeable entirely superseded. He was born about the time when King René, the last of the princely *trouvères*, died; he finished his career when Marot had already introduced a new and natural *genre* which he could not understand, and when Ronsard and Baif were beginning those studies which would interpose a barrier between the old language and the new. It was not to be expected that he should ever fall in with the new movements, or that he should understand the enormous value of the changes which were destined to consign his own works to oblivion.

The place of his birth is uncertain. Perhaps it was Lorraine, perhaps Normandy. His real name was Gringon, which he changed to Gringoire, for the poetical reason that it sounded better. His early history is almost entirely unknown; at the age of nineteen or twenty he produced his first poem, *Le Chateau de Labour*, in which he is supposed to have narrated his own experiences. Most probably he did. René, Charles of Orleans, Froissart, Deschamps, all the poets whose works he would study, began with a poetical exposition of their own experiences. There are, in Gringoire's poem, the personages common to all mediæval allegories, *Raison*, *Bonne Volonté*, *Talent de beau faire*, for friends, and *Souci Tromperie*, and the rest, for enemies. Finding that the trade in allegorical poems was ruined for want of demand, and discovering an opening in the direction of mysteries, Gringoire began to produce those dramas, and joined the "Enfants de Sans Souci." The fraternity advanced him to the dignity of "Mère Sotte," and afterwards to the highest honor of the guild, that of "Prince des Sots." For twenty years Gringoire seems to have been at the head of this illustrious *confrèrie*, writing for them farces, *sotie*s, and satires. In this capacity of dramatist he exercised an extraordinary influence. At no time was the stage, rude and coarse as it was, more popular as a true exponent of the popular mind. Gringoire's success lay in the fact that he followed, but did not attempt to lead; on his stage the people saw exhibited their passions, their judgments of the moment, their jealousies, their hatreds, and their ambitions. Brotherhoods of the kind existed all over France. In Paris there were the "Enfans Sans Souci," the "Basochiens," the "Confrèrie de la Passion," and the "Souverain Empire de Galilée"; at Dijon there were the "Mère Folle" and her family; in Flanders the "Société des Arbaletriers" played comedies; at Rouen the "Cornards" or "Conards" yielded to none in vigor and fearlessness of satire. There is every reason, therefore, to believe that Gringoire enjoyed considerable distinction as the leading spirit among the satirists of the capital. He adopted for his device, *Tout par Raison*, *Raison par Tout*, *Par tout Raison*. He has been called the "Aristophanes des Halles." In one respect at least he resembles Aristophanes. He is serious in his merriment; there is purpose behind his extravagancies. Among his principal works are *Les Folles Enterprises* and *Les Abus du Monde*,—poems in which everything under the sun is criticised,—certain political pieces, such as *La Chasse du Cerf des Cerfs* (*Serf des Serfs*, *i. e.*, *servus servorum*), under which title that of the pope is thinly veiled, and *La Mère Sotte*, with all her literary offspring. During the last twenty years of a long life he became orthodox, and contributed the *Blason des Hereticques* to orthodox literature. It was during this period also that he wrote the work by which he is best known, the *Mystère de la Vie de Saint Louis*, of which an analysis may be found in M. Leroy's *Études sur les Mystères*. After more than 300 years of oblivion this poet has been republished, not so much on account of his own merits as because of the position which he occupies in the history of dramatic literature.

GRIQUALAND WEST, (1881) incorporated into Cape Colony, comprising the territory belonging to the western division of the Griqua people, which was annexed to the British empire October 27, 1871. The extent of the province is 17,800 square miles. It is bounded on the S. by the Orange River (which separates it from the Cape Colony), on the N. and N. E. by territory occupied by the Bechuana tribes and the Transvaal settlement, and on the E. by the Orange Free State. The general elevation of the country is about 3000 feet above sea-level; its characteristic features are undulating grassy plains, alternating with low ranges of rocky hills and sandy downs. The Vaal River flows through the principal districts, receiving in its course the

Hart River and Modder River, with its affluent the Riet River, before its junction with the Orange River. A portion of the territory is adapted for sheep-farming, and the river basins contain fertile lands suitable for agricultural purposes. But the great wealth of the country is in its diamond mines. Since the first discovery of diamonds, in 1867, the total value of the gems exported from the province up to the close of the year 1878 is estimated at £20,000,000. Digging operations were at first confined to the alluvial deposits on the banks of the Vaal River, but in 1871 mines were opened in the locality known as the "dry diggings," which have since received the names of Kimberley, De Beer's, Du Toit's Pan, and Bultfontein, all situated within a radius of a few miles. The area of the diamond-producing ground at each of these places is distinctly defined. At Kimberley the mine covers only 9 acres, at De Beer's 14 acres, at Du Toit's Pan 41 acres, and at Bultfontein 22 acres. These circular areas appear to be "throats" or "pipes" through which the volcanic and serpentinous matter containing the sparkling gems have been erupted; the surrounding rock consists of sandstones and shales entirely barren of diamonds. Kimberley, the chief centre of the mining industry, is the capital of the province and the seat of government. There is a resident lieutenant-governor or administrator, who is assisted by an executive council, and a legislative council composed of members partly elective and partly nominated by the crown. There is also a high court of justice presided over by a resident recorder. The other towns are Du Toit's Pan (including Bultfontein), Barkly, and Griqua Town. The villages and native locations are Hebron, Likatlong, Boetsap, Campbell, and Douglas. Among the river diggings or encampments are Pniel, Waldek's Plant, Sifonell, and Setlacomie's. A census taken in 1891 showed the total population of Griqualand West at that time to be 83,375, of whom 26,670 were Europeans.

GRISONS (German, *Graubünden*) is the largest and easternmost of the Swiss cantons. It is 80 miles in length from E. N. E. to W. S. W., and 45 in breadth, and has an area of 2963 square miles. On the N. E. and E. it abuts against the little principality of Liechtenstein, and the Austrian provinces of Tyrol and Vorarlberg, on the S. on the Italian provinces of Val Tellina and Como, and on the W. and N. on the Swiss cantons of Ticino, Uri, Glarus, and St. Gall.

The whole canton is mountainous, and, with the exception of the Rhine valley below Reichenau and the Italian valleys, which still form part of it, has a severe alpine climate and vegetation. One-tenth of the surface is covered by glaciers. The five principal glacier groups are those of the Tödi, N.; the Medelser Gebirge and the Rheinwald or Adula Gebirge, containing the chief source of the Rhine, S. W.; the Bernina group, the largest and loftiest, S. E.; and the Silvretta Gebirge, E. The principal valleys are the Vorder and Hinter Rheinthäler, with their side-valleys, the Valserthal, Averserthal, Oberhalbstein, and Prätigau, forming together the upper basin of the Rhine. Besides these, the canton includes the long narrow trough of the upper Inn, and the Italian valleys of Misocco, Bregaglia, and Poschiavo, whose streams join the Ticino or the Adda. The high average elevation of the country, with the absence of any large lake, renders the scenery more severe than that of central Switzerland, and the mountain summits less imposing. The most fertile valleys are the Prätigau and Rheinthal below Ilanz. The lower chains are rent by many great gorges. The Via Mala, the Rofla, and the Schyn are the best known, but those of the Züge, the Averserthal, Medelserthal, and Valserthal are almost equal to them in grandeur. In the Rheinthal below Chur the vine flourishes and good wine is produced, and the Cisalpine territory bears the usual products of the southern slope of the Alps, maize and chestnuts. At Poschiavo tobacco is cultivated to some extent. The inner valleys are the highest of Central Europe, containing several villages at an elevation of about 6000 feet (St. Moritz, Engadine, 6080; Bivio, Oberhalbstein, 5827; Cresta, in the Averserthal, 6394); snow lies there for six or seven months in the year, and corn will not ripen. The hay-harvest is the great agricultural event of the year, and is so large that great numbers of Italian laborers are annually employed in it. The forests and pasturages are the chief source of wealth. The lower Alps maintain a fine breed of cows; the upper are let to Bergamasque shepherds, who drive yearly immense flocks of sheep from North Italy for the summer pasturage. There are many mineral springs in the country; the most frequented are at Alveneu, Fideris, Le Prese, and San Bernardino, besides those in the Engadine (see ENGADINE).

The Grisons is sparsely peopled. The population in 1900 amounted to 105,065,—55,371 Protestants and 49,585 Catholics. 48,937 speak German and 17,883 Italian. The remainder use the Romansch or the Ladin dialect, probably corrupt descendants of the old "lingua rustica" of the Roman empire. The former is dying out in some districts on the Tyrolese frontier, and German is now everywhere taught in the schools. A large portion of the population find occupation and profit in the summer in attending to the wants of the numerous visitors attracted by the scenery or the mineral waters. There is a considerable transport trade with Italy, particularly in Val Tellina wines. Many of the young men seek their fortunes abroad as confectioners and coffee-house keepers.

Since Roman times the passes of the Grisons have been among the most frequented routes across the Alps. The Julier and Bernina, the Septimer, Splügen, and Lukmanier, were the most used in the Middle Ages. In 1818–23 the great road of the San Bernardino was made, and it was soon rivalled by the Splügen. The internal communications of the canton have been greatly developed in the last twenty years. The following are the principal carriage roads:—(1) the Ober Alp, Vorderrheinthal to Uri; (2) the Valserberg, Ilanz to Hinterrhein; (3) the Schyn, Julier, Albula, and Fluela Passes, connecting the Rhine valley and Davos district with the Engadine; (4) the Maloya and Bernina Passes, connecting the Upper Engadine with Chiavenna and Val Tellina respectively; (5) the Ofen Pass and the road following the gorge of the Inn to Finstermuntz, leading into Tyrol.

Two districts, the Upper Engadine and Davos, have lately acquired European fame as health resorts. Davos now receives every winter over 1000 consumptive patients. Statistics show that diseases of the lungs are very rare in high mountain districts, and local doctors observed that inhabitants who had contracted them in the plain recovered speedily on their return home. Davos is singularly well situated for a sanatarium for these diseases. The climate, owing to its distance from the warm currents rising from the Italian plain, is, though severe, singularly dry and equable in winter, and the valley is open and sunny. Many good hotels offer every comfort to invalids.

History.—The Rhæti, the original inhabitants of the region now known as Grauhünden, who were conquered under Augustus by the Romans, are reputed to have been an Etruscan race who had emigrated thither 500 years B. C. The Romans established numerous roads through the country, and held it in subjection until the downfall of their empire. In 496 A. D. Theodoric the Great settled some Alemanni in Rhætia. In 807 the district was incorporated by Charles the Great in his empire, and placed under a temporal count. In the middle of the 11th century, in the confusion consequent on the fall of the duchy of Alemannia, the bishop of Chur regained part of the temporal authority some of his predecessors had already held before 807, and in the early Middle Ages he appears as the most powerful among the petty rulers who disputed among themselves the right of oppressing the peasantry. Towards the end of the 14th century, the bishop of Chur supported the league formed by the neighboring districts to resist the encroachment of the lay nobles. This was known as the Gotteshausbund, and had Chur (see COIRE) as its chief town. In 1424 the Oberbund, sometimes called, perhaps from the gray coats of the delegates who assembled at Trons to confirm it, the Grauebund, was formed with the aid of the abbot of Dissentis and a party among the nobles in the Vorder Rheinthal. In 1436 the districts bordering on Tyrol, which had been vassals of the counts of Toggenburg (till the extinction of the line in that year), concluded, in imitation of their neighbors, a league known as the Zehngerichtenbund, with Davos for its centre. In 1450 the Zehngerichte formed an alliance with the Gotteshausbund, in 1471 with the Grauebund; but of the so-called "perpetual alliance" at Vazerol near Tiefenkasten there exists no authentic evidence in the oldest chronicles. It is certain, however, that several diets were held at Vazerol. Unhappily for the whole Grisons, nearly all the possessions of the Toggenburg family had fallen by 1489 to the house of Austria, to which an excuse was thus given for interference in the country. In 1497 the Grauebund and in 1498 the Gotteshausbund entered into alliance with the seven Swiss cantons. In 1499 the contest with Austria broke out. The memorable victory of the Malserheide or Calven, in which the imperial troops were defeated with a loss of 5000 men, coupled with other disasters to his arms in North Switzerland, weakened the authority of Maximilian, but the rights of Austria in the Zehngerichtenbund were only ex-

tinguished by purchase in 1652. In 1512 the Grisons took advantage of the war in Italy to lay hands on Val Tellina, Bormio, Chiavenna, and Val Misocco.

These acquisitions attracted, a hundred years later, the cupidity of the Spanish governor of Milan. The Grisons, torn between the French and the Spanish, the Reformed and Catholic parties, offered a favorable field for his intrigues. In 1620 the Protestants of Val Tellina were cruelly massacred, the Spaniards gained the district, and an Austrian force occupied the greater part of the Grisons. The Austrians were expelled in 1635 by the French, but the Grisons did not recover their full authority over their Italian possessions till 1639. They finally lost them when Napoleon annexed these districts to his Cisalpine republic, a measure confirmed by the congress of Vienna.

The obscure quarrels of the Planta and De Salis factions, dating from the 17th century, were put an end to by the Napoleonic wars and the appearance of great armies—French, Austrian, and Russian—upon the mountains. The incursion of the French was marked by the wanton destruction of the great convent of Dissentis, in which perished the chronicle of Dissentis, dating from the 7th century, and many of the MSS. of Placidus a Spescha, one of the first systematic explorers of his native Alps. In 1803 the Grisons, by virtue of Napoleon's act of mediation, became a member of the Swiss Confederation, retaining its internal government. This consists of a great council elected by universal suffrage, and meeting every year. Three citizens, elected yearly, form the executive government. A committee of 12 members assist them in weighty matters and in preparing bills for the chamber. Large powers of self-government are left to the separate communities. The constitution was last completely revised in 1853, but a further reform in an extreme democratic sense is now (1879) under debate.

For a list of ancient works on the Graubünden, see Röder & Tscharner's *Graubünden*, Bern, 1838, and Georg of Basel's *Bibliotheca Alpina Tertia*, 1878. See also Theobald's *Bundner Oberland* and *Naturbilder aus den Rhätischen Alpen;* Berlepsch's *Graubünden*, Leipsic, 1858; Leonhardi's *Das Poschiavino Thal*, Leipsic, 1859; Lechner, *Das Thal Bergell*, Leipsic, 1865; Coxe's *Travels in Switzerland*, 1780; Mrs. H. Freshfield's *Summer Tour in the Grisons*, 1862; Conradin von Moor's *Geschichte von Currätien*, Chur, 1870–74; P. C. Planta's *Das alte Rätien*, Berlin, 1872; *Davos by one who knows it*, 1878; *Fortnightly Review*, July, 1878, Nov., 1879; Ball's *Alpine Guide;* and articles ALPS and ENGADINE. (D. W. F.)

GRIVEGNÉE, a town of Belgium in the arrondissement and province of Liége, is situated on the Ourthe about a mile and a half S. W. of Liége. There are coal-mines in the neighborhood, and the town possesses iron foundries and manufactories of brass-wire, nails, and iron boats. The population is (1900), 10,550.

GROCYN, WILLIAM, an English scholar of the 15th century, was born at Bristol about 1442. Designed by his parents for the church, he was sent to Winchester College, and there he remained till his twenty-second year, when he was elected to a scholarship at New College, Oxford. In 1467 he became a fellow, and though in 1479 he accepted the rectory of Newton Longville in Buckinghamshire, he continued to reside in the university city. Having been chosen reader in divinity in Magdalen College in 1483, it fell to his lot to maintain a disputation with John Taylor, professor of divinity, in presence of King Richard III., and so well did he carry himself in the matter that the king sent him a buck and five marks. About 1488 Grocyn left England for Italy, and before his return in 1492 he had visited Florence, Rome, and Padua, and studied Greek and Latin under Demetrius Chalchondyles and Politian. As lecturer in Exeter College he found an opportunity of indoctrinating his countrymen in the new learning, and had the honor of teaching Greek not only to Sir Thomas More but to Erasmus himself, who was indebted to him also for an introduction to Archbishop Warham. When, some time afterwards, Grocyn removed to London, he was chosen by Dean Colet to deliver lectures in St. Paul's; and in connection with this engagement he gave a singular proof of his honesty. Having at first denounced all who impugned the authenticity of the *Hierarchia Ecclesiastica* ascribed to Dionysius the Areopagite, he was led to modify his views as he advanced in his investigation of the subject, and at length openly declared that he had been completely mistaken. About this time he was evidently in straitened circumstances, and though in 1506 he was appointed on Archbishop Warham's recommendation master or warden of All Hallow's College at Maidstone in Kent, we find him still obliged to borrow from his friends, and even to pledge his plate as a security. He died probably in 1519, and was buried in the collegiate church at Maidstone. With the exception of a few lines of Latin verse, and a letter to Aldus Manutius at the head of Linacre's translation of Proclus's *Sphæra* (Venice, 1499), Grocyn has left no literary proof of his scholarship or abilities. He was a great admirer of Aristotle, but his proposal to execute a translation of the philosopher in company with Linacre and Latimer was never carried out. By Erasmus he has been described as "vir severissimæ castissimæ vitæ, ecclesiasticarum constitutionum observantissimus pene usque ad superstitionem, scholasticæ theologiæ ad unguem doctus ac natura etiam acerrimi judicii, demum in omni disciplinarum genere exacte versatus" (*Declarationes ad Censuras Facultatis Theologiæ Parisianæ*, 1522).

See John Noble Johnson, *Life of Thomas Linacre*, London, 1835; Wood's *Athenæ Oxonienses;* Cunningham, *Lives of Eminent Englishmen*, vol. ii., 1835; Knight, *Life of Erasmus*.

GRODNO, a western province or government of Russia in Europe, lying between 52° and 54° N. lat., 23° and 26° E. long., and bounded N. by Vilna, E. by Minsk, S. by Volhynia, and W. by the former kingdom of Poland; area 14,896 square miles. The country is a wide plain, in some parts very swampy and covered with large pine forests. Of these that of Bielovieeza in the district of Prushana, comprising a circuit of over 100 miles, deserves notice, for here bisons are preserved. The navigable rivers are the Niemen, Bug, Narev, and Bobra. There are also several canals, among which those of Augustow and Oginsky are the most important. The soil, being chiefly alluvial deposit intermixed with sand, is favorable for agriculture and the rearing of cattle and bees. The atmosphere is damp and misty, and the climate in winter is cold. Large quantities of rye, barley, oats, hops, hemp, and flax are raised, but the amount of fruit and vegetables grown is small. The mineral products are insignificant. The manufactures consist of woollen cloths, hats, leather, paper, and spirits; there is also a good export trade in grain, wool, cattle, and timber. Some forty fairs are held annually in the province. Grodno is divided into nine districts, viz., Grodno, Brest, Bielostock, Bielsk, Volkovysk, Kobryn, Prushana, Slonim, and Sokolka. The administration of the whole province is in the hands of a governor appointed by the crown. In 1906 the population was 1,826,900, comprising Lithuanians, Russians, Poles, Tartars, and a few German colonists.

GRODNO, capital of the province of the same name, stands on the right bank of the Niemen in 53° 40′ N. lat., 23° 50′ E. long., and is connected by railway with St. Petersburg, Moscow, and Warsaw. It is the seat of the provincial government, and contains eight Roman Catholic, a Greek Eastern and two United Greek Catholic churches, a Lutheran chapel, and two Jewish synagogues. The government office is a splendid edifice. There are two fine palaces erected respectively by Stephen Batory, who died here in 1586, and Augustus III., kings of Poland. Among the other buildings are a public library, a school of medicine, a gymnasium, and several seminaries. The inhabitants (46,920) are engaged in the manufacture of woollens, silks, hats, paper, and the preparation of wax. Three fairs are held annually. Grodno was built in the 12th century, and at the commencement of the 13th was annexed to Poland. The Polish diet held there in 1793 ratified the second partition of Poland. Two years later Stanislaus Augustus, the last king, signed his abdication there.

GROEN VAN PRINSTERER, WILHELM (1801–1876), Dutch statesman, historian, and publicist, was born at Voorburg on August 21, 1801, received his grammar school education at the Hague, and studied law, philosophy, and history at the university of Leyden. At the age of twenty-five he published a volume of miscellaneous essays (*Verspreide Geschriften*, 1826), and in 1827 he was appointed private secretary to King William I. From this post he retired in 1833, in order that he might devote himself with less interruption to the historical researches which resulted in the gradual publication of his *Archives ou Correspondance inédite de la Maison d'Orange-Nassau*, in fifteen volumes (Leyden, 1835–64). An ardent conservative on all the ecclesiastical and political questions of the day, he entered the chamber of representatives in 1840, and took part with both tongue and pen in all the more important discussions of the years that followed, especially in those of 1848 and 1849. Between 1849 and 1865 he frequently sat in the second chamber, and from 1850 to 1855 the anti-liberal newspaper *Nederlander* was managed by him. The mortification which European events in 1864 and 1866 had caused him found expression in the occasional writings entitled *La Prusse et les*

Pays-Bas, A mes amis à Berlin, and *L'Empire Prussien et L'Apocalypse* (1867). Shortly afterwards he withdrew entirely from public affairs, but continued his literary pursuits, his latest production *Maurice et Barnevelt,* an able vindication of the Calvinistic prince as against the Arminian statesman, having been completed (1875) only a short time before his death, which occurred 19th May, 1876. Among other works of this author may be mentioned a *Handboek der Geschiedenis van het Vaterland* (1835), and an essay entitled *Ongeloof en Revolutie* (1847); but his sole claim to European celebrity rests upon the *Archives,* with their able if one-sided *Prolegomena.* The letters and documents comprised in the series are of extraordinary interest and value for the whole of the important period which elapsed between the outbreak of the revolution in the Netherlands and the establishment of the commercial oligarchy upon the death of William II.

GRONINGEN, a town of the Netherlands, in the province of the same name, is situated on the Hunse at the influx of the Aa, 45½ miles in an eastward direction from Harlingen. The central and more ancient part of the town is still surrounded by the old ditch, and communication is maintained with the outer portions by eighteen bridges. In the centre of the old town lies a group of open places, of which the greatest, the Breedemarkt, is one of the most spacious in the Netherlands. Five of the principal streets bear the name of as many ancient families—the Boterings, the Ebbings, the Gelkings, the Huddings, and the Folkings. Among the public buildings of Groningen the town-house (Radhuis) is one of the finest. It was built between 1793 and 1810 according to the plans of Jacob Otten Husley, and was extended in 1873. The administrative offices of the province of Groningen also occupy a fine building, which received a splendid front in 1870–1871. The provincial court of justice, transformed in the middle of the 18th century; the corn exchange, dating from 1825; and the weigh-house, completed in 1874; the so-called *Ommelanderhuis,* or house formerly devoted to the administration of the surrounding district; the civil and military prison; and the arsenal, are also all worthy of mention. There are twelve churches in Groningen, including two for the Roman Catholics, and five for the Reformed Church of the Netherlands, as well as a Jewish synagogue. St. Martin's, the Aa Church, and the New Church (all Reformed) are the principal. Of these the first is a Gothic building founded in 1253, and the last dates from the 17th century. The university of Groningen was founded in 1614, and its buildings were erected in 1847–1850. According to the *Annales Academici* (Leyden, 1877), the number of the students in 1874 was only 173, the strongest faculty being that of the physical sciences with 57. It has a library, an observatory, botanical gardens, an antiquarian museum, and a hospital among its auxiliary establishments. A fine deaf and dumb institution, founded by Henri Daniel Guyot, a gymnasium, a normal college, a school of navigation, a school of design, and a musical school are among the secondary educational establishments. A society *pro excolendo jure patris* has been in existence since 1761; an academy of fine arts was formed in 1830 by the incorporation of two older societies of similar character; and the same year saw the formal establishment of the society for the advancement of natural science, which may be traced back to the association started by Van Swinderen in 1801. Groningen maintains a considerable trade, and engages in a variety of industries. It manufactures salt, beer, vinegar, soap, earthenware, and ropes, weaves cotton and woollen stuffs, spins flax, makes brushes, furniture, mirrors, organs, and pianos, and has numerous goldsmiths and silversmiths. In 1840 the town and the suburbs comprised a population of 31,782. In 1870 the number of people in the commune, including 1248 on shipboard, was 37,894, and in the year 1506 it had increased to 73,278.

Mention is made of the Villa Cruoninga in a deed of gift from Henry III. to the church of Utrecht in 1040. In 1110 the town was surrounded with walls, but the bishop of Utrecht caused them to be dismantled in 1112, and it was not till 1255 that the defences began to be restored. The compass of the town, which at this time was about 13,000 feet, received considerable extension in 1469, when the walls were strengthened with six massive towers, and a ditch was dug. A further increase of defensive capabilities was effected in the course of the Gueldres war of 1514–36, and again under William Louis of Nassau between 1608 and 1624. The early history of Groningen consists mainly of struggles with the bishops of Utrecht. In the course of the 13th century there is evidence that the commercial activity of its population was finding outlet in various directions, and in the 14th it attained to no small political influence as the chief city of Friesland. Maximilian I. assigned Groningen to Albert of Saxony, but the citizens preferred to accept the protection of the bishop of Utrecht; and when Albert's son George attempted in 1505 to seize the town, they recognized the lordship of Edzart of East Frisia. On George's renewal of hostilities they transferred their allegiance to Duke Charles of Guelderland, and his position was sanctioned in 1515 by the emperor Charles V. In the course of the great wars of the 16th century the city had an eventful history, passing from hand to hand, and suffering all the miseries of siege and military occupation; but at length, in 1594, it was finally secured for the United Netherlands by Prince Maurice of Nassau. The dissensions between the citizens proper and the inhabitants of the "Ommelanden" continued, however, in spite of the decree of the states in 1597, which was intended to set them at rest. In 1672 the town was besieged by the bishop of Münster, but it was successfully defended, and in 1698 its fortifications were improved under Coehorn's direction. The French republicans planted their tree of liberty in the Great Market on February 14, 1795, and they continued in authority till 16th November, 1814. The fortifications of the city were doomed to destruction by the law of 18th April, 1874. Among the numerous men of mark who have been natives of Groningen it is enough to mention J. D. Bernoulli the mathematician, Surenhusius and Schultens the Orientalists, and Hemsterhuis the philologist.

See *Oudheden en Gestichten van Groningen uyt het Latijn vertaald,* door H. V. R., Leyden, 1724; *Kronyk van Groningen ende Ommelanden tot op dezen Jaare 1743,* Groningen, 1743; E. J. D. Lorgion, *Geschiedkundige Beschrijving der Stad Groningen,* Groningen, 1852–57; *Album der Stad Groningen,* Groningen, 1860; Wynne, *Handel en Ontwikkeling van Stad en Provincie Groningen,* Groningen, 1865; Theodor Wenzelberker, in Ersch and Gruber's *Encyclopädie, sub voce,* 1872; Witkamp, *Aardrijkskundig Woordenboek,* 1877.

GRONOVIUS, or GRONOV, Jakob (1645–1716), one of the very great scholars of the 17th century, was born 20th October, 1645, at Deventer, where his father, J. F. Gronovius (*q.v.*), was at that time professor of rhetoric and history. On the completion of his studies at Leyden, where he had early distinguished himself by his powers of intellectual acquisition, he in 1698 visited England, where he became acquainted with Pocock, Pearson, and Mery Casaubon, and where he devoted several months to the collation of rare manuscripts at Oxford and Cambridge. His edition of Polybius, published at Leyden in 1670, in addition to his own and variorum notes, contained those which Casaubon on his deathbed had bequeathed to him. Declining an invitation to a chair at Deventer, he in 1671 visited France, and was brought into intimate relations with D'Herbelot, Thevenot, and other distinguished scholars; and after another brief interval at Leyden he in 1672 travelled in Spain, whence he passed into Italy. There he accepted from the grand duke of Tuscany a chair at the university of Pisa, which, however, he resigned at the end of two years. Having returned to Deventer by way of Germany, he had settled down with the purpose of working uninterruptedly at an edition of Livy, when in 1679 he was invited by the curators of the university of Leyden to occupy a professorial chair. Here, untempted by several pressing invitations to various foreign universities, he spent the remaining years of his life, in which the calmness which normally characterizes even the most ardent scholarly research was unfortunately too often broken by literary quarrels conducted on his part with excessive violence and scurrility. He died 21st October, 1716.

The most celebrated as well as the most important of the works of J. Gronovius is the *Thesaurus Antiquitatum Græcarum* (Leyden, 1608–1702, in 13 vols. fol., and Venice 1732–1737, also in 13 vols. fol.). For this invaluable collection he adopted the plan traced out by Grævius in the *Thesaurus Antiquitatum Romanarum.* Gronovius published new editions of several authors commented on by his father, such as Seneca, Phædrus, and others; and he also edited Macrobius, Polybius, Tacitus, Cicero, Ammianus Marcellinus, Quintus Curtius, Suetonius, Arrian, Minutius Felix, Herodotus, Cebes, and some ancient geographers; the poem of Manetho, on the stars; the *Dactylotheca* of Gorlæus; the *Lexicon* of Harpocration, etc. The other productions of Gronovius consist of theses, discourses, and diatribes, of which a list will be found in the *Dictionnaire* of Chauffepié.

GRONOVIUS, or GRONOV, Johann Friedrich (1613–1671), scholar and critic, was born at Hamburg,

20th September, 1613. He went through his early studies with great distinction at Bremen, and afterwards attended the universities of Leipsic, Jena, and Altorf, whence he extended his travels into France and Italy. In 1643 he was appointed professor of rhetoric and history at Deventer, and in 1658 he succeeded Daniel Heinsius in the Greek chair at Leyden, where he died on the 28th of December, 1671.

Besides editing, with notes, Statius, Plautus, Livy, Pliny, Tacitus, Aulus Gellius, and Seneca's tragedies, he was the author of numerous works which have been exhaustively catalogued by Chauffepié and others. They include *De Sestertiis, sive subsecivorum Pecuniæ veteris Græcæ et Romanæ Libri IV* (1643), and notes upon Seneca, Phædrus, etc., which were subsequently utilized by his son Jacobus Gronovius in his editions of those authors.

GROOT, Gerhard (1340–1384), in Latin *Gerardus Magnus*, founder of the society of "Brethren of the Common Life," was born in October, 1340, at Deventer, where his father held a good civic position. Other forms of the family name are Groote, Groet, and Groete. At the close of his school education, received partly at Deventer and partly at Aix-la-Chapelle and Cologne, Gerhard ("Gerrit" or "Geert") in his fifteenth year entered the university of Paris, where he became firmly attached to the nominalism then in vogue, and where he made distinguished progress in almost all the branches of learning then cultivated,—canon law, medicine, astrology, and even magic being added to the theology and philosophy of the schoolmen. Shortly after his graduation in 1358, he returned to his father's house at Deventer, where, however, his stay was comparatively brief. We next hear of him as learning and teaching in Cologne; according to one account he studied also at Prague; and in 1366 he visited, on public business it is presumed, the papal court at Avignon. About this time he was appointed to a couple of canonries at Utrecht and Aix-la-Chapelle respectively, and the life of the brilliant young scholar was rapidly becoming luxurious, secular, and selfish, when a great spiritual change passed over him which resulted in a final renunciation of every worldly enjoyment. This conversion, which took place in 1374, appears to have been due partly to the effects of a dangerous illness, and partly to the influence of the learned and pious prior of the Carthusian monastery at Munnikhuizen near Arnheim, who had seriously remonstrated with him on the vanity of his life. During the next five years he devoted a considerable portion of his time to repeated and prolonged visits to the monastery of the Augustinian canons regular at Viridis Vallis (Groenendael near Brussels), whose prior, Johann Ruysbroeck, a man of deep though somewhat mystical piety and of considerable literary power, could not fail to impress those who came in contact with him, and many of whose special views are unmistakably reproduced in the writings of Groot and his "fratres devoti." Between 1374 and 1379 Gerhard had also spent some three years in all at Munnikhuizen in study and prayer; and in the course of the last-mentioned year he left the privacy of the cloister, and having received ordination as a deacon, became a missionary preacher within the diocese of Utrecht. The success which followed his labors, not only in the town of Utrecht itself, but also in Zwolle, Kampen, Leyden, Delft, Gouda, Amsterdam, and many other places, was immense; according to Thomas a Kempis, the people left their business and their meals to hear his sermons, so that the churches could not hold the crowds that flocked wherever he came. The impartiality of the censures, however, which he directed, not only against the prevailing sins of the laity, but also against the heresy, simony, avarice, and impurity of the secular and regular clergy, soon provoked the uncompromising hostility of the entire body of the latter; and accusations of heterodoxy speedily began to be brought against him. It was in vain that Groot emitted a *Publica Protestatio*, in which he declared that Jesus Christ was the great subject of his discourses, that in all of them he believed himself to be in harmony with the Catholic doctrine, and that he willingly subjected them to the candid judgment of the Roman Church. By a skilfully framed episcopal edict of 1383, which excluded from the pulpit all who had not received priest's orders, his public preaching was brought abruptly to an end; an appeal to Urban VI. was made in vain. Compelled thus to search for some other field of usefulness, Groot, in conjunction with his friend Florentius, a canon of Utrecht, began to superintend the labors of certain young men who employed themselves in transcribing manuscripts of church fathers and other authors; from time to time as they met to receive payment for their work, he sought to edify them with religious exhortation. Ultimately the idea suggested itself that the little band might throw their earnings into a common fund and live together according to a fixed rule. The house of Florentius forthwith became a cloister of "fratres vitæ communis," who were speedily joined by many new members, both clerical and lay, practised in a considerable variety of handicrafts; the general rule of the Augustinian order was adopted; it was also agreed that their daily bread should be shared in common, and that it should be earned, not begged. Groot's private estate sufficed for the establishment on like principles of a sisterhood who supported themselves by spinning, weaving, and needlework. After a comparatively brief life of singular energy, patience, and self-denial, Groot fell a victim to the plague at Deventer on the 20th of August, 1384. Within fifty years of his death the "Brethren of the Common Life," also called "Fratres bonæ voluntatis" or "Fratres Collationarii," numbered seventeen collegiate churches in the Netherlands, and contributed somewhat extensively to theological literature. Thomas a Kempis, who wrote a *Vita Gerhardi Magni*, was trained under Gerhard himself at Deventer. The order disappeared at the time of the Reformation.

For a very clear and full account of the life of Groot, with an analytic and exhaustive catalogue of his extant works, reference may be made to the article on the "Brethren of the Common Life," by Hirsche, in Herzog's *Real Encyklopädie*, ii. 679–696 (1878). The principal original authority is the work of Thomas a Kempis already referred to. See also Ullmann's *Reformers before the Reformation*, whose somewhat *ex parte* exposition of Groot's theological views, however, must be taken with reservations.

GROS, Antoine Jean, Baron (1771–1835), the pupil of David and the forerunner of Géricault, occupies a peculiar position between the classic and romantic schools which divided opinion at the beginning of the present century. He was born at Paris in 1771. His father, who was a miniature painter, began seriously to teach him to draw at the early age of six, and showed himself from the first an exacting master. Towards the close of 1785 Gros, by his own choice, entered the studio of David, which he frequented assiduously, continuing at the same time to follow the classes of the Collége Mazarin. The death of his father, whose circumstances had been embarrassed by the Revolution, threw Gros, in 1791, upon his own resources. He now devoted himself wholly to his profession, and competed in 1792 for the *grand prix*, but unsuccessfully. About this time he was, however, on the recommendation of the École des Beaux Arts, employed on the execution of portraits of the members of the Convention, and when—disturbed by the development of the Revolution—Gros in 1793 left France for Italy, he supported himself at Genoa by the same means, producing a great quantity of miniatures and *fixés*. He visited Florence, but returning to Genoa made the acquaintance of Josephine, and followed her to Milan, where he was well received by her husband. On November 15, 1796, Gros was present with the army near Arcola when Bonaparte planted the tricolor on the bridge. Gros seized on this incident, and showed by his treatment of it that he had found his vocation. Bonaparte at once gave him the post of "inspecteur aux revues," which enabled him to follow the army, and in 1797 nominated him on the commission charged to select the spoils which should enrich the Louvre. In 1799, having escaped from the besieged city of Genoa, Gros made his way to Paris, and in the beginning of 1801 took up his quarters in the Capucins. His "esquisse" (Musée de Nantes) of the Battle of Nazareth gained the prize offered in 1802 by the consuls, but was not carried out, owing it is said to the jealousy of Junot felt by Napoleon; but he indemnified Gros by commissioning him to paint his own visit to the pest-house of Jaffa. Les Pestiférés de Jaffa (Louvre) was followed by the Battle of Aboukir, 1806 (Versailles), and the Battle of Eylau, 1808 (Louvre). These three subjects—the popular leader facing the pestilence unmoved, challenging the splendid instant of victory, heart-sick with the bitter cost of a hard-won field—gave to Gros his chief titles to fame. As long as the military element remained bound up with French national life, Gros received from it a fresh and energetic inspiration

which carried him to the very heart of the events which he depicted; but as the army and its general separated from the people, Gros, called on to illustrate episodes representative only of the fulfilment of personal ambition, ceased to find the nourishment necessary to his genius, and the defect of his artistic position became evident. Trained in the sect of the Classicists, he was shackled by their rules, even when—by his naturalistic treatment of types, and appeal to picturesque effect in color and tone—he seemed to run counter to them. In 1810 his Madrid and Napoleon at the Pyramids (Versailles) show that his star had deserted him. His Francis I. and Charles V., 1812 (Louvre), had considerable success; but the decoration of the dome of St. Geneviève (begun in 1811 and completed in 1824) is the only work of Gros's later years which shows his early force and vigor, as well as his skill. The Departure of Louis XVIII. (Versailles), the Embarkation of Madame d'Angoulême (Bordeaux), the plafond of the Egyptian room in the Louvre, and finally his Hercules and Diomedes, exhibited in 1835, testify only that Gros's efforts—in accordance with the frequent counsels of his old master David—to stem the rising tide of Romanticism served but to damage his once brilliant reputation. Exasperated by criticism and the consciousness of failure, Gros sought refuge in the grosser pleasures of life, but suddenly his vital forces failed him, and on the 25th June, 1835, he was found drowned on the shores of the Seine near Sèvres. From a paper which he had placed in his hat it became known that "las de la vie, et trahi par les dernières facultés qui la lui rendaient supportable, il avait résolu de s'en défaire." The number of Gros's pupils was very great, and was considerably augmented when, in 1815, David quitting Paris made over his own classes to him. Gros was decorated and named baron of the empire by Napoleon, after the Salon of 1808, at which he had exhibited the Battle of Eylau. Under the Restoration he became a member of the Institute, professor at the École des Beaux Arts, and was named chevalier of the order of St. Michel.

M. Delécluze gives a brief notice of his life in *Louis David et Son Temps*, and Julius Meyer's *Geschichte der modernen französischen Malerei* contains an excellent criticism on his works.

GROSBEAK (French, *Grosbec*), a name very indefinitely applied to many birds belonging to the families *Fringillidæ* and *Ploceidæ* of modern ornithologists, and perhaps to some members of the *Emberizidæ* and *Tanagridæ*, but always to birds distinguished by the great size of their bill. Taken alone it is commonly a synonym of HAWFINCH (*q. v.*), but a prefix is most usually added to indicate the species, as Pine-Grosbeak, Cardinal-Grosbeak, and the like. By earlier writers the word was generally given as an equivalent of the Linnæan *Loxia*, but that genus, as first established, has been found to include many forms which, according to more recent notions, cannot possibly be placed in the same Family.

The PINE-GROSBEAK (*Pinicola enucleator*) is, with the exception of the Hawfinch just mentioned, the best known species to which the name is applied. It inhabits the conifer-zone of both the Old and the New Worlds, seeking, in Europe and probably elsewhere, a lower latitude as winter approaches—often journeying in large flocks; and stragglers have occasionally reached the British Islands, though the records of not more than half a dozen such occurrences can be wholly trusted (Yarrell, *Br. Birds*, ed. 4, ii. pp. 177–179). In structure and some of its habits much resembling a Bullfinch (see FINCH, vol. ix. p. 167), but much exceeding that bird in size, it has the plumage of a Crossbill (vol. vi. p. 542), and appears to undergo exactly the same changes as do the members of the restricted genus *Loxia*,—the young being of a dull greenish-gray streaked with brownish-black, the adult hens tinged with golden-green, and the cocks glowing with crimson-red on nearly all the body-feathers, this last color being replaced after moulting in confinement by bright yellow. Nests of this species were found in 1821 by Zetterstedt near Juckasjärwi in Swedish Lapland, but little was really known with certainty concerning its nidification until 1855, when the late Mr. Wolley, after two years' ineffectual search, succeeded in obtaining in the not very distant district of Muonioniska well-authenticated specimens with the eggs, both of which are like exaggerated Bullfinches'. The food of this species seems to consist of the seeds and buds of many sorts of trees, though the staple may very possibly be those of some kind of pine. The cock has a clear and pleasing song, which makes him in many countries a favorite cage-bird; and the notes of the hen may even be deemed to qualify her as a musician of no small merit.

Allied to the Pine-Grosbeak are a number of species of smaller size, but its equals in beauty of plumage.[1] These have been referred to several genera, such as *Carpodacus*, *Propasser*, *Bycanetes*, *Uragus*, and others; but possibly *Carpodacus* is sufficient to contain all. Most of them are natives of the Old World, and chiefly of its eastern division, but several inhabit the western portion of North America, and one, *C. githagineus* (of which there seem to be at least two local races), is an especial native of the deserts, or their borders, of Arabia and North Africa, extending even to some of the Canary Islands—a singular modification in the *habitat* of a form which one would be apt to associate exclusively with forest trees, and especially conifers.

The VIRGINIAN GROSBEAK, or Virginian Nightingale of many writers, *Cardinalis virginianus*, next claims notice here, though doubts may be entertained as to the family to which it really belongs. No less remarkable for its bright carmine attire, and the additional embellishment of an elongated crest of the same color, than for its fine song, it has been an object of attraction almost ever since the settlement of its native country by Europeans. All American ornithologists speak of its easy capture and its ready adaptation to confinement, which for nearly three centuries have helped to make it a popular cage-bird on both sides of the Atlantic. The vocal powers possessed by the cock are to some extent shared by the hen, though she is denied the vivid hues of her partner, and her plumage, with exception of the wings and tail, which are of a dull red, is light olive above and brownish-yellow beneath. This species inhabits the eastern parts of the United States southward of 40° N. lat., and also occurs in the Bermudas. It is represented in the south-west of North America by other forms that by some writers are deemed species, and in the northern parts of South America by the *C. phœniceus*, which would really seem entitled to distinction. Another kindred bird, placed from its short and broad bill in a different genus, and known as *Pyrrhuloxia sinuata* or the Texan Cardinal, is found on the southern borders of the United States and in Mexico; while among North Amerian "Grosbeaks" must also be named the birds belonging to the genera *Guiraca* and *Hedymeles*—the former especially exemplified by the beautiful blue *G. cærulea*, and the latter by the brilliant rose-breasted *H. ludovicianus*, which last extends its range into Canada.

The species of the Old World which, though commonly called "Grosbeaks," certainly belong to the family *Ploceidæ*, may be in this work more conveniently treated under the title of WEAVER-BIRDS (*q. v.*). (A. N.)

GROSE, FRANCIS (*c.* 1730–1791), a celebrated English antiquary, son of a wealthy Swiss jeweller settled in England, was born at Greenford in Middlesex, about the year 1730. The bias of his mind towards heraldry and antiquities showed itself early; and his father, indulging it, procured him a position in the Herald's College. In 1763, being then Richmond Herald, he sold his tabard, and shortly afterwards became adjutant and paymaster of the Hampshire militia, where, as he himself humorously observed, the only account-books he kept were his right and left pockets, into the one of which he received, and from the other of which he paid. This carelessness exposed him to serious losses; and after a vain attempt to repair them by accepting a captaincy in the Surrey militia, the competency left him by his father being squandered, he began to turn to account his excellent education and his powers as a draughtsman. In 1757 he had been elected fellow of the Society of Antiquaries. In 1773 he began to publish his *Antiquities of England and Wales*, a work which brought him money as well as fame. This, with its supplementary parts relating to the Channel Islands, was not completed till 1787. In 1789 he set out on an antiquarian tour through Scotland, and in the course of this journey met Burns, who composed in his honor the famous song beginning "Ken ye aught o' Captain Grose," and in that other poem, still more famous, "Hear, land o' cakes, and brither Scots," warned

[1] Many of them are described and beautifully figured in the *Monographie des Loxiens* of the late Prince C. L. Bonaparte and Professor Schlegel (Leyden and Düsseldorf, 1850), a work which includes, however, all the Crossbills, Redpolls, and Linnets then known to the authors, while it excludes many birds that an English writer would have to call "Grosbeaks."

all Scotchmen of this "chield amang them taking notes." In 1790 he began to publish the results of what Burns called "his peregrinations through Scotland;" but he had not finished the work when he bethought himself of going over to Ireland and doing for that country what he had already done for Great Britain. About a month after his arrival, however, while in Dublin at the table of his friend Hone, he was seized with an apoplectic fit, and died in a moment, June 12, 1791.

Grose was a sort of antiquarian Falstaff,—at least he possessed in a striking degree the knight's physical peculiarities; but he was a man of true honor and charity, a valuable friend, "overlooking little faults and seeking out greater virtues," and an inimitable boon companion. His professional merits were far from contemptible; he was a clever draughtsman, and had considerable power of pictorial composition. While most of his writings concern only the learned, others exhibit strong satiric power. But he showed to greatest advantage as a social being; his humor, his varied knowledge, and his good nature were all eminently calculated to make him a favorite in society. As Burns says of him—

> "But wad ye see him in his glee,
> For meikle glee and fun has he,
> Then set him down, and twa or three
> Gude fellows wi' him;
> And *port, O port!* shine thou a wee,
> And THEN ye'll see him!"

Grose published *The Antiquities of England and Wales*, 6 vols. fol., 1773–87. In 1782 appeared *Advice to the Officers of the British Army*, a satire in the manner of Swift's *Directions to Servants*, which is very confidently attributed to Grose; in 1783, *A Guide to Health, Beauty, Riches, and Honor*, a collection of advertisements of the period, with characteristic satiric preface; in 1785, *A Classical Dictionary of the Vulgar Tongue*, 8vo; 1785–89, *A Treatise on Ancient Armor and Weapons*; in 1786, Darrell's *History of Dover*; 1786–88, *Military Antiquities*, 2 vols. 4to; 1787, *A Provincial Glossary*; 1788, *Rules for Drawing Caricatures*, 8vo; 1789–91, *The Antiquities of Scotland*, 2 vols. 4to; 1791, *Antiquities of Ireland*, 2 vols. 4to, edited and partly written by Ledwich. *The Grumbler*, sixteen clever humorous ossays by Grose, appeared in 1791, after his death; and in 1793 *The Olio*, a collection of essays, jests, and small pieces of poctry, highly characteristic of Grose, though certainly not all by him, was put together from his papers by his publisher, who was also his executor. A capital full-length portrait of Groso by Dance is in the first volume of the *Antiquities of England and Wales*, and another is among Kay's *Portraits*. A versified sketch of him appoared in the *Gentleman's Magazine*, vol. lxi. p. 660. See *Gentleman's Magazine*, vol. lxi. pp. 498, 582; Noblo's *Hist. of the College of Arms*, p. 434.

GROSSENHAIN, a town in the circle of Dresden, Saxony, is situated on the Röder, an affluent of the Elbe, 20 miles N. W. of Dresden. It has manufactures of woollen and cotton stuffs, buckskin, silk thread, and waxcloth. The principal buildings are the church of Our Lady completed in 1748, the real school of the second order, the new town-house completed in 1876, the infirmary, and the poorhouse. The population in 1905, exclusive of the garrison, was 12,024.

Grossenhain owes its origin to the Sorbs, and obtained the rank of a town in the 10th century. It was for a time possessed by the Bohemians, by whom it was strongly fortified. It afterwards came into the possession of the counts of Meissen, from whom it was taken in 1312 by the margraves Waldemar and John of Brandenburg. It suffered considerably in all the great German wars, and in 1744 was nearly destroyed by fire.

GROSSETESTE, ROBERT (*c.* 1175–1253), in some respects the most distinguished of all the English mediæval prelates as regards his personal influence both over the men of his time and on its literature, was born of humble parents at Stradbrook in Suffolk about the year 1175. All that is known of his early years is (from his own account) that he studied the characters of the best men in the Scriptures, and endeavored to conform his actions to theirs. He was sent by his friends to Oxford, where he studied law and medicine, and seems to have finished his education at Paris, where he probably laid the foundation of his knowledge of Greek and Hebrew. His first patron was William de Vere, bishop of Hereford, to whom he was introduced by Giraldus Cambrensis, but who died in 1199, and thus had little opportunity of assisting the young scholar. From Paris he returned to Oxford, graduated in divinity, and became master of the schools (*rector scolarum*) or chancellor. He also became the first rector of the Franciscans at Oxford. Here he probably wrote his commentaries on Aristotle, and laid the foundations of his fame as a preacher. His earliest preferment of which we can speak with certainty was the archdeaconry of Wilts, which he held in 1214 and 1220; he was archdeacon of Northampton in 1221, holding at the same time the prebend of Empingham, which belonged to the archdeaconry. This he exchanged for the archdeaconry of Leicester, which he probably held till 1232. In May, 1225, he was collated by Hugh de Wells, bishop of Lincoln, to the church of Abbotsley, Hunts, and at one time he held the rectory of St. Margaret's, Leicester. In 1231 he probably wrote his treatise *De Cessatione Legalium* with the view of converting the Jews, for whose benefit the *Domus conversorum* was established in London this year. A fever in November, 1232, induced him to resign all his preferments excepting his Lincoln prebend, and the leisure he thus obtained was spent at Oxford, and probably employed in writing his mathematical treatises and his theological *Dicta*. On the death of Bishop Hugh de Wells in February, 1235, the chapter of Lincoln elected Grosseteste to the see; the election took place on March 27, and he was consecrated at Reading on June 17. His administration of his diocese, then the most extensive in the country, was characterized by great vigor. Within a year of his consecration he visited the monasteries, removing seven abbots and four priors; and in 1238 he issued his constitutions, embodying the points discussed at the great council of the Church of England held in London in 1237, concerning which he had already written to his archdeacons; at the same time, as diocesan of Oxford, he exercised a watchful supervision over the university, protecting the scholars who were in trouble for their attack on the legate Otho in 1238, and even entering into such matters of detail as the place where the university chest should be kept. His energy in his visitations did not pass without opposition; an attempt on his life by poison was made in 1237, from which he recovered with difficulty through the help of John de S. Giles; and in 1239 began the quarrel with the chapter of Lincoln, which lasted six years, and was only quieted by the decision of the pope himself. They claimed exemption from episcopal visitation, and spoke of the bishop's demanding what had never from the earliest times been the custom. He would not tolerate an *imperium in imperio*, a body of men joined by common interests, who declined to submit to his jurisdiction, and who might be in need of visitation and correction as much as any others. Full details are given in the bishop's letters of the progress of the quarrel; appeals to Canterbury and the Roman court were followed by excommunications on both sides, the chapter even condescending to exhibit a forged paper as to the history of the church and see of Lincoln. The question was at length settled by a personal appeal to Pope Innocent IV. at Lyons. In a bull of August 25, 1245, he decided almost all the points at issue in favor of the bishop, who lost no time in putting his powers into execution. Of his own view of the matter a very curious exemplification is given in the letter or pamphlet sent to the chapter (epist. 127), where his right to visit them is proved by all kinds of mystical arguments and scriptural examples. In 1242, with the help of one Nicholas, a Greek, clerk of the abbey of St. Alban's, he translated the *Testamenta XII Patriarcharum*, which had been brought from Athens by John of Basingstoke. In 1243 occurred the serious quarrel with the chapter of Canterbury (the see being practically vacant, as Boniface was not yet consecrated) respecting the abbey of Bardney,—the bishop deposing the abbot in spite of his appeal to Canterbury, and the monks in an especially solemn manner excommunicating the bishop. On receiving the letters from the convent, he threw them on the ground in spite of the seal containing the effigy of St. Thomas, and paid no attention whatever to the sentence. Both parties appealed to the pope, and an arrangement was made between them. In 1244, being one of a committee of twelve chosen to determine what answer should be given to the king's demand of a subsidy, his influence kept the members from being separately won over by the king's endeavors to make parties among them; and the council broke up without giving way to the royal demands. The same year his examination of Robert Passelew, who through the king's influence had been elected bishop of Chichester, though utterly unfit, caused the election to be annulled. On returning from Lyons we find Grosseteste executing various com-

missions with which he was entrusted by the pope; urging on the archbishop of York the claims of the bishop of Cervia; endorsing and sending round the papal letter allowing Archbishop Boniface the revenues of all benefices in his province that should fall vacant within the next seven years till 10,000 marks should be collected, in order to free the see from its debts; and insisting on the bishops paying the subsidy demanded by the pope, in spite of the king's opposition. In this year (1245) he obtained a bull to prevent any of the Oxford scholars graduating in arts without passing through the usual examinations *secundum morem Parisiensem*, and without having been approved by the bishop himself or one appointed by him. In 1247 he delivered an address vindicating the genuineness of the relic (a portion of our Lord's blood) presented by the king to Westminster. His visitation of his diocese, especially of the monasteries in it, and his superintendence of the studies of Oxford, which went on without interruption during these years, while inducing others of the bishops to follow his example, were not accomplished without serious troubles, embroiling him even with the king. Thus, in 1250, his visitation having proved that many of the religious houses had converted to their own uses certain possessions which belonged to the parishes, which were thus impoverished and left without resident priests, he procured a papal letter authorizing him to revoke what they had thus obtained, citing all the beneficed monks in his diocese to hear the letter. Those who had exemptions appealed to the pope, and Grosseteste again crossed the sea to lay the case before him. But the gold of the religious orders had been at Lyons before him, and the pope sent him away from his presence in confusion, hopelessly exclaiming against the power of money at the Roman court. He was not, however, downhearted, but busied himself in other affairs, and delivered before the pope and certain cardinals his celebrated sermon on the abuses of the papal court. Here he stayed till the end of September, and then returned in sad plight to England, almost thinking of resigning his see in despair. But he soon recovered from this, and pursued his visitation of the monasteries with still greater vigor, so as to be accused by Matthew Paris of tyranny such as to make him be thought, "not severe, but rather austere and inhuman." In 1251 he was suspended by the pope in consequence of his refusing to admit an Italian ignorant of English to a rich benefice in his diocese. The suspension was short, as he officiated at Halcs this year, on the dedication of the church founded by Richard of Cornwall, his position among the bishops being shown by his celebrating mass at the high altar. In 1252 he obtained a papal letter authorizing the appointment of vicars, and their payment out of the revenues of their livings; and in the same year his influence kept the bishops together in their resistance to the royal demands of a tenth of church revenues for three years granted by the pope, nominally for the king's necessities on his intended crusade. He had also this year a calculation made of the revenues of the foreigners in England, which amounted to more than 70,000 marks. In 1253 the pope ordered him to induct by provision his nephew Frederick di Lavagna into a canonry at Lincoln; the bishop's answer to the requisition sent to the papal commissioners (the archdeacon of Canterbury, and Innocent, the pope's notary), though of less importance than many of his other letters, has done more to make his fame popular and permanent than any of his works. He is very decided in refusing to institute the candidate from his unfitness, at the same time that he expresses the utmost reverence for the pope and the Roman see. The letter made the pope very angry, and he was only quieted by the advice of the cardinals, who spoke in the highest terms of the bishop's character and position. Grosseteste was present at the parliament in May, when the violators of Magna Charta were again excommunicated; not content with this, he had the sentence read in every parish in the diocese of Lincoln. In October he fell ill at his manor of Buckden, where he died on October 9th. He was buried on October 13th in Lincoln Cathedral, the archbishop performing the service and many other bishops assisting. Bells were said to have been heard in the air on the night of his death, and miracles to have taken place at his tomb. The pope is said to have expressed joy at his death, and to have desired to have his bones cast out of the church. The story of the pope's dream, that the bishop appeared to him and struck him in such a manner as to cause his death, shows what the popular estimation of the two was. It is perhaps not to be wondered at that the attempt to procure the canonization of the bishop in 1307 failed.

How great the personal influence of Bishop Grosseteste was may be chiefly learnt from his letters: he was the instructor of the king (*e. g.*, in one of his letters on the value of the royal anointing), the friend of the queen, the tutor of Simon de Montfort's sons, his warner and consoler at different times, the correspondent of Adam de Marisco, the referee of many as to spiritual difficulties. Of those who speak of him, one is especially struck by his courage, another by his universal knowledge, a third by his subtlety in interpreting scripture, a fourth by his frequent preaching. Even Matthew Paris, no favorable judge, warms into admiration in speaking of his character (*Chron. Maj.* v. p. 408). The popularity of Grosseteste as an author is proved by the number of manuscripts remaining of his works, and from the fact that very few writers for the two centuries following his death do not contain quotations from *Lincolniensis*. His determination to root out all abuses is seen in his opposition to unjust demands of the king or the archbishop, to unfit nominees of the pope, indeed to the whole system of papal provisions. That he was of a hasty temper, and harsh and severe at times, is true; but no one ever more thoroughly tried to do his duty, probably few have effected more.

The chief sources for the facts of his life are his own letters, those of Adam de Marisco, the History of Matthew Paris, and the Annals of Dunstable. Of his works, a fragment of the *De Cessatione Legalium* was printed in London, 1658; a selection of his letters was printed by E. Brown in the *Appendix* to his *Fasciculus Rerum Expetendarum et Fugiendarum*, 1690, and a complete edition in the Rolls series of chronicles and memorials, 1861, by H. R. Luard. Brown printed also some of his sermons. The tract *De moribus pueri ad mensam* was printed by W. de Worde, and that "De phisicis, lineis, angulis, et figuris per quas omnes actiones naturales complentur" at Nuremberg, 1503; and others of his mathematical treatises are in print. His French poem *Le Chastel d'Amour*, and an English version called *The Castel of Love*, have been printed for the Caxton and Philological Societies. Separate lives of him have been written by Samuel Pegge, 1793, and G. G. Perry, 1871. Complete lists of his works are given by Oudin, Tanner, Fabricius, etc. In Pegge's life, the list fills 23 quarto pages. (H. R. L.)

GROSSETO, a town of Italy, at the head of the province of the same name, is situated in the Maremma district, near the right bank of the Ombrone-Senese, with a station on the railway between Florence and Rome. It is well built and surrounded with solid walls about 2 miles in circuit, and among its public edifices is a spacious cathedral with a marble façade, but the principal interest of the place results from the great hydraulic labors by which the surrounding swamp—the Lacus Prelius of Cicero—has gradually been drained and rendered capable of tillage. Drinking water, of which the town was formerly almost destitute, has been supplied by an artesian well of enormous depth, bored since 1833. About 3½ miles to the N. E. lie the sulphurous baths of Roselle (*Aquæ Rusellarum*), and about 2 miles further off are the ruins of the ancient Etruscan city of Rusellæ, the walls of which are about two miles in circumference. Roselle continued to be inhabited till the close of the 13th century, but its unhealthiness gradually constrained the inhabitants to remove to Grosseto, which is first distinctly mentioned in 830 in a document of Louis I., and became a bishop's see in 1138. For some time Grosseto was under the sway of the Aldobrandini family, and it was afterwards subject to the republic of Siena, which treated it badly. Francis I. furnished it with a fortress and walls, and Ferdinand I. made it a regular place of arms. At present the climate is so unhealthy in summer that the provincial authorities remove to Scansano. The population of Grosseto in 1900 was 6153 in the town proper, 7200 including the suburbs, and 9,600 in the commune.

GROSSI, Tommaso (1791–1853), Lombard poet and novelist, was born at Bellano, on the Lake of Como, January 20, 1791. He took his degree in law at Pavia in 1810, and proceeded thence to Milan to exercise his profession; but the Austrian Government, suspecting the young barrister's loyalty, interfered with his prospects, and thus it happened that Grossi was a simple notary all his life. That the suspicion was well grounded he soon showed by writing in the Milanese dialect the battle poem *La Prineide*, in which he described with vivid colors the tragical death of Prina, chief treasurer during the empire, whom the people of Milan, instigated by Austrian agitators, had

torn to pieces and dragged through the streets of the town (1814). The poem, being anonymous, was first attributed to the celebrated Porta, but Grossi of his own accord acknowledged himself the author. In 1816 he published other two poems, written likewise in Milanese—*The Golden Rain* (La Pioggia d'Oro) and *The Fugitive* (La Fuggitiva). These compositions secured him the friendship of Porta and Manzoni, and the three poets came to form a sort of romantic literary triumvirate. Grossi took advantage of the popularity of his Milanese poems to try Italian verse, into which he sought to introduce the moving realism which had given such satisfaction in his earliest compositions; and in this he was entirely successful with his poem *Ildegonda* (1814). He next set about writing an epic poem, entitled *The Lombards in the First Crusade*, a work of which Manzoni makes honorable mention in his *Betrothed*. This composition, which was published by subscription (1826), attained a success that has not been equalled by that of any other Italian poem within the century. The example of Manzoni, who had meanwhile published *The Betrothed* (1827), induced his friend Grossi to enter the same arena with an historical novel entitled *Marco Visconti* (1834)—a work which contains passages of fine description and deep pathos. A little later Grossi published a tale in verse, *Ulrico and Lida*, but with this publication his poetical activity ceased. After his marriage in 1838 he continued to employ himself as a notary in Milan till his death on December 10, 1853.

GROSSWARDEIN (Hungarian, *Nagy-Várad*), a royal free city, and capital of the county of Bihar in the Trans-Tibiscan circle, Hungary, is situated in a beautiful plain on the banks of the river Scbeskörös, 47° 3′ N. lat., 21° 53′ E. long. It is the seat of a Roman Catholic and of a Greek (Old-United) bishopric, of a royal court of justice, of the county assizes, and of a board of assessment, and is the headquarters of the divisional regiments and militia (*honvéd*). The town consists of Nagy-Várad proper, with Várad-Olaszi, Várad-Velencze, and Várad-Váralja. The streets and squares are well laid out, and adorned with many fine public and private buildings. Among these are sixteen Roman Catholic churches, of which the most striking is the cathedral; two Calvinist, one Lutheran, one Old-United and two Orthodox Greek churches, and a Jews' synagogue. The other noteworthy edifices comprise the county and town halls, two episcopal palaces, chapter and clergy houses, hospitals, cloisters belonging to the Compassionate Brothers, and a convent for Ursula nuns, several manufactories, a large and handsome railway station, a prison, and barracks. Among the educational establishments are the royal law academy, a Roman Catholic gymnasium and seminary for the education of priests, a Calvinist school, and a gymnasium for adherents of the Old-United or Catholic Greek confession, two institutes for training teachers, a military academy, a real-school, and an orphan asylum. The inhabitants are chiefly employed in industrial and commercial pursuits; and the neighborhood yields a good supply of wine, fruit, and agricultural produce. The great fairs periodically held in the town attract strangers from a considerable distance. Grosswardein is the point of junction of the Alföld-Fiume, Tibiscan, and Hungarian Eastern railroads. Not far from the town are the much-frequented warm springs of Püspökfürdö (Bishop's-bath). In 1900 the population was 50,177, of whom the majority were native Magyars, the rest chiefly Germans and Wallachs.

Grosswardein is one of the oldest towns in Hungary. Its Roman Catholic bishopric was founded by St. Stephen of Hungary at the commencement of the 11th century. It was there that peace was concluded on 24th February, 1538, between Ferdinand I. of Austria and his rival John Zápolya, waiwode of Transylvania. In 1556 it passed into the possession of Transylvania, but afterwards reverted to Austria. In 1598 the fortress was unsuccessfully besieged by the Turks; in 1660, however, it fell into their hands, and was ceded to them by the treaty of Vasvár (Eisenburg), 10th August, 1664. In 1692 it was recovered by the Austrians. The Greek Old-United or Catholic bishopric was founded in 1776. From its vicinity to Debreczin, the temporary seat of the Hungarian revolutionary government during the early part of the year 1849, Grosswardein became for a time invested with additional importance, as the depository of the state archives, bank-note-press, and arms manufactory.

GROTE, George (1794–1871), the historian of Greece, eminent also as a philosopher, a politician, and a laborer in the advancement of university education, was born on the 17th of November, 1794, at Clay Hill, near Beckenham in Kent. He drew his lineage from a Dutch, or, more strictly speaking, a Low German family. The name (Groot, equivalent to "great") is the same as that of Hugo Grotius, with whom the Grotes would gladly have traced a relationship, but the evidence was wanting. George Grote's grandfather, Andreas (born in 1710), a merchant of Bremen, removed to England, and after some years of successful business joined Mr. George Prescott in founding the banking-house of "Grote, Prescott, & Company" (January 1, 1766). He was married twice. His eldest son by his second marriage, George (born in 1762), was married (in 1793) to Selina, daughter of the Rev. Dr. Peckwell, one of the countess of Huntingdon's chaplains, whose portrait is preserved in the vestry of the chapel at Chichester, where he ministered. Dr. Peckwell was descended on the mother's side from the French Protestant family of De Blosset, who had left Touraine in consequence of the revocation of the edict of Nantes; and thus the historian, who was the son of George Grote and Selina Peckwell, had a share of that Huguenot blood which has been a rich source of intellectual as well as industrial life in England.

Like many other eminent men, George Grote owed much of his future intellectual greatness to his mother's careful training. Having a strong desire to see her son excel in learning, she taught him reading and writing herself, and even grounded him in the elements of Latin before he was sent to the grammar school at Sevenoaks, in his sixth year (1800). The four years spent there gave an earnest of his whole future life. In the language of his biographer, who has lately attained the end of a life inseparably interwoven with his, "he evinced a decided aptitude for study, being rarely found behindhand with his tasks, and ranking habitually above boys of his age in the class to which he belonged." In his tenth year he was removed to the Charterhouse, the headmaster of which, Dr. Raine, had the honor of training, along with George Grote, Connop Thirlwall, Dean Waddington and his brother Horace, Sir Cresswell Cresswell, Sir Henry Havelock, and other men of future distinction. Grote was not allowed to share the course of most of his schoolfellows at a university; but this great privation was turned into a pre-eminent distinction by the resolution with which his own strong will and untiring industry supplied the loss. The supposed advantage of an early application to business led the father to take George into the bank at the age of sixteen. But his six years at the Charter-house had not only imbued him with a strong taste for classical learning, but had supplied him with that motive to high culture, which forms the most convincing argument in its favor, and to which he remained faithful through a half century of educational disputes and heresies. It was not as an alternative to a life of business, but as its proper complement, that he chose and advocated ancient learning. "Looking forward," says his biographer, "to a commercial course of life, certain to prove uninteresting in itself, he resolved to provide for himself the higher resources of intellectual occupation." Engaged in the bank throughout the day, he devoted his early mornings and evenings to a systematic course of reading, of which the chief subjects were the ancient classics, history, metaphysics, and political economy, to the last of which he was attracted by the writings of David Ricardo, whose personal acquaintance he formed in 1817. To these studies he added the learning of German by the aid of a Lutheran clergyman, which, together with his knowledge of French and Italian, placed the stores of Continental scholarship within his reach. His chief recreation was music, and he learned to play the violoncello, to accompany his mother, who was a fine musician. Arrived at the age of manhood (in the winter of 1814–1815), he formed the acquaintance of the young lady who afterwards became his wife, devoted to and worthy of him, the very complement of his life, intellectual as well as social, and finally his biographer in a spirit of loving but not indiscriminate admiration. This was Miss Harriet Lewin, the daughter of Mr. Thomas Lewin, of Bexley, in Kent, a gentleman of old family and independent fortune. She was born at Southampton, July 1, 1792, and was consequently nearly two years older than Grote. From causes which need not be related here their intimacy was suspended for three years, during which Grote's studies made steady progress. To this period belongs his earliest literary composition, an essay on his favorite Lucretius, which still exists in MS. His letters also record the careful study of

Aristotle, his final estimate of whom formed his last unfinished work. But the most interesting light is thrown on the method and course of his studies in the diary which he kept for Miss Lewin's information. This record bears witness, not only to the wide diversity of his studies in ancient and modern literature, philosophy, and political economy, but also to the fact that he read the authors themselves whom he wished to know,—read them as a whole, instead of merely reading what others had written about them.

An epoch, perhaps the most critical turning-point of Grote's intellectual life, was formed by his introduction, through David Ricardo, to James Mill, who was then composing his metaphysical work entitled *An Analysis of the Human Mind*. Already attracted to this study, Grote became Mill's admiring disciple in mental and political philosophy. From this time he adopted the fixed principles, from which he never receded, of experience as the source of all knowledge, and utility as the foundation of morals. The views derived from Mill were confirmed by the teaching of Jeremy Bentham, and by intercourse with a band of young disciples, over whom the two philosophers wielded an unbounded influence. Among these John Stuart Mill began now to make his appearance as a boy of twelve years old. It is important to note the influence which the study of metaphysics exercised upon the development of Grote's intellectual character. To the general public he is chiefly known as an historian; but he was equally distinguished as a metaphysical philosopher. To the teaching of James Mill may also be traced his democratic principles and his zeal for freedom of thought, hardening into intolerance of all religious systems and their ministers. But, however they may have determined his course upon certain occasions, these antipathies never struck their root down into the real soil of his gentle and courteous nature.

In 1820, at the age of twenty-four, he was married to Miss Harriet Lewin. They lived at first at the banking-house in Threadneedle Street. The confined situation soon told on Mrs. Grote's health, and the death of her only child, a week after its birth, was followed by a dangerous illness. It was at her bedside at Hampstead, during her slow recovery, that Grote composed the first work he published, an *Essay on Parliamentary Reform*, in reply to an article by Sir James Mackintosh in the *Edinburgh Review*, No. 61 (1821). The pamphlet is a vigorous assertion of the broadest principles of popular representation, in opposition to a scheme of class representation sketched by the reviewer. It proclaimed Grote's adherence to those political views held by the party afterwards called the "philosophic radicals," and it strongly pleaded for the vote by ballot, of which he afterwards became the parliamentary advocate. The most important parts of this pamphlet were embodied in his later essay on the *Essentials of Parliamentary Reform* (1831), reprinted in his *Minor Works*.

In April, 1822, Grote sent a vigorous letter to the *Morning Chronicle* in reply to Canning's speech against Lord John Russell's motion for reform. In the same year he spent much time upon some MSS. of Jeremy Bentham, which the aged philosopher entrusted to his young disciple to put into a readable form. After carefully digesting and arranging them, he published them anonymously in a small 8vo volume, entitled *Analysis of the Influence of Natural Religion on the Temporal Happiness of Mankind, by Philip Beauchamp*. Meanwhile the quiet course of life went on in Threadneedle Street. The scanty leisure of each day was devoted to the joint studies of husband and wife, for "Mrs George Grote was habitually studious, after her fashion, under the direction of her husband, who laid great stress upon her cultivating the ratiocinative vein of instruction—above all, logic, metaphysics, and politics; and she accordingly strove to master these subjects, out of deference to his wish, and in order to qualify herself to be associated with his intellectual tastes and labors as time wore on." Their pleasures were likewise in common; the wife, who was an accomplished musician, learnt the violoncello to accompany her husband; but he dropped his music in 1830. A circle of congenial minds frequented the house in Threadneedle Street from 1822 to 1830. Within that choice society there was a narrower circle of students, who met there twice a week at half-past eight in the morning for an hour or two's reading. Among others were John Stuart Mill, Charles Buller, and John Arthur Roebuck. They read the most recent works on metaphysics and kindred subjects in the light of their adored teach Bentham and James Mill, beyond whom they believed all to be in Cimmerian darkness.

The year 1823 marks the epoch of the first conception of Grote's great work; and an extant letter shows the spirit in which he approached it. On January 14 he writes:—"I am at present engaged in the fabulous ages of Greece, which I find will be required to be illustrated by bringing together a large mass of analogical matter from other early histories, in order to show the entire uncertainty and worthlessness of tales to which early associations have so long familiarized all classical minds. I am quite amazed to discover the extraordinary greediness and facility with which men assert, believe, re-assert, and are believed. The weakness appears to be next to universal, and I really think that one ought to write on the walls of one's dressing-room the caution of the poet Epicharmus:—

'Νῆφε, καὶ μέμνησ' ἀπιστεῖν, ἄρθρα ταῦτα τῶν φρένων.'"

The subject ever present to his thoughts came up so often in the discussions with his friends as to suggest to his wife's sympathy and ambition for his fame the definite work of his future life. One day she said to him—"You are always studying the ancient authors whenever you have a moment's leisure, now here would be a fine subject for you to treat. Suppose you try your hand!" "The idea" (she adds) "proved acceptable to the young student, and, after reflecting for some time, he came to the resolution of entering upon the work." Henceforth this definite aim prevailed amidst the still wide range of reading which threw new light from all quarters upon the central object, and the mass of notes and extracts still preserved attest the diligence with which he prepared for it. Happily for himself and for the world, he was diverted from the work till he could resume it, not only with that clearer mental perspective in which a long meditated object appears when we return to it afresh, but with the enlarged experience of nearly twenty years occupied in practical politics and converse with statesmen, abroad as well as at home. Meanwhile he gave the world an earnest of his work in an exhaustive review of Mitford's *History of Greece* in the *Westminster Review* for April, 1826,—one result of which was a letter from Niebuhr, clearly designating Grote as the historian of Greece, and inviting him to a visit which events never permitted him to pay.

From 1825 to 1827 Grote took part in the scheme of founding the "University of London" in Gower Street, with the management of which institution he became afterwards intimately connected. As the political crisis of 1830 approached, public and private events conspired to draw Grote into the vortex of politics. The failure of his father's health gave him a new position in the bank; and in the spring of 1830 he was able to arrange for a visit to the Continent, which brought him into connection with the liberal politicians of Paris on the eve of the revolution. An interesting record of the state of affairs and of the impressions of this visit are preserved in Mrs. Grote's *Life of Ary Scheffer*, published in 1860. The travellers were recalled in June by the illness of Grote's father, who died before their arrival, at the age of 70.

Thus, in his 36th year, George Grote, now the head of the family, found himself master of his own affairs, and of about £40,000 personal property, besides the family estates in Lincolnshire and Oxfordshire. His business and studies alike led him to fix his residence in London; and the first use he made of his wealth was to subscribe £500 to the revolutionary committee of the Hôtel de Ville, with an offer to come himself to Paris if his presence would be of any use. The pressure of business as his father's executor kept him, in spite of strong solicitations, out of any active part in the agitation for reform, but did not prevent the steady progress of the *History*, which Mrs. Grote writes (February 1, 1831), "*must* be given to the public before he can embark in any active scheme of a political kind." He refused an invitation to stand for the city in 1831; but he made an able contribution to the argument in a statement of the *Essentials of Parliamentary Reform*, published this year, to which reference has already been made. His reluctance to enter parliament was overcome after the passing of the Reform Act in 1832; and, being returned at the head of the poll, he appeared as one of the members for the city of London in the first reformed parliament, which met on February 4, 1833. He at once gave notice

of a motion for the vote by ballot in parliamentary elections, which he brought before the house on the 25th of April following. His speech on that occasion was prepared with great care, and displayed that cogent reason and calm earnest eloquence which marked all his efforts in debate. The substance of the argument, and a notice of his principal speeches in parliament, will be found in Professor Bain's sketch of his character and writings prefixed to his "minor works." Earnest as were his political convictions, and faithfully as he discharged the duties which he had undertaken, Grote's parliamentary career forms only an episode in his life, but an episode which contributed to refresh and qualify him for his main work. He sat in three successive parliaments, from 1833 to 1841, witnessing the gradual passage from the first triumphs of reform to the Conservative reaction under Sir Robert Peel, and the steady decay of his own sect of philosophic radicalism, which never had a root in popular opinion. He was returned the last time by a bare majority of six, and his party numbered just the same figure. Charles Buller said to him one evening: "I see what we are coming to, Grote; in no very long time from this, you and I shall be left to 'tell' Molesworth."

During the eight years and a half of his parliamentary life, Grote kept up his varied reading, and formed a growing desire for a knowledge of physical science. But the staff of his mental diet, and his refuge from all meaner objects of thought, was still the same. In the weary intervals of attendance on parliament a Tauchnitz copy of Plato was ready in his pocket, and when snowed up in the country during the vacation he writes—"A Greek book is the only refuge." His hospitalities expanded with his social position; and among his new friendships the one he most valued was that formed in 1835 with Mr. (afterwards Sir) George Cornewall Lewis, the letters exchanged with whom on various points in classics and philosophy enrich the narrative of his *Life*. Among the other objects of his literary interest at that time was Sir William Molesworth's collected edition of the works of Hobbes, dedicated to Grote, whose review of the first two volumes in the *Spectator* (1839) is reprinted among the *Minor Works*.

During the whole period of Whig decay, and especially from the beginning of the present reign, Grote felt a declining interest in politics, and accordingly, on the dissolution in June, 1841, he determined to retire from parliament. Thus at the age of forty-six he was set free to spend the remaining thirty years of his life in the work long prepared and contemplated. In half that period the *History of Greece* was finished; the remaining half was devoted to the two works on Plato and Aristotle, which made up the Hellenic "trilogy" of his life-long studies.

After a six months' holiday (1841–1842) for the long desired purpose of visiting Italy and studying the antiquities of Rome upon the spot, he returned to his business at the bank, and set vigorously to work on the new plan for the first two volumes of his *History*—reperusing the authorities, revising his notes, and rewriting the whole. The greater part of these two volumes was occupied with the first division of his subject, which was now for the first time severed from actual history, and placed in its proper mythical light, under the title of "Legendary Greece." The closing months of 1842 were employed in sending forth a sort of "pilot-vessel" in the form of a review of Niebuhr's *Griechische Heroen-Geschichte*, which appeared in the *Westminster Review* (May, 1843), under the title of "Grecian Legends and Early History," and is reprinted in the *Minor Works*. His biographer states that, "this article, wherein the collected store of Grote's long and assiduous studies on the subject found a vent, was written with uncommon zest, and he anticipated with lively curiosity the effect it would produce over the learned world." It was received as a striking promise of the new light in which he was about to place the primeval ages of Grecian history. It is important to record an incidental remark, which shows that, amidst his uncompromising severance of legend from real history, Grote adhered to the great principle avowed alike by Herodotus and by Bede: "An historian is bound to produce the materials upon which he builds, be they never so fantastic, absurd, or incredible."

With the beginning of 1843, exactly ten years after the interruption caused by his entrance into parliament, the composition of the first volume for the press was vigorously begun; and at midsummer he further cleared his path by retiring from the banking-house of Prescott, Grote, & Company. While still at work upon the *History*, he published in the *Classical Museum* (1843) an important essay on ancient weights and measures, reviewing Boeckh's *Metrologische Untersuchungen*, which is reprinted among his *Minor Works*.

The first two volumes of the *History* were completed early in 1845, and published in March, 1846. Their reception is well known; and the effect of their success upon Grote himself was thoroughly characteristic of the man:—"From all sides congratulation and eulogy flowed in upon the author, insomuch that he himself now began to feel something like confidence in the success of his long-cherished work. Thus I became" (writes Mrs. Grote) "*for once* witness of a state of feeling on his part approaching to gratified self-love, which at times would pierce through that imperturbable veil of modesty habitually present with him." The first volume and nearly half of the second are occupied with "Legendary Greece;" the latter half of the second volume begins "Historical Greece," and consequently contains only a small portion of the real history. These volumes were reviewed with great praise by John Stuart Mill in the *Edinburgh Review*, and by Dean Milman in the *Quarterly Review*.

The success of the first two volumes incited Grote to prosecute the work with redoubled ardor; and such progress had been already made that the third and fourth volumes, bringing the narrative down to the battle of Marathon, and containing an account of Grecian poetry and philosophy in its earlier stages, appeared in the following year (1847). Two more volumes, the fifth and sixth, coming down to the eleventh year of the Peloponnesian war, were published in 1849. These two volumes, together with the two preceding ones, were reviewed in the *Edinburgh Review* by Sir George Cornewall Lewis. The seventh and eighth volumes, which brought the Peloponnesian war to the end, and which contained the striking and original view of the Sophists and of Socrates, appeared in 1850. Two articles in the *Quarterly Review* upon this portion of the work, one upon the history, and the other upon Socrates and the Sophists, were written by Dean Stanley. The ninth and tenth volumes were published in 1852, the eleventh in 1853, and the last and twelfth in 1856, just ten years after the appearance of the first two volumes. The work closes with the generation contemporary with Alexander the Great, "an epoch," the historian observes, "from whence dates not only the extinction of Grecian political freedom and self-action, but also the decay of productive genius, and the debasement of that consummate literary and rhetorical excellence which the 4th century B. C. had seen exhibited in Plato and Demosthenes."

The peculiar merits of Grote as an historian are discussed at length by the writer of the present notice in a review of the whole work in the *Quarterly Review* in 1856. It is sufficient to state here that the quality in which he surpassed all his predecessors in Grecian history, and which achieved for him a success that can never be undone or superseded, lies in his placing his whole subject in the full light of historic truth apart from partial judgments, looking at the actions of men from their own points of view and not only from ours, and having constant regard to those ethical principles of human nature which his twofold training as a philosopher and politician qualified him to estimate. Many of his details may be disproved and his judgments reversed, but his work will last for ever. The opinion of scholars may be summed up in Bishop Thirlwall's "hearty congratulations on the completion of this glorious monument of learning, genius, and thought to which I believe no other literature can exhibit a parallel."

An episode during the progress of the *History* is characteristic of the wide range of political observation which Grote brought to bear upon his work. In the Swiss dissensions during 1847, which led to the war of the "Sonderbund," he saw so close a resemblance to the conflicts of the Greek republics that he resolved to study the question on the spot. His *Letters* on the subject, which originally appeared in the *Spectator* newspaper, were collected into a volume, which was reprinted in 1876 by Mrs. Grote, with the addition of a letter written by him to M. de Tocqueville after the termination of the war.

On the completion of the *History*, Grote contributed to the *Edinburgh Review* (1856) a criticism of Sir George Cornewall Lewis's *Enquiry into the Credibility of the early Roman History*, which is reprinted in his *Minor Works*, a most interesting study of the points in which the two scholars

agreed and differed, Grote stopping short of his friend's scepticism in some cases.

After a well-earned holiday on the Continent in the summer of 1856, Grote set steadily to work upon his *Plato*, which occupied him nine years, and appeared in 1865 in three volumes 8vo, under the title of *Plato and the other Companions of Sokrates*, when the author had completed his seventieth year This work, he remarks, was "intended as a sequel and supplement to his *History of Greece*." After giving an exhaustive review of early Greek philosophy, from Thales to Democritus, and an account of the life of Plato, of the Platonic Canon, and of Platonic compositions generally, he analyzes at great length each of the dialogues, with illustrative remarks, unfolding a number of his own philosophical views. The work concludes with two chapters, one on the "Other Companions of Sokrates," and another on "Xenophon."

On the completion of this work, Grote wrote in the *Westminster Review* (1866) an elaborate criticism of John Stuart Mill's *Examination of Sir William Hamilton's Philosophy*. At the same time, though in his seventy-first year, he set to work upon Aristotle, hopeful in the continuance of those powers which he thus described three years later:—"My power of doing work is sadly diminished as to *quantity*, as my physical powers in walking are; but as to *quality* (both perspicacity, memory, and suggestive association bringing up new communications), I am sure that my intellect is as good as it ever was," and all who knew him well can attest the accuracy of this judgment. But he did not live to complete the third portion of his "trilogy," though he had been studying the Aristotelian treatises from his earliest manhood. The fragment of his Aristotelian labors was published in 1872, the year after his death, in two volumes, edited by Professors Bain and Robertson. Besides the life of Aristotle and the canon of his works, these volumes are chiefly occupied with an examination of the logical treatises of the great philosopher; but the editors have been able to give, from the MSS. of the author and from the contributions which he made to Professor Bain's *Manual of Mental and Moral Science*, some account of Aristotle's other works. There are also two valuable essays on the ethics and politics of Aristotle, found among the author's MSS. after the publication of Aristotle, which were printed in 1876 in the *Fragments on Ethical Subjects by the late George Grote*.

During the composition of the Plato and the Aristotle Grote resided in London, at 12 Savile Row, and in two country houses, which he occupied in succession, first at Barrow Green in Kent from 1859 to 1863 (where Jeremy Bentham had once lived), and afterwards at Shiere among the Surrey hills, in which places his day was divided between regular work, exercise as regular, and the society of congenial friends. Many a work of social duty and benevolence found prompt performance; and he paid unremitting attention to the business of his three favorite institutions—the University of London, University College, and the British Museum, of which last he became a trustee on the death of Henry Hallam in 1859. But his connection with the two former bodies was so close, and he made their administration so completely the chief business of his life after his literary works, that a few words upon the subject are necessary.

It has been already mentioned that he took an active part in the foundation of the university of London in Gower Street. He was a member of the original council of that institution from 1827 to 1831, from which he retired upon entering parliament. This institution exchanged its name for that of "University College" before the foundation in 1836 of the "University of London," which now conducts its business in Burlington House. Grote joined again the council of University College in 1849, and from that time till his death he took a leading part in the administration of its affairs. He became treasurer in 1860, and president in 1868, on the death of Lord Brougham. Grote was one of the seven new members added by the crown to the senate of the "University of London" in 1850. From 1862, when he was elected vice-chancellor, on the resignation of Sir John Shaw Lefevre, he became the leading spirit of the university.

In both University College and the University of London he was the constant advocate of the threefold cord of knowledge—literature, philosophy, science,—which he held to be ruined by tampering with any one of them,—earnestly upholding what he regarded as sound metaphysics, supporting the establishment of degrees in science, and opposing, to the last of his life and strength, the omission of Greek from the examination for matriculation. He left his library to the university; and he showed his attachment to the college and to metaphysical studies by bequeathing to it a sum of £6000 for the endowment of a professorship of mental philosophy He continued to labor in the discharge of his duties to these institutions, even when far gone in the malady which appeared in 1870, and carried him off on the 18th of June, 1871, in his seventy-seventh year. He found his fit resting-place in Westminster Abbey, just beneath Camden's monument, and near Macaulay's grave. His portrait by Mr Millais, taken the year before his death, is preserved in the senate-room of the university of London.

Grote's great literary merits received due and fitting acknowledgment from his contemporaries. He was elected a fellow of the Royal Society, received from the university of Oxford the honorary degree of D.C.L, and from that of Cambridge the honorary degree of LL D., was made a foreign member of the French Institute in the place of Macaulay, and lastly was offered a peerage by Mr Gladstone in 1869, an honor which he declined. His personal character cannot be better described than in the words of his friend Professor Bain.—"In the depths of his character there was a fund of sympathy, generosity, and self-denial rarely equalled among men; on the exterior, his courtesy, affability, and delicate consideration for the feelings of others were indelibly impressed upon every beholder; yet this amiability of demeanor was never used to mislead, and in no case relaxed his determination for what he thought right. Punctual and exact in his engagements, he inspired a degree of confidence and respect which acted most beneficially on all the institutions and trusts that he took a share in administering; and his loss to them was a positive calamity."

The authorities for Grote's life are—*The Personal Life of George Grote*, by Mrs. Grote, 1873, and the *Critical Remarks on his Intellectual Character, Writings, and Speeches* (170 pages), by Professor Bain, prefixed to Grote's *Minor Works*, 1873.

The following is a list of Grote's works, most of which have been noticed in the course of the preceding memoir:—*A History of Greece*, in 12 vols. 8vo, 1846–1856, reprinted in 1862 in 8 vols. 8vo, in 1869 in 12 vols. 12mo, and lastly in 1871 in 10 vols. 8vo; *Plato and the other Companions of Sokrates*, in 3 vols. 8vo, 1865, reprinted in the same form in 1867, and a third time in 1874; *Aristotle*, edited by Alexander Bain and G. Croom Robertson, 2 vols. 8vo, 1872; *The Minor Works of George Grote*, edited by Professor Bain, 1873, containing—(1) "Essentials of Parliamentary Reform;" (2) "Notice of Sir William Molesworth's edition of the Works of Hobbes," (3) "Grecian Legends and Early History;" (4) "Review of Boeckh on Ancient Weights, Coins, and Measures;" (5) "Presidential Address, in commemoration of the twenty-first Anniversary of the London Scientific Institution;" (6) "Address on delivering the prizes at University College;" (7) "Review of Sir G. C. Lewis on the Credibility of Early Roman History;" (8) "Plato's Doctrine respecting the Rotation of the Earth, and Aristotle's Comment upon that doctrine;" (9) "Review of John Stuart Mill on the Philosophy of Sir William Hamilton;" (10) "Papers on Philosophy;" *Seven Letters concerning the Politics of Switzerland, pending the Outbreak of the Civil War in 1847*, 1847, reprinted in 1876, with the addition of an unpublished letter written by the author to M. de Tocqueville shortly after the termination of the war; *Fragments on Ethical Subjects*, 1876 (a selection from his posthumous papers).

MRS. GROTE survived her husband upwards of seven years, and died on the 29th of December, 1878, at her residence in Shiere. She was one of the most remarkable Englishwomen of the present century. Endowed in youth with great personal beauty, which matured into a grand expression and noble presence in advanced age, she possessed intellectual powers of the highest order, combined with a lofty sense of duty and the strictest regard to truth. The chief events of her life have been already related in the preceding notice of her husband. Her own writings, besides the biography of Mr. Grote, are *A Memoir of the Life of Ary Scheffer* (1860), and *Collected Papers (original and reprinted) in Prose and Verse* (1862), of which the most important are a "Review of M. Lavergne's Essay on the Rural Economy of England," "Case of the Poor against the Rich correctly stated," a "Review of Thomas Moore's Life and Works," and the "History of East Burnham." But though she wrote lucidly and powerfully, it has been well observed

by one of her friends that "her writings fail to give a just idea of the irresistible fascination of her conversation. *That* she never succeeded in fully transmitting to paper; and it remains a thing of unapproachable excellence and tender memory, only understood by those to whom it offered the highest mental enjoyment." (W. SM.)

GROTEFEND, GEORG FRIEDRICH (1775–1853), to whose patience and ingenuity the decipherment of the cuneiform inscriptions was originally due, was born at Münden in Hanover, June 9, 1775. He was educated partly in his native town, partly at Ilfeld, where he remained till 1795, when he entered the university of Göttingen, and there became the friend of Heyne, Tychsen, and Heeren. Heyne's recommendation procured for him an assistant mastership in the Göttingen gymnasium in 1797. While there he published his work *De Pasigraphia sive Scriptura Universali* (1799), which first brought him into notice, and led to his appointment in 1803 as prorector of the gymnasium of Frankfort-on-the-Main, and shortly afterwards as conrector. Grotefend was best known during his lifetime as a Latin and Italian philologist, though the attention he paid to his own language is shown by his *Anfangsgründe der deutschen Poesie*, published in 1815, and his foundation of a society for investigating the German tongue in 1817. In 1821 he became director of the gymnasium at Hanover, a post which he retained till his retirement in 1849, four years before his death. In 1823–4 appeared his revised edition of Wenck's Latin grammar, in two volumes, followed by a smaller grammar for the use of schools in 1826; in 1835–8 a systematic attempt to explain the fragmentary remains of the Umbrian dialect entitled *Rudimenta Linguæ Umbricæ ex Inscriptionibus antiquis enodata* (in eight parts); and in 1839 a work of similar character upon Oscan (*Rudimenta Linguæ Oscæ*). In the same year he published an important memoir on the coins of Bactria, under the name of *Die Münzen der griechischen, parthischen, und indoskythischen Könige von Bactrien und den Ländern am Indus*. He soon, however, returned to his favorite subject, and brought out a work in five parts, *Zur Geographie und Geschichte von Altitalien* (1840–2). Previously, in 1836, he had written a preface to Wagenfeld's translation of the spurious *Sanchoniathon* of Philo Byblius, which professed to have been discovered in the preceding year in the Portuguese convent of Santa Maria de Merinhao. But it was in the East rather than in the West that Grotefend did the work which has given him a lasting name. The mysterious cuneiform inscriptions of Persia had for some time been attracting attention in Europe; exact copies of them had been published by the elder Niebuhr, who lost his eyesight over the work: and Grotefend's friend, Tychsen of Rostock, believed that he had ascertained the characters in the column now known to be Persian to be alphabetic. At this point Grotefend took the matter up. His first discovery was communicated to the Royal Society of Göttingen in 1800, and reviewed by Tychsen two years afterwards. In 1815 he gave an account of it in Heeren's great work on ancient history, and in 1837 published his *Neue Beiträge zur Erläuterung der persepolitanischen Keilschrift*. Three years later appeared his *Neue Beiträge zur Erläuterung der babylonischen Keilschrift*. His discovery may be summed up as follows:—(1) that the Persian inscriptions contain three different forms of cuneiform writing, so that the decipherment of the one would give the key to the decipherment of the others; (2) that the characters of the Persian column are alphabetic and not syllabic; (3) that they must be read from left to right; (4) that the alphabet consists of forty letters, including signs for long and short vowels; and (5) that the Persepolitan inscriptions are written in Zend (which, however, is not the case), and must be ascribed to the age of the Achæmenian princes. The process whereby Grotefend arrived at these conclusions is a prominent illustration of persevering genius. History made it clear that the monuments to which the inscriptions were attached belonged to Cyrus and his successors, whose names ought accordingly to be found in them. By a comparison of texts Grotefend determined the groups of characters by which these names were expressed, and by further observing what characters were common to the several groups, and of how many characters each group consisted, he was able to assign the conjectural values of D-A-R-H-E-U-SCH or Darius to the letters of a frequently recurring one. The native pronunciation of Darius was furnished by Strabo and the Old Testament. The names of Xerxes and Artaxerxes were next deciphered, and the phonetic powers of a good many characters were thus ascertained. The correctness of the decipherment was verified, not only by the fact that the right letters were always found in the right places in each name, but also by the discovery that the word which invariably followed each name, and therefore presumably meant "king," when read by the new alphabet, presented the same form as the Zend term for "monarch." It was clear that a solid basis had been laid for the interpretation of the Persian inscriptions, and all that remained was to work out the results of Grotefend's brilliant discovery, a task ably performed by Burnouf, Lassen, and Rawlinson. Grotefend died the 15th of December, 1853.

GROTIUS, HUGO (1583–1645), in his native country Huig van Groot, but known to the rest of Europe by the Latinized form of the name, was one of the famous men of the 17th century, almost equally eminent for public services and as a writer. He was born at Delft on Easter day, 10th April, 1583. The Groots were a branch of a family of distinction, which had been noble in France, but had removed to the Low Countries more than a century before. Their French name was De Cornets, and this cadet branch had taken the name of Groot on the marriage of Hugo's great-grandfather with a Dutch heiress. The father of Hugo was a lawyer in considerable practice, who had four times served the office of burgomaster of Leyden, and was one of the three curators of the university of that place.

In the annals of precocious genius there is no greater prodigy on record than Hugo Grotius, who was able to make good Latin verses at nine, was ripe for the university at twelve, and at fifteen edited the encyclopædic work of Marcianus Capella. At Leyden he was much noticed by J. J. Scaliger, whose habit it was to engage his young friends in the editing of some classical text, less for the sake of the book so produced than as a valuable education for themselves. At fifteen Grotius accompanied Count Justin of Nassau, and the grand pensionary Oldenbarnevelt on their special embassy to the court of France. After a year profitably spent in that country in acquiring the language and making acquaintance with the leading men, Grotius returned home. He took the degree of doctor of law at Leyden, and entered on practice as an advocate.

Notwithstanding his successes in his profession, which seemed to open the most brilliant career to his ambition, he was in secret hankering after the pleasures of literature. In 1600 he edited the remains of Aratus, with the versions of Cicero, Germanicus, and Avienus. Of the *Germanicus* Scaliger says—"A better text than that which Grotius has given, it is impossible to give;" but it is probable that Scaliger had himself been the reviser. Grotius vied with the Latinists of his day in the composition of Latin verses. Some lines on the siege of Ostend were greatly admired, and spread his fame beyond the circle of the learned. He wrote three dramas in Latin:—*Christus Patiens; Sophomphaneas*, on the story of Joseph and his brethren; and *Adamus Exul*, a production which is still remembered as having given hints to Milton. The *Sophomphaneas* was translated into Dutch by Vondel, and into English by Francis Goldsmith (1652); the *Christus Patiens* into English by George Sandys (1640).

In 1603 the United Provinces, desiring to transmit to posterity some account of their struggle with Spain, determined to appoint a historiographer. Several candidates appeared, Dominicus Bandius of course among them. But the choice of the states fell upon Grotius, though only twenty years of age, and not having offered himself for the post.

There was some talk at this time in Paris of calling Grotius to be librarian of the royal library. But it was never meant seriously. It was a ruse of the Jesuit party, who wished to persuade the public that the opposition to the appointment of Isaac Casaubon did not proceed from theological motives, since they were ready to appoint a Protestant in the person of Grotius.

His next preferment was that of advocate-general of the fisc for the provinces of Holland and Zeeland. This was followed by his marriage, in 1608, to Mary van Reigesberg, a lady of family in Zeeland, a woman of great capacity and noble disposition, who proved every way worthy to be the wife of Grotius.

He had already passed from occupation with the classics to studies more immediately connected with his profession.

In the winter of 1604 he composed a treatise entitled *De iure prædæ*. This treatise he did not publish, and the MS. of it remained unknown to all the biographers of Grotius till 1868, when it was brought to light, and printed at the Hague under the auspices of Professor Fruin. It discovers to us that the principles and the plan of the celebrated *De jure belli*, which was not composed till 1625, more than twenty years after, had already been conceived by a youth of twenty-one. It has always been a question among the biographers what it was that determined Grotius, when an exile in Paris in 1625, to that particular subject, and various explanations have been offered; among others we have been referred to a casual suggestion of Peiresc in a letter of early date. The discovery of the MS. of the *De jure prædæ* discloses to us the whole history of Grotius's ideas, and shows us that from youth upwards he had steadily read and meditated in one direction, that, namely, of which the famous *De jure belli* was the mature product. In the *De jure prædæ* of 1604 we have much more than the germ of the later treatise *De jure belli*. Its main principles, and the whole system of thought implied in the later, are anticipated in the earlier work. The arrangement even is the same. The chief difference between the two treatises is one which twenty years' experience in affairs could not but bring,—the substitution of more cautious and guarded language, less dogmatic affirmation, more allowance for exceptions and deviations. The *Jus pacis* was an addition introduced first in the later work, an insertion which is the cause of not a little of the confused arrangement which has been found fault with in the *De jure belli*.

We learn further from the *De jure prædæ* that Grotius was originally determined to this subject, not by any speculative intellectual interest, but by a special occasion presented by his professional engagements. He was retained by the Dutch East India Company as their advocate. The company had been formed for the peaceful purposes of commerce, but had found itself compelled by the aggressions of the Portuguese to repel force by force. One of their captains, Heemskirk, had captured a rich Portuguese galleon in the Straits of Malacca. The right of a private company to make prizes was hotly contested in Holland, and denied by the stricter religionists, especially the Mennonites, who considered all war unlawful. Grotius undertook to prove that Heemskirk's prize had been lawfully captured. In doing this he was led to investigate the grounds of the lawfulness of war in general. Such was the casual origin of a book which long enjoyed such celebrity that it used to be said, with some exaggeration indeed, that it had founded a new science.

A short treatise which was printed in 1609, Grotius says without his permission, under the title of *Mare Liberum*, is nothing more than a chapter—the 12th—of the *De jure prædæ*. It was necessary to Grotius's defence of Heemskirk that he should show that the Portuguese pretence that Eastern waters were their private property was untenable. Grotius maintains that the ocean is free to all, and cannot be appropriated by any one nation. The occasional character of this piece explains the fact that at the time of its appearance it made no sensation. It was not till many years afterwards that the jealousies between England and Holland gave importance to the novel doctrine broached in the tract by Grotius, a doctrine which Selden set himself to refute in his *Mare clausum*, 1632.

Equally due to the circumstances of the time was his small contribution to constitutional history entitled *De antiquitate reipublicæ Batavæ* (1610). In this he vindicates, on grounds of right, prescriptive and natural, the revolt of the United Provinces against the sovereignty of Spain.

On the death of Elias Oldenbarnevelt, Grotius, though only thirty, succeeded him as pensionary of the city of Rotterdam. Foreseeing the troubles impending from the growing theological fermentation, he made the stipulation that he should be irremovable by the municipal authorities—a stipulation certain not to be respected should it ever be wanted for his protection.

In 1613 he formed one of a deputation to the court of England, for the purpose of adjusting those differences which were already beginning to arise between the two young maritime powers, and which gave rise afterwards to a naval struggle disastrous to Holland. He was received by James with every mark of distinction due to his rising reputation. He also cultivated the acquaintance of the Anglican ecclesiastics Overal and Andrewes, and was much in the society of the celebrated scholar Isaac Casaubon, with whom he had been in correspondence by letter for many years. Though the mediating views in the great religious conflict between Catholic and Protestant, by which Grotius was afterwards known, had been arrived at by him by independent reflection, yet it could not but be that he would be confirmed in them by finding in England a developed school of thought of the same character already in existence. How highly Casaubon esteemed Grotius appears from a letter of his to Daniel Heinsius, dated London, 13th April, 1613. "I cannot say how happy I esteem myself in having seen so much of one so truly great as Grotius. A wonderful man! This I knew him to be before I had seen him; but the rare excellence of that divine genius no one can sufficiently feel who does not see his face, and hear him speak. Probity is stamped on his features; his conversation savors of true piety and profound learning. It is not only upon me that he has made this impression; all the pious and learned to whom he has been here introduced have felt the same towards him; the king especially so!"

After Grotius's return from England the exasperation of theological parties in Holland gradually rose to such a pitch that it became clear that an appeal to force would sooner or later be made. This Grotius must have foreseen, but he could hardly have anticipated that he himself would be one of the first and principal victims. Grotius was not sufficient of a philosopher to rise above the level of a mere theological wrangle. But from a natural moderation of temper he sought to find some mean term in which the two hostile parties of Remonstrants and Anti-remonstrants, or as they were subsequently called Arminians and Gomarists (see REMONSTRANTS), might agree. A form of edict drawn by Grotius was published by the states, recommending mutual toleration, and forbidding ministers in the pulpit from handling the disputed dogmas. To the orthodox Calvinists the word toleration was insupportable. They had the populace on their side. This fact determined the stadtholder, Maurice of Nassau, to support the orthodox party—a party to which he inclined the more readily that Oldenbarnevelt, the grand pensionary, the man whose uprightness and abilities he most dreaded, sided with the Remonstrants.

In 1618 Prince Maurice set out on a sort of pacific campaign, disbanding the civic guards in the various cities of Guelders, Holland, and Zeeland, and occupying the places with troops on whom he could rely. The states of Holland sent a commission, of which Grotius was chairman, to Utrecht, with the view of strengthening the hands of their friends, the Remonstrant party, in that city. Feeble plans were formed, but not carried into effect, for shutting the gates upon the stadtholder, who entered the city with troops on the night of 26th of July, 1618. There were conferences in which Grotius met Prince Maurice face to face, and taught him that Oldenbarnevelt was not the only man of capacity in the ranks of the Remonstrants whom he had to fear. On the early morning of 31st July the prince's *coup d'état* against the liberties of Utrecht and of Holland was carried out, the civic guard was disarmed,—Grotius and his colleagues saving themselves by a precipitate flight. But it was only a reprieve. The grand pensionary, Oldenbarnevelt, the leader of the Remonstrant party, Grotius, and Hoogeoberz were arrested by order of the stadtholder, brought to trial, and condemned,—Oldenbarnevelt to death, and Grotius to imprisonment for life and confiscation of his property. In June, 1617, he was immured in the fortress of Lovestein near Gorcum. His confinement was rigorous, but after a time his wife obtained permission to share his captivity, on the condition that if she came out, she should not be suffered to return.

Grotius had now before him, at thirty-six, no prospect but that of a lifelong captivity. He did not abandon himself to despair, but sought refuge in returning to the classical pursuits of his youth. Several of his translations (into Latin) from the Greek tragedians and other writers, made at this time, have been printed. They are without any philological value, and only prove his taste and facility in the classical languages. "The Muses," he writes to Voss, "were now his consolation, and appeared more amiable than ever."

The address and ingenuity of Madame Grotius at length devised a mode of escape. It had grown into a custom to send, at stated intervals, the books which he had done with,

in a chest, along with his linen to be washed at Gorcum. For many months the warders of the fortress were very exact in searching the chest. But never finding anything but books and linen they grew careless, and began to let the chest pass without opening it. Madame Grotius, perceiving this, prevailed on her husband to allow himself to be shut up in it at the usual time. The two soldiers who carried the chest out complained that it was so heavy "there must be an Arminian in it." "There are indeed," said Madame Grotius, "Arminian books in it." The chest was carried by canal to Gorcum. When it came there they wanted to put it on a sledge; but the maid telling the boatmen there were some brittle things in it, it was put on a horse, and so carried to the house of a friend, where it was opened, and Grotius released. He was then dressed up like a mason with hod and trowel, and so conveyed in disguise over the frontier. His first place of refuge was Antwerp, from which he proceeded to Paris, where he arrived in April, 1621. In October he was joined by his wife. There he was presented to the king, Louis XIII., and a pension of 3000 livres conferred upon him. French pensions were easily granted, all the more so as they were never paid. Grotius was now reduced to great straits. He had not the means of procuring the bare necessaries of life. His family was a growing one, and it was with difficulty that he procured them clothes. His relations in Holland sent him occasionally small remittances in money, clothes, or Dutch butter. He looked about for any opening through which he might earn a living. There was talk of something in Denmark; or he would settle in Spire, and practise in the court there. Some little relief he got through the intervention of D'Aligre, the new chancellor, who procured a royal mandate which enabled Grotius to draw, not all, but a large part of his pension. In 1623 the president Henri de Même lent him his chateau of Balagni near Senlis (dep. Oise), and there Grotius passed the spring and summer of that year. De Thou gave him facilities to borrow books from the superb library formed by his father.

Under these circumstances the *De jure belli et pacis* was composed. The biographers are naturally astonished by the fact that a work of such immense reading, consisting in great part of quotation, could have been written in little more than a year. The achievement would have been, not wonderful, but impossible, but for the fact above mentioned that Grotius had with him the first draft of the work made in 1604. He had also got his brother William, when he was reading his classics, to mark down all the passages which touched upon law, public or private. In March, 1625, the printing of the *De jure belli*, which had taken four months, was completed, and the edition despatched to the fair at Frankfort. His own honorarium as author consisted of 200 copies, of which, however, he had to give away many to friends, to the king, the principal courtiers, the papal nuncio, etc. What remained he sold for his own profit, at the price of a crown each, but the sale did not recoup him his outlay. But though his book brought him no profit it brought him reputation, so widely spread, and of such long endurance, as no other legal treatise has ever enjoyed.

Grotius naturally hoped that his fame would soften the hostility of his foes, and that his country would recall him to her service. In this he was disappointed. Theological rancor prevailed over all other sentiments. After some fruitless attempts to re-establish himself in Holland, Grotius was fain to accept service under the crown of Sweden, in the capacity of ambassador to the court of France. He was not very successful in negotiating the treaty on behalf of the Protestant interest in Germany, Richelieu having a special dislike to him. He never enjoyed the confidence of the court to which he was accredited, and frittered away his influence in disputes about precedence, which seem little worthy of his reputation.

In 1645 he demanded and obtained his recall. He was received at Stockholm with all the honors due to him. But neither the climate nor the tone of the court suited him, and he demanded permission to leave. He was driven by a storm on the coast near Dantzic. He got as far as Rostock, where he found himself very ill. Stockman, a Scotch physician who was sent for, thought it was only weakness, and that rest would restore the patient. But Grotius sank rapidly, and died on 29th August, 1645.

Grotius was a man of varied interests and accomplishments, combining a wide circle of general knowledge with a profound study of one branch of law. History, theology, jurisprudence, politics, classics, poetry,—all these fields he cultivated, and has left numerous works in each kind.

His commentaries on the Scriptures were the first application on an extensive scale of the principle affirmed by Scaliger, that, namely, of interpretation by the rules of grammar without dogmatic assumptions. Grotius's philological skill, however, was not sufficient to enable him to work up to this ideal.

As in many other points Grotius inevitably recalls to us Erasmus, so he does in his attitude towards the great schism. Grotius was indeed a man of profound religious sentiment, which Erasmus was not; but he had an indifference to dogma equal to that of Erasmus, although his disregard sprang from another source. Erasmus felt the contempt of a man of letters for the barbarous dissonance of the monkish wrangle. Grotius was animated by an ardent desire for peace and concord. He thought that a basis for reconciliation of Protestant and Catholic might be found in a common piety, combined with reticence upon discrepancies of doctrinal statement. His *De veritate religionis Christianæ* (1627), a presentment of the evidences, is so written as to form a code of common Christianity, irrespective of sect. The little treatise diffused itself rapidly over Christendom, gaining rather than losing popularity in the 18th century. It became the classical manual of apologetics in Protestant colleges, and was translated for missionary purposes into Arabic (by Pococke, 1660), Persian, Chinese, etc. His *Via et votum ad pacem ecclesiasticam* (1642) was a detailed proposal of a scheme of accommodation. Of course, like all men of moderate and mediating views, he was charged by both sides with vacillation. An Amsterdam minister, James Laurent, published his *Grotius papizans* (1642), and it was continually being announced from Paris that Grotius had "gone over." Hallam, who has collected all the passages from Grotius's letters in which the prejudices and narrow tenets of the Reformed clergy are condemned, thought he had a "bias towards popery" (*Lit. of Europe*, ii. 312). The true interpretation of Grotius's mind appears to be an indifference to dogmatic propositions, produced by a profound sentiment of piety. He rose above the separatist bigotry of the vulgar theologian, but did not ascend into that philosophical region in which dogma is transcended and dissolved. He approached parties as a statesman approaches them, as facts which have to be dealt with, and governed, not suppressed in the interests of some one of their number.

His editions and translations of the classics were either juvenile exercises prescribed by Scaliger, or "lusus poetici," the amusement of vacant hours. Grotius read the classics as a humanist, for the sake of their contents, not as a professional scholar.

His *Annals of the Low Countries* was begun as an official duty while he held the appointment of historiographer, and was being continued and retouched by him to the last. It was not published till 1657, by his sons Peter and Cornelius.

But the high reputation which Grotius attained in his lifetime, though it rests in part, like that of Erasmus, on the diversity of his accomplishments and the comprehensiveness of his literary view, had also a scientific basis in a professional specialty. Grotius was a great jurist, and his *De jure belli et pacis* (Paris, 1625), though not by any means the first attempt in modern times to ascertain the principles of jurisprudence, went far more fundamentally into the discussion than any one had done before him. The title of the work was so far misleading that the *jus belli* was a very small part of his comprehensive scheme. In his treatment of this narrower question he had the works of Albericus Gentilis (1588) and Ayala (1597) before him, and has acknowledged his obligations to them. But it is in the larger questions to which he opened the way that the merit of Grotius consists. His was the first attempt to obtain a principle of right, and a basis for society and government, outside the church or the Bible. The distinction between religion on the one hand and law and morality on the other is not indeed clearly conceived by Grotius, but he wrestles with it in such a way as to make it easy for those who followed him to seize it. The law of nature is unalterable; God Himself cannot alter it any more than He can alter a mathematical axiom. This law has its source in the nature of man as a social being; it would be valid even were there no God, or if God did not interfere in the government of

the world. These positions, though Grotius's religious temper did not allow him to rely unreservedly upon them, yet, even in the partial application they find in his book, entitle him to the honor of being held the founder of the modern science of the law of nature and nations. The *De jure* exerted little influence on the practice of belligerents, yet its publication was an epoch in the science. "The elegance of his diction," says Bluntschli, "the pearls from classical antiquity with which he adorned his pages, the temper of humanity which pervaded his argument, his effort to mitigate the horrors of the Thirty Years' War in the midst of which he wrote, and the warmth of his general sympathy for a moral as opposed to a material order, enlisted men's hearts on the side of his reasoning, while the deficiencies of his doctrine were not as yet detected." These defects are probably now, at 250 years' distance of time, more palpable than the merits of the work. But only in the heat and impertinence of irresponsible periodical criticism could it be said, as De Quincey has said, that the book is equally divided between "empty truisms and time-serving Dutch falsehoods." For a saner judgment and a brief abstract of the contents of the *De jure*, the reader is referred to Bluntschli, *Geschichte des allgemeinen Staatsrechts* (Munich, 1864). A fuller analysis, and some notice of the predecessors of Grotius, will be found in Hély, *Étude sur le droit de la guerre de Grotius* (Paris, 1875). The writer, however, with the usual unacquaintance of Frenchmen with everything which goes on outside France, has never heard of the *De jure prædæ*, published in 1868. Hallam, *Lit. of Europe*, ii. p. 543, has an abstract done with his usual conscientious pains. Dugald Stewart (*Collected Works*, i. 370) has dwelt upon the confusion and defects of Grotius's theory. Mackintosh (*Miscell. Works*, p. 166) has defended Grotius, affirming that his work "is perhaps the most complete that the world has yet owed, at so early a stage in the progress of any science, to the genius and learning of one man."

The chief writings of Grotius have been named in the course of our article. For a complete bibliography of his works, published and unpublished, the reader is referred to Lehmann, *Hugonis Grotii manes vindicati*, Delft, 1727, which also contains a full biography. Of this Latin life De Burigny published a réchauffée in French, 2 vols. 8vo, Paris, 1752. Other lives are:—Van Brandt, *Historie van het Leven H. de Groot*, 2 vols. 8vo, Dordrecht, 1727; Von Luden, *Hugo Grotius nach seinen Schicksalen und Schriften dargestellt*, 8vo, Berlin, 1806; *Life of Hugo Grotius*, by Charles Butler of Lincoln's Inn, 8vo, London, 1826. The work of the Abbé Hély already mentioned contains a life of Grotius. Grotius's theological works were collected in 3 vols. fol. at Amsterdam, 1644–46 (reprinted London, 1660; Amsterdam, 1679; and again Amsterdam, 1698). His letters were printed first in a selection, *Epistolæ ad Gallos*, 12mo, Leyden, 1648, abounding, though an Elzevir, in errors of press. They were collected in *H. Grotii Epistolæ quotquot reperiri potuerunt*, fol., Amsterdam, 1687. A few may be found scattered in other collections of *Epistolæ*. Supplements to the large collection of 1687 were published at Haarlem, 1806; Leyden, 1809; and Haarlem, 1829. The *De jure belli* was translated into English by Whewell, 3 vols. 8vo, Camb., 1853; into French by Barbeyrac, 2 vols. 4to, Amst., 1724; into German in Kirchmann's *Philosophische Bibliothek*, 3 vols. 12mo, Leipsic, 1879. (M. P.)

GROTON, a post town of New London county, Connecticut, U.S., is situated on the rivers Mystic and Pequonnock, opposite New London, and on the east side of the river Thames at its junction with Long Island Sound. There are granite quarries in the neighborhood, and the town possesses manufactures of cotton goods, britannia ware, carriages, and sashes and blinds, and brass and iron foundries. There is also a considerable coasting trade, and shipping and fishing are carried on to a small extent. On the heights behind the town stands Fort Griswold, which surrendered to the British troops, September 6, 1781. The majority of its defenders, including the commander Colonel Ledyard, were put to death after they had surrendered; and a granite monument was erected in the town to their memory in 1830. The population in 1900 was 5,962.

GROTTAGLIE, a small city of Italy, in the province of Lecce and circondario of Taranto, about 14 miles N.E. of Taranto. It probably occupies the site of Rudiæ, the birth-place of the Latin poet Ennius, afterwards known as Castel Rodelle. The name Grottaglie is due to the number of caves in the vicinity. In modern times the place is worthy of note mainly because it has given birth to several men of considerable national eminence, as is set forth in detail in Pignatelli's history of the town. An excellent red clay for the manufacture of earthenware is found at Grottaglie. The inhabitants numbered 10,681 in 1901.

GROUND NUT (synonyms, Earth Nut, Pistache de Terre, Monkey Nut, Pea Nut, Manilla Nut), a nut or pod the produce of the *Arachis hypogæa*, L. (Nat. Ord. *Leguminosæ*). The plant is an annual of diffuse habit, with hairy stem, with two-paired, abruptly pinnate leaflets. The flowers above ground are sterile, and the pods or legumes are stalked, oblong, cylindrical, about 1 inch in length, the thin reticulated shell containing one or two irregularly ovoid seeds. After the flower withers, the stalk of the ovary has the peculiarity of elongating and bending down, forcing the young pod under ground, and thus the seeds become matured at some distance below the surface. Hence the specific and vernacular names of the plant. Two varieties are recognized in Malacca and Java, a white and a brown, and the seeds are known as *minyak katjang* (oil bean). Of the history of this plant much has been written. Monardes in 1596 writes of having seen it largely used about the river Marañon in Brazil, and Marcgraf in 1648 gave a description and figure of it. To M. Jaubert, however, a colonist at Gorée near Cape Verd, seems to belong the honor of first recommending it as of commercial value. As to its native country the opinions of botanists are divided between Africa and America. It is extensively cultivated in all tropical and subtropical countries, especially in America, Africa, India, the Malayan Archipelago, and China. The plant affects a light sandy soil, and is very prolific, yielding in some instances 30 to 38 bushels of nuts per acre. The pods when ripe are dug up and dried. The seeds when fresh are largely eaten in tropical countries, and in taste are almost equal to almonds; when roasted they are used as a substitute for chocolate. Even in England large quantities of these "monkey nuts" are consumed by the poorer children. By expression the seeds yield a large quantity of oil, which is used by natives for lamps, as a fish or curry oil, and for medicinal purposes. The leaves form an excellent food for cattle, being very like clover.

Large quantities of seeds are imported to Europe, chiefly to Marseilles, London, Hamburg, and Berlin, for the sake of their contained oil. The seeds yield from 42 to 50 per cent. of oil by cold expression, but a larger quantity is obtained by heat, although of an inferior quality. The seeds being soft facilitate mechanical expression, and where bisulphide of carbon or other solvent is used, a very pure oil is obtained.

The expressed oil is limpid, of a light yellowish or straw color, having a faint smell and bland taste; it forms an excellent substitute for olive oil, although in a slight degree more prone to rancidity than the latter. Its specific gravity is 0·916 to 0·918; it becomes turbid at 3° C., concretes at + 3° to − 4° C., and hardens at + 7° C. It is a non-drying oil. Ground nut oil consists of (1) oleic acid ($C_{18}H_{34}O_2$); (2) hypogæic acid ($C_{16}H_{30}O_2$), by some supposed to be identical with a fatty acid found in whale oil; (3) palmitic acid ($C_{16}H_{32}O_2$); and (4) arachic acid ($C_{20}H_{40}O_2$). The oil is officinal in the Indian pharmacopœia, replacing olive oil, and it is also used in the adulteration of gingelly oil. In 1874 about 145 million lb of ground nuts, valued at £1,040,000, were exported from the west coast of Africa, chiefly to Marseilles, London, Hamburg, and Berlin.

GROUNDSEL (German, *Kreuzkraut;* French, *Seneçon*), *Senecio vulgaris*, Linn., is an annual, glabrous or more or less woolly plant of the natural order *Compositæ*, series *Tubuliflorœ* and tribe *Senecionideæ*, having a branched succulent stem 6 to 15 inches in height; pinnatifid and irregularly and coarsely-toothed leaves; flowers in separate corymbs, with involucres of about 20 equal and several external and smaller bracts, and florets yellow and tubular, rarely ligulate in the marginal row; and ribbed and silky fruit. The plant is indigenous to Europe, whence it has been introduced into all temperate climates. It is a troublesome weed, flowering throughout the year, and propagating itself rapidly by means of its light feathery fruits; it has its use, however, as a food for cage-birds. *Senecio sylvaticus* and *S. viscosus* are known respectively as mountain groundsel and stinking groundsel. Many species of the genus are handsome florists' plants. The groundsel tree, *Baccharis halimifolia*, Linn., a native of the North American sea-coast from Massachusetts southward, is a Composite shrub, attaining 6 to 12 feet in height, and having angular branches, obovate or oblong-cuneate, somewhat scurfy leaves, and

flowers larger than but similar to those of common groundsel. The long white pappus of the female plant renders it a conspicuous object in autumn. The groundsel tree has been cultivated in British gardens since 1683.

See Loudon, *Arboretum*, vol. ii., 1838; Syme, *Sowerby's English Botany*, vol. v., 3d ed., 1866.

GROUSE, a word of uncertain origin,[1] now used generally by ornithologists to include all the "rough-footed" Gallinaceous birds, but in common speech applied almost exclusively, when used alone, to the *Tetrao scoticus* of Linnæus, the *Lagopus scoticus* of modern systematists—more particularly called in English the Red Grouse, but not a century ago almost invariably spoken of as the Moor-fowl or Moor-game. The effect which this species is supposed to have on the British legislature, and therefore on history, is well known, for it is the common belief that parliament in these days always rises when the season for Grouse-

Red Grouse.

shooting begins; but even of old time it seems to have excited on one occasion a curious kind of influence, for we may read in the *Orkneyinga Saga* (ed. Jonæus, p. 356; ed. Anderson, p. 168) that events of some importance in the annals of North Britain followed from its pursuit in Caithness in the year 1157. The Red Grouse is found on moors from Monmouthshire and Derbyshire northward to the Orkneys, as well as in most of the Hebrides. It likewise inhabits similar situations throughout Wales and Ireland, but it does not naturally occur beyond the limits of the British Islands,[2] and is the only species among birds peculiar to them. The word "species" may in this case be used advisedly (since the Red Grouse invariably "breeds true," it admits of an easy *diagnosis*, and it has a definite geographical range); but scarcely any zoologist who looks further into the matter can doubt of its common origin with the Willow-Grouse, *Lagopus albus* (*L. subalpinus* or *L. saliceti* of some authors), that inhabits a subarctic zone from Norway across the whole continent of Europe and Asia, as well as North America from the Aleutian Islands to Newfoundland. The Red Grouse indeed is rarely or never found away from the heather on which chiefly it subsists, and with which in most men's minds it is associated; while the Willow-Grouse in many parts of the Old World seems to prefer the shrubby growth of berry-bearing plants (*Vaccinium* and others) that, often thickly interspersed with willows and birches, clothes the higher levels or the lower mountain-slopes, and it contrives to flourish in the New World where heather scarcely exists, and a "heath" in its strict sense is unknown. It is true likewise that the Willow-Grouse always becomes white in winter, which the Red Grouse never does; but then we find that in summer there is a considerable resemblance between the two species, the cock Willow-Grouse having his head, neck, and breast of nearly the same rich chestnut-brown as his British representative, and, though his back be lighter in color, as is also the whole plumage of his mate, than is found in the Red Grouse, in other respects than those named above the two species are precisely alike. No distinction can be discovered in their voice, their eggs, their build, nor in their anatomical details, so far as these have been investigated and compared.[3] In connection too with this matter it should not be overlooked that the Red Grouse, restricted as is its range, varies in color not inconsiderably according to locality, so that game-dealers of experience are able to pronounce at sight the native district of almost any bird that comes to their hands.

Other peculiarities of the Red Grouse—the excellence of its flesh, and its economic importance, which is perhaps greater than that of any other wild bird in the world—hardly need notice here, and there is not space to dwell upon that dire and mysterious malady to which it is from time to time subject, primarily induced, in the opinion of many, by the overstocking of its haunts and the propagation of diseased offspring by depauperized parents.[4]

Though the Red Grouse does not, after the manner of other members of the genus *Lagopus*, become white in winter, Scotland possesses a species of the genus which does. This is the Ptarmigan,[5] *L. mutus* or *L. alpinus*, which differs far more in structure, station, and habits from the Red Grouse than that does from the Willow-Grouse, and in Scotland is far less abundant, haunting only the highest and most barren mountains. It is said to have formerly inhabited both Wales and England, but there is no evidence of its appearance in Ireland. On the continent of Europe it is found most numerously in Norway, but at an elevation far above the growth of trees, and it occurs on the Pyrenees, and on the Alps. It also inhabits northern Russia, but its eastern limit is unknown. In North America, Greenland, and Iceland it is represented by a very nearly allied form—so much so indeed that it is only at certain seasons that the slight difference between them can be detected. This form is the *L. rupestris* of authors, and it would appear to

[1] It seems first to occur (*fide* O. Salusbury Brereton, *Archæologia*, iii. p. 157) as "grows" in an ordinance for the regulation of the royal household dated "apud Eltham, mens. Jan. 22 Hen. VIII.," *i. e.*, 1531, and considering the locality must refer to Black game. It is found in an Act of Parliament 1 Jac. I. cap. 27, § 2, *i. e.*, 1603, and, as reprinted in the *Statutes at Large*, stands as now commonly spelt, but by many writers or printers the final *e* is now omitted. In 1611 Cotgrave had "Poule Grieseke. A Moore-henne; the henno of the *Grice* [in ed. 1673 'Griece'] or Mooregame" (*Dictionarie of the French and English Tongues*, sub voce *Poule*). The most likely derivation seems to be from the old French word *Griesche*, *Greoche*, or *Griais* (meaning speckled, and cognate with *griseus*, grisly or gray), which was applied to some kind of Partridge, or according to Brunetto Latini (*Trés*, p. 211) to a Quail, "porce que elo fu premiers trovée en Greee."

[2] It has been successfully, though with much trouble, introduced by Mr. Oscar Dickson on a tract of land near Gottenburg in Sweden (*Svenska Jägarförbundets Nya Tidskrift*, 1868, p. 64 *et alibi*), and seems likely to maintain itself there, so long at least as the care hitherto bestowed upon it is continued.

[3] A very interesting subject for discussion would be whether *Lagopus scoticus* or *L. albus* has varied most from the common stock of both. We can here but briefly indicate the more salient points that might arise. Looking to the fact that the former is the only species of the genus which does not assume white clothing in winter, an evolutionist might at first deem the variation greatest in its case; but then it must be borne in mind that the species of *Lagopus* which turn white differ in that respect from all other groups of the family *Tetraonidæ*. Furthermore it must be remembered that every species of *Lagopus* (even *L. leucurus*, the whitest of all) has its first set of *remiges* colored brown. These are dropped when the bird is about half-grown, and in all the species but *L. scoticus* white *remiges* are then produced. If therefore, as is generally held, the successive phases assumed by any animal in the course of its progress to maturity indicate the phases through which the species has passed, there may have been a time when all the species of *Lagopus* wore a brown livery even when adult, and the white dress donned in winter has been imposed upon the wearers by causes that can be easily suggested, for it has been freely admitted by naturalists of all schools that the white plumage of the birds of this group protects them from danger during the snows of a protracted winter. On the other hand it is not at all inconceivable that the Red Grouse, instead of perpetuating directly the more ancient properties of an original *Lagopus* that underwent no great seasonal change of plumage, may derive its ancestry from the widely-ranging Willow-Grouse, which in an epoch comparatively recent (in the geological sense) may have stocked Britain, and left descendants that, under conditions in which the assumption of a white garb would be almost fatal to the preservation of the species, have reverted (though doubtless with some modifications) to a comparative immutability essentially the same as that of the primal *Lagopus*.

[4] On the Grouse-disease the papers of Prof. Young in *Proc. Nat. Hist. Soc. Glasgow*, i. p. 225, and Dr. Farquharson, *Edinb. Med. Journal*, No. 263, p. 222, may be advantageously consulted.

[5] James I. (as quoted by Mr. Gray, *B. W. Scotland*, p. 230) writing from Whitehall in 1617 spelt the word "Termigant," and in this form it appears in one of the Scots Acts in 1621. Taylor the "water-poet," who (in 1630) seems to have been the first Englishman to use the word, has "Termagant." How the unnecessary initial letter has crept into the name is more than the writer knows. The word is admittedly from the Gaelic *Tarmachan*, meaning, according to some, "a dweller upon heights," but thought by Dr. T. M'Lauchlan to refer possibly to the noise made by the bird's wings in taking flight.

be found also in Siberia (*Ibis*, 1879, p. 148). Spitzbergen is inhabited by a large form which has received recognition as *L. hemilcucurus*, and the northern end of the chain of the Rocky Mountains is tenanted by a very distinct species, the smallest and perhaps the most beautiful of the genus, *L. leucurus*, which has all the feathers of the tail white. The very curious and still hardly understood question of

Ptarmigan.

the moulting of the Ptarmigan could not possibly be discussed within these limits—reference has already been made to it in another article (Birds, vol. iii. p. 673).

The bird, however, to which the name of Grouse in all strictness belongs[1] is probably the *Tetrao tetrix* of Linnæus —the Blackcock and Grayhen, as the sexes are with us re-

Blackcock.

spectively called. It is distributed over most of the heath-country of England, except in East Anglia, where attempts to introduce it have been only partially successful. It also occurs in North Wales, and very generally throughout Scotland, though not in Orkney, Shetland, or the Outer Hebrides, nor in Ireland. On the continent of Europe it has a very wide range, and it extends into Siberia. In Georgia its place is taken by a distinct species, on which a

[1] See footnote (1), p. 197.

Polish naturalist (*Proc. Zool. Society*, 1875, p. 267) has unhappily conferred the name of *T. mlokosiewitzi*. Both these birds have much in common with their larger congener the Capercally (see vol. v. p. 48) and its eastern representative.

We must then notice the species of the genus *Bonasa*, of which the European *B. sylvestris* is the type. This does not inhabit the British Islands; unfortunately so, for it is perhaps the most delicate game-bird that comes to table. It is the *Gelinotte* of the French, the *Haselhuhn* of Germans, and *Hjerpe* of Scandinavians. Like its transatlantic congener *B. umbellus*, the Ruffed Grouse or Birch-Partridge (of which there are two other local forms, *B. umbelloides* and *B. sabinii*), it is purely a forest-bird. The same may be said of the species of *Canace*, of which two forms are found in America, *C. Canadensis*, the Spruce-Partridge, and *C. franklini*, and also of the Siberian *C. falcipennis*. Nearly allied to these birds is the group known as *Dendragapus*, containing three large and fine forms, *D. obscurus*, *D. fuliginosus*, and *D. richardsoni*—all peculiar to North America. Then we have *Centrocercus urophasianus*, the Sage-cock of the plains of Columbia and California, and *Pediœcetes*, the Sharp-tailed Grouse, with its two forms *P. phasianellus* and *P. columbianus*, while finally *Cupidonia*, the Prairie-hen, also with two local forms, *C. cupido* and *C. pallidicincta*, is a bird that in the United States of America possesses considerable economic value, as witness the enormous numbers that are not only consumed there, but exported to Europe. It will be seen that the great majority of Grouse belong to the northern part of the New World, and it is much to be regretted that space here fails to do justice to these beautiful and important birds, by enlarging on their interesting distinctions. They are nearly all figured in Elliot's *Monograph of the Tetraoninæ*, and an excellent account of the American species is given in Baird, Brewer, and Ridgway's *North American Birds* (iii. pp. 414–465). (A. N.)

GROVE. The almost universal occurrence, at one stage or another in the religious and social development of the races of mankind, of the practice of worshipping by preference under or among trees to which a peculiarly sacred and inviolable character is attached, is a fact too well known to require particular illustration here. Its explanation is to be sought partly in obvious considerations of physical convenience, but even more in certain psychical phenomena which may still be made matters of direct observation and experience ("Lucos, et in iis silentia ipsa adoramus," Pliny, *H. N.* xii. 1; "Secretum luci . . . et admiratio umbræ fidem tibi numinis facit," Sen., *Ep.* xli.). It does not appear to have any necessary connection with tree-worship, another very widely diffused practice on which, and on its possible connection with ancestor-worship, some suggestive remarks will be found in Spencer's *Principles of Sociology*. It has sometimes been alleged as a characteristic difference between the Semitic and the Aryan races that the former show a tendency to select single trees for sanctuaries, while the latter are generally found worshipping in groves; and this generalization, though liable to many exceptions, is really borne out at least by the familiar indications to be met with in Scripture. The word "grove," so often met with in the authorized version of the Bible, is nowhere there correctly employed. In Gen. xxi. 33 and 1 Sam. xxii. 6 (margin) it is used as a rendering of the Hebrew word אֶשֶׁל of which "tamarisk" is the proper translation. In every other instance in which it occurs (Ex. xxxiv. 13; Deut. xii. 3; xvi. 21; Judg. iii. 7; vi. 25, 28; Isa. xvii. 8; Mic. v. 14; and often in Kings and Chronicles), where the LXX. translate ἄλσος, and the Vulgate *lucus*, the original is invariably Asherah (אֲשֵׁרָה), meaning a tree or post (see Baal, vol. iii. p. 152). The "plain" of Moreh, or Mamre also, in Gen. xii. 6 and xiii. 18, represents אֵלוֹן, which all modern interpreters render "terebinth."

GRUBER, Johann Gottfried (1774–1851), a learned German author, was born at Naumburg on the Saale, 29th November, 1774. He received his education at the town school of Naumburg and the university of Leipsic, after which he resided successively at Göttingen, Leipsic, Jena, and Weimar, occupying himself partly in teaching and partly in various literary enterprises, and enjoying in Weimar the friendship of Herder, Wieland, and Goethe. In 1811 he was appointed professor at the university of Wittenberg, and after the division of Saxony he was sent by the senate to Berlin in connection with the negotiations

for the union of the university of Wittenberg to that of Halle. After the union was effected he became in 1815 professor of philosophy at Halle. On the death of Hufeland he was associated with Ersch in the editorship of the great work *Allgemeine Encyklopädie der Wissenschaften und Künste;* and after the death of Ersch he continued the first section from vol. xviii. to vol. liv. He also succeeded Ersch in the editorship of the *Allgemeine Literaturzeitung.* He died 7th August, 1851.

Gruber was the author of a large number of works, the principal of which are *Charakteristik Herders,* in conjunction with Danz, Leipsic, 1805; *Geschichte des Menschlichen Geschlechts,* 2 vols., Leipsic, 1806; *Wörterbuch der Altclassischen Mythologie,* 3 vols., Weimar, 1810–15; *Wielands Leben,* 2 parts, Weimar, 1815–16; and *Klopstocks Leben,* Weimar, 1832. A completed biography of Wieland was prefixed to Gruber's edition of Wieland's *Sämmtliche Werke,* Leipsic, 1818–28.

GRÜN, Anastasius (1806–1876), pseudonym for Anton Alexander, count of Auersperg, who was born April 11, 1806, at Laibach, the capital of the Austrian duchy of Carniola. He received his university education first at Gratz and then at Vienna, where he studied jurisprudence. In 1832 the title of "Imperial Chamberlain" was conferred upon him, and in 1839 he married the daughter of Count Attems. He accepted no official post, and devoted himself chiefly to literary pursuits. When the "March Revolution" broke out in 1848 at Vienna, the count entered the political arena, and represented the district of Laibach at the National Assembly at Frankfort-on-the-Main. After a few months, however, he resigned his seat, and again retired into private life. In 1860, when a fresh impulse was given to political life in Austria, he resumed his activity as a politician, and greatly distinguished himself in the Austrian House of Lords as one of the most intrepid and influential supporters of the cause of liberalism, both in political and religious matters, until his death in 1876. Count Auersperg acquired great fame as a poet, as which he is known under the pseudonym of *Anastasius Grün.* His first publication, *Blätter der Liebe,* "Leaves of Love" (1830), showed little originality; but his second production, *Der letzte Ritter,* "The last Knight" (1830), brought to light his eminence as a poet. It celebrates the deeds and adventures of the emperor Maximilian I. (1493–1519), and contains exquisite poetical descriptions tinged with playful humor. His next poetical productions, *Spaziergänge eines Wiener Poeten,* "Walks of a Vienna Poet" (1831), and *Schutt,* "Ruins" (1835), quite electrified the whole of Germany by the boldness and originality of their conception and by their decided liberal tendency. His *Collected Poems* (1837) increased his reputation as a poet, but not so his epics, *Die Nibelungen im Frack* (1843) and *Der Pfaff vom Kahlemberg* (1850). He also produced masterly translations of the popular Slovenic songs current in Carniola (1850), and of the English poems relating to "Robin Hood" (1869). Anastasius Grün may be called the originator of the modern school of political lyric poetry in Germany. His language is sonorous and majestic, and his descriptions, though sometimes overcrowded with imagery, bear the stamp of great poetical originality. He loved to employ the stately "Nibelungen measure," which imparted considerable vigor to some of his productions. Of his shorter poems *Der letzte Dichter,* "The last Poet," is deservedly the most popular.

GRÜN, Hans Baldung (*c.* 1470–1545), commonly called Grün, a painter of the age of Dürer, was born about 1470 at Gmünd in Swabia, and spent the greater part of his life at Strasburg and Freiburg in Breisgau. The earliest pictures assigned to him are altarpieces with the monogram H. B. interlaced, and the date of 1496, in the monastery chapel of Lichtenthal near Baden. Another early work is a portrait of the emperor Maximilian, drawn in 1501 on a leaf of a sketch-book now in the print-room at Carlsruhe. The Martyrdom of St. Sebastian and the Epiphany (Berlin Museum), fruits of his labor in 1507, were painted for the market-church of Halle in Saxony. In 1509 Grün purchased the freedom of the city of Strasburg, and resided there till 1513, when he removed to Freiburg in Breisgau. There he began a series of large compositions, which he finished in 1516, and placed on the high altar of the Freiburg cathedral. He purchased anew the freedom of Strasburg in 1517, resided in that city as a domicile, and died a member of its great town council 1545.

Though nothing is known of Grün's youth and education, it may be inferred from his style that he was no stranger to the school of which Dürer was the chief. Gmünd is but 50 miles distant on either side from Augsburg and Nuremberg. Grün's prints were often mistaken for those of Dürer; and Dürer himself was well acquainted with Grün's woodcuts and copper-plates, in which he traded during his trip to the Netherlands (1520). But Grün's prints, though Düreresque, are far below Dürer, and his paintings are below his prints. Without absolute correctness as a draughtsman, his conception of human form is often very unpleasant, whilst a questionable taste is shown in ornament equally profuse and "baroque." Nothing is more remarkable in his pictures than the pug-like shape of the faces, unless we except the coarseness of the extremities. No trace is apparent of any feeling for atmosphere or light and shade. Though Grün has been commonly called the Correggio of the north, his compositions are a curious medley of glaring and heterogeneous colors, in which pure black is contrasted with pale yellow, dirty gray, impure red, and glowing green. Flesh is a mere glaze under which the features are indicated by lines. No wonder that English collectors should have neglected him. There is not one of his pictures in the whole of Great Britain, unless we accept as genuine a "Youth and Old Age" in the Liverpool Institution, bought by Roscoe as a masterpiece of Antonello da Messina. Even Germans express but slight esteem for Grün; and if his works have any claims to attention at all, it is merely because of the wild and fantastic strength which some of them display. We may pass lightly over the Epiphany of 1507, the Crucifixion of 1512, or the Stoning of Stephen of 1522, in the Berlin Museum. There is some force in the Dance of Death of 1517, in the museum of Basel, or the Madonna of 1530, in the Lichtenstein Gallery at Vienna. Grün's best effort is the altarpiece of Freiburg, where the Coronation of the Virgin, and the Twelve Apostles, the Annunciation, Visitation, Nativity, and Flight into Egypt, and the Crucifixion, with portraits of donors, are executed with some of that fanciful power which Martin Schön bequeathed to the Swabian school. As a portrait painter he is well known. He drew the likeness of Charles V., as well as that of Maximilian; and his bust of Margrave Philip in the Munich Gallery tells us that he was connected with the reigning family of Baden as early as 1514. At a later period he had sittings from Margrave Christopher of Baden, Ottilia his wife, and all their children, and the picture containing these portraits is still in the grand-ducal gallery at Carlsruhe. Like Dürer and Cranach, Grün became a hearty supporter of the Reformation. He was present at the diet of Augsburg in 1518, and one of his woodcuts represents Luther under the protection of the Holy Ghost, which hovers over him in the shape of a dove.

GRUNBERG, or Grüneberg, a town of Prussian Silesia, chief town of a circle in the government district of Liegnitz, is beautifully situated on an affluent of the Oder, and on the railway from Breslau to Stettin by Küstrin, 36 miles N.N.W. of Glogau. It has a real-school of the first order, a higher female school, and a trade school. The prosperity of the town depends chiefly on the vine culture in the neighborhood, from which, besides the exportation of a large quantity of grapes, about 700,000 gallons of wine are manufactured annually. The wine is a kind of champagne, and is largely exported to Russia. There are also manufactures of machinery, cloth, preserved fruits, and lignite. The population of the town in 1905 was 21,630.

GRUNDTVIG, Nikolai Frederik Severin (1783–1872), the Danish poet, statesman, and divine, was born at Udby on the 8th of September, 1783; in 1791 he was sent to live at the house of a priest in Jutland, and studied at the free school of Aarhuus until he went up to the university of Copenhagen in 1800. At the close of his university life he made Icelandic his special study, until in 1805 he took the position of tutor in a house on the island of Langeland. The next three years were spent in the study of Shakespeare, Schiller, and Fichte. His cousin, the philosopher Henrik Steffens, had returned to Copenhagen in 1802 full of the teaching of Schelling, and his lectures and the early poetry of Oehlenschlager opened the eyes of Grundtvig to the new era in literature that was commencing. The latter began to essay writing himself, but his first work, *On the Songs in the Edda,* attracted no attention. Returning to Copenhagen in 1808, he achieved a greater success with his *Northern Mythology,* and in 1809 with his *Decline of the Heroic Life in the North.* The boldness of his

theological views having provoked opposition, he retired to a country parsonage for a while, but soon returned to pursue a literary career with extraordinary earnestness. From 1812 to 1817 he published five or six works, of which the *Rhyme of Roeskilde* is the most remarkable. From 1816 to 1819 he was editor of a polemical journal entitled *Dannevirke*, and in 1818 to 1822 appeared his Danish paraphrases of Saxo Grammaticus and Snorre. During these years he was preaching to an enthusiastic congregation in Copenhagen, but he accepted in 1821 the country living of Præstö, only to return to the metropolis the year after. His theological career was, however, presently stopped, for, having in 1825 published a brochure, *The Church's Reply*, against the popular Dr. Clausen, he was publicly prosecuted and fined. For seven years he was forbidden to preach, years which he spent in publishing a collection of his theological works, in paying two visits to England, and in studying Anglo-Saxon. In 1832 he obtained permission to preach again, and in 1839 he became priest of the workhouse church of Vartou Hospital, a post he continued to hold until his death. In 1837 he published *Songs for the Danish Church*, a rich collection of spiritual poems; in 1838 he brought out a selection of early Scandinavian verse; in 1840 he edited the Anglo-Saxon poem of the *Phœnix*, with a Danish translation. He visited England a third time in 1843. From 1844 until after the first German war Grundtvig took a very prominent part in politics. In 1861 he received the titular rank of bishop, but without a see. He went on writing occasional poems till 1866, and preached in the Vartou every Sunday until a month before his death. He was married thrice, the last time in his seventy-sixth year, and left children by each marriage. He died September 2, 1872. Grundtvig holds a unique position in the literature of his country; he has been styled the Danish Carlyle. He was above all things a man of action, not an artist; and the formless vehemence of his writings, which have had a great influence over his own countrymen, is hardly agreeable or intelligible to a foreigner. His spiritual poems are among the best that the North has produced, but they are apt to be too long. The writings of Grundtvig have not yet been collected in a permanent form, but the best of his poetical works were published in a selection by his eldest son, Svend Grundtvig, the eminent comparative mythologist, in 1869, with a critical memoir by the poet Hostrup, who belongs to the religious body denominated Grundtvigians.

GRUNEWALD, Mathias. The accounts which are given of this painter, a native of Aschaffenburg, are curiously contradictory. Between 1518 and 1530, according to statements adopted by Waagen and Passavant, he was commissioned by Albert of Brandenburg, elector and archbishop of Mainz, to produce an altarpiece for the collegiate church of St. Maurice and Mary Magdalen at Halle on the Saale; and he acquitted himself of this duty with such cleverness that the prelate in after years caused the picture to be rescued from the Reformers and brought back to Aschaffenburg. From one of the churches of that city it was taken to the Pinakothek of Munich in 1836. It represents St. Maurice and Mary Magdalen between four saints, and displays a style so markedly characteristic, and so like that of Lucas Cranach, that Waagen was induced to call Grunewald Cranach's master. He also traced the same hand and technical execution in the great altarpieces of Annaberg and Heilbronn, and in various panels exhibited in the museums of Mainz, Darmstadt, Aschaffenburg, Vienna, and Berlin. A later race of critics, declining to accept the statements of Waagen and Passavant, affirm that there is no documentary evidence to connect Grunewald with the pictures of Halle and Annaberg, and they quote Sandrart and Bernhard Jobin of Strasburg to show that Grunewald is the painter of pictures of a different class. They prove that he finished before 1516 the large altarpiece of Issenheim, at present in the museum of Colmar, and starting from these premises they connect the artist with Altdorfer and Dürer to the exclusion of Cranach. That a native of the Palatinate should have been asked to execute pictures for a church in Saxony can scarcely be accounted strange, since we observe that Hans Baldung was entrusted with a commission of this kind. But that a painter of Aschaffenburg should display the style of Cranach is strange and indeed incredible, unless vouched for by first class evidence. In this case documents are altogether wanting, whilst on the other hand it is beyond the possibility of doubt, even according to Waagen, that the altarpiece of Issenheim is the creation of a man whose teaching was altogether different from that of the painter of the pictures of Halle and Annaberg. At this stage the controversy now stands; and it is needless to do more than observe that the altarpiece of Issenheim is a fine and powerful work, completed as local records show before 1516 by a Swabian, whose distinguishing mark is that he followed the traditions of Martin Schongauer, and came under the influence of Altdorfer and Dürer As a work of art the altarpiece is important, being a poliptych of eleven panels, a carved central shrine covered with a double set of wings, and two side pieces containing the Temptation of St. Anthony, the hermits Anthony and Paul in converse, the Virgin adored by Angels, the Resurrection, the Annunciation, the Crucifixion, St. Sebastian, St. Anthony, and the Marys wailing over the dead body of Christ. The author of these compositions is also the painter of a series of monochromes described by Sandrart in the Dominican convent, and now in part in the Saalhof at Frankfort, and a Resurrection in the museum of Basel, registered in Amerbach's inventory as the work of Grunewald.

GRUTER, or Gruytère, Jan (1560–1627), a critic and scholar of Dutch parentage by his father's side and English by his mother's, was born at Antwerp, December 3, 1560. To avoid religious persecution his parents while he was still young came to England; and for some years he prosecuted his studies at Cambridge, after which he went to Leyden, where he graduated M. A. In 1586 he was appointed professor of history at Wittenberg, but as he refused to subscribe the *formula concordiæ* he was unable to retain his office. From 1589 to 1592 he taught at Rostock, after which he went to Heidelberg, where in 1602 he was appointed librarian to the university. He died at Heidelberg, September 20, 1627. The chief service rendered by Gruter to classical learning was in the department of inscriptions, his principal work on which is *Inscriptiones antiquæ totius orbis Romani*, in 2 vols., Heidelberg, 1603. He also published editions of most of the Latin classics, but as his critical faculty bore little proportion to his erudition these are of small value.

GRUYÈRE, or Gruyères (German, *Greyerz*), is a small pastoral district in the Swiss canton of Freiburg, noted for its cheese (see Cheese and Freiburg), which was at one time a separate countship. It forms part of the basin of the Saane. The old town of Gruyère, where the counts had their castle, had only 1375 inhabitants according to the census of 1900, while the neighboring town of Bulle had 3355. There is no mention by that name of the counts or countship of Gruyère in any document previous to the 12th century, but the same family with the title of count of Ogo, *i. e.*, Hoch-gau, have been traced, though not without interruption, as far back as 923. The new designation was due, it would appear, to the fact the counts of Ogo had held the post of gruyer (gruerius) or warden of the woods and forests to one of the later kings of Burgundy, the name of office, as in the case of the Scotch Stewarts, gradually passing into a regular family name. The counts of Gruyère were for the most part a vigorous and warlike line, and their banner, with the figure of a *grue* or crane, was not only a familiar object in the local conflicts of Savoy and Switzerland but saw good service in distant fields. Their last representative died in exile, his possessions having been seized by his creditors and sold to Bern in 1554.

The fortunes of the house are related with much detail in Hisely's "Histoire du Comté de Gruyère," which occupies vols. ix., x., and xi. of the *Mémoires de la Soc. d'histoire de la Suisse Romande*, Lausanne, 1838, etc. See also Bonstetten, *Briefe über ein Schweizerisches Hirtenland*, Basel, 1782; H. Charles, *Course dans La Gruyère*, Paris, 1826.

GRYNÆUS, or Gryner, Johann Jakob (1540–1617), a learned theologian of the period immediately succeeding the Reformation, was born, October 1, 1540, at Bern, where his father Thomas, nephew of Simon Grynæus, was at that time a teacher of theology, was educated at Basel, and in 1559 received an appointment as curate to his father who had become pastor of Röteln in Baden. In 1563 he proceeded to Tübingen for the purpose of completing his theological studies, and in 1565 he returned to Röteln as successor to his father. Here, as the result of much reading and reflection, he felt compelled to abjure the Lutheran doctrine of the Lord's Supper, and to renounce the

Formulæ Concordiæ. Called in 1575 to the chair of Old Testament exegesis at Basel, he became involved in unpleasant controversy with Simon Sulzer and other champions of Lutheran orthodoxy; and in 1584 he was glad to accept an invitation to Heidelberg, where two years were spent. Returning to Basel in 1586 as antistes or superintendent of the church there, he exerted for upwards of twenty-five years a very considerable influence upon both the church and the state affairs of that community, and acquired a wide reputation as a skilful theologian of the school of Zwingli. Five years before his death, which occurred August 13, 1617, he had the misfortune to become totally blind, but he continued to preach and lecture to the last.

His numerous works include commentaries on various books of the Old and New Testament, *Theologica theoremata et problemata* (1588), and a collection of patristic literature entitled *Monumenta S. Patrum Orthodoxographa* (2 vols. fol., 1569).

GRYNÆUS, Simon (1493–1541), a learned theologian of the Reformation, was born in 1493 at Vehringen, in his fourteenth year was sent to school at Pforzheim, and subsequently studied at the university of Vienna, where he graduated as master of arts, and for some time acted as tutor. He next became rector of a school at Ofen (Buda), but as an avowed sympathizer with Reuchlin and Erasmus he was not permitted by the Dominicans to retain this post long. After an interval spent at Wittenberg with his old school friend Melanchthon, he became professor of Greek in the university of Heidelberg in 1525; with the duties of this post he from 1526 combined those also of the Latin chair. In 1529 the friendship of Œcolampadius obtained for him a call to Basel as successor of Erasmus; the completely disorganized state of the university at that time gave him abundant leisure not only for private study but also for a tour to England, where he charged himself with the task of obtaining the opinions of the Reformed theologians upon the subject of the king's divorce. On his return to Basel in 1531, the year of the death both of Zwingli and of Œcolampadius, he began as theological professor to give exegetical lectures on the New Testament; and in 1534 he was summoned by Duke Ulrich of Würtemberg to assist in the reformation there, and especially in the reorganization of the university of Tübingen. In 1536 he took an active part in the framing of the first Helvetic confession, and also in the conferences held with the purpose of inducing the Swiss to accept the concord of Wittenberg, which had also been drawn up in that year. He was the sole representative of the Swiss churches at the conference of Worms in 1540. His death took place suddenly at Basel on August 1, 1541. In Greek philology Grynæus was one of the first scholars of his day. In theology he was more of a theoretical than of a practical turn; but his profound erudition and singularly penetrating judgment gave him great influence among the more active spirits of the time. In literature his chief contributions were translations into Latin of Plutarch, Aristotle, and Chrysostom. See Streuber's *Simonis Grynæi Epistolæ* (1847), where a full list of his works is given.

GRYPHIUS, Andreas (1616–1664), German poet, was born at Grossglogau, Silesia, on the 11th of October, 1616. His youth fell in the period of the Thirty Years' War, which began in 1618, when he was two years old. After spending five years at school in various towns, he returned to his native place in 1636, and became tutor in the family of Palsgrave George von Schönborn, who crowned him laureate and granted him a patent of nobility. In 1638 he went to the university of Leyden, where he spent six years, at first as a student, afterwards as a tutor. Having travelled through France and Italy in association with a young Pomeranian, and lived a year in Strasburg, he went back to Silesia, and in 1650, at the age of thirty-four, was made syndic of the principality of Glogau. This office, the duties of which he faithfully discharged, he held till his death in 1664. He was a man of deeply melancholy temperament, and his natural tendencies were fostered both by private misfortune and by the terrible public calamities of his age. Like most German writers in the first half of the 17th century, he was profoundly influenced by the critical doctrines of Opitz, on which account he is usually classed with the first Silesian school, although by some of his characteristics he is more closely allied to the second Silesian school. His best works are his comedies, one of which, *Peter Squenz*, is based on the comic episode of *A Midsummer Night's Dream*. *Die geliebte Dornrose* (The Beloved Wildrose), which is written in a Silesian dialect, contains many touches of natural simplicity and grace, and still ranks high among the comparatively small number of genuine comedies of which German literature can boast. *Horribiliscribrifax* is a rather labored attack on pedantry. Besides these three comedies, Gryphius wrote five tragedies. In all of them his tendency is to become wild and bombastic, but he had the merit of at least attempting to work out artistically conceived plans, and there are occasional flashes both of passion and of imagination. His models seem to have been Seneca, and the great Dutch poet Vondel. He had the courage, in *Carolus Stuardus*, to deal with events of his own day; his other tragedies are *Leo Arminius*, *Katharina von Georgien*, *Cardenio und Celinda*, and *Pampinianus*. The lyrics of Gryphius give utterance to his despairing views of life, and are not without power; but it is as a dramatist that he is mainly important. No German dramatic writer before him had risen to so high a level, nor had he worthy successors until about the middle of the 18th century. A selection from his lyrics will be found in W. Müller's *Bibliothek der deutschen Dichter des 17ten Jahrhunderts* (Bd. 2), and a selection from his dramatic writings in Tittmann's *Deutsche Dichter des 17ten Jahrhunderts*.

See Klopp, *Andreas Gryphius als Dramatiker* (1851); and Herrmann, *Ueber Andreas Gryphius* (1851).

GUACHARO,[1] the Spanish-American name of what English writers have lately taken to calling the Oil-Bird, the *Steatornis caripensis* of ornithologists, a very remarkable bird, first described by Alexander von Humboldt (*Voy. aux Rég. Équinoxiales*, i. p. 413, Engl. transl., iii. p. 119; *Obs. Zoologie*, ii. p. 141, pl. xliv.) from his own observation and from examples obtained by Bonpland, on the visit of those two travellers, in September, 1799, to a cave near Caripé (at that time a monastery of Aragonese Capuchins) in the Venezuelan province of Cumaná on the northern coast of South America. A few years later it was discovered, says Latham (*Gen. Hist. Birds*, 1823, vii. p. 365), to inhabit Trinidad, where it appears to bear the name of *Diablotin*;[2] and much more recently, by the receipt of specimens procured at Sarayacu in Ecuador, Caxamarca in the Peruvian Andes, and Antioquia in New Grenada (*Proc. Zool. Society*, 1878, pp. 139, 140; 1879, p. 532), its range has been shown to be much greater than had been supposed. The singularity of its structure, its curious habits, and its peculiar economical value have naturally attracted no little attention, and it has formed the subject of investigation by a considerable number of zoologists both British and foreign. First referring it to the genus *Caprimulgus*, its original describer soon saw that it was no true Goatsucker. It was subsequently separated as forming a Subfamily, and has at last been regarded as the type of a distinct Family, *Steatornithidæ*—a view which, though not put forth till 1870 (*Zool. Record*, vi. p. 67), seems now to be generally deemed correct. Its systematic position, however, can scarcely be considered settled, for though on the whole its predominating alliance may be with the *Caprimulgidæ*, nearly as much affinity may be traced to the *Strigidæ*, while it possesses some characters in which it differs from both (*Proc. Zool. Society*, 1873, pp. 526–535). About as big as a Crow, its plumage exhibits the blended tints of chocolate-color and gray, barred and pencilled with dark brown or black, and spotted in places with white, that prevail in the two families just named. The beak is hard, strong, and deeply notched, the nostrils are prominent, and the gape is furnished with twelve long hairs on each side. The legs and toes are comparatively feeble, but the wings are large. In habits the Guacharo is wholly nocturnal, slumbering by day in deep and dark caverns which it frequents in vast numbers. Towards evening it arouses itself, and, with croaking and clattering which has been likened to that of castanets, it approaches the exit of its retreat, whence at nightfall it issues in search of its food, which, so far as is known, consists entirely of oily nuts or fruits, belonging especially to the genera *Achras*, *Aiphanas*, *Laurus*, and *Pstchotria*, some of them sought, it would seem, at a very great distance, for M. Funck (*Bull. Acad. Sc. Bruxelles*, xi. pt. 2,

[1] This is said to be an obsolete Spanish word signifying one that cries, moans, or laments loudly.

[2] Not to be confounded with the bird so called in the French Antilles, which is a Petrel (*Œstrelata*).

pp. 371–377) states that in the stomach of one he obtained at Caripé he found the seed of a tree which he believed did not grow nearer than 80 leagues. The hard, indigestible seeds swallowed by the Guacharo are found in quantities on the floor and the ledges of the caverns it frequents, where many of them for a time vegetate, the plants thus growing being etiolated from want of light, and, according to travellers, forming a singular feature of the gloomy scene which these places present. The Guacharo is said to build a bowl-like nest of clay, in which it lays from two to four white eggs, with a smooth but lustreless surface, resembling those of some Owls. The young soon after they are hatched become a perfect mass of fat, and while yet in the nest are sought by the Indians, who at Caripé, and perhaps elsewhere, make a special business of taking them and extracting the oil they contain. This is done about midsummer, when by the aid of torches and long poles many thousands of the young birds are slaughtered, while their parents in alarm and rage hover over the destroyers' heads, uttering harsh and deafening cries. The grease is melted over fires kindled at the cavern's mouth, run into earthen pots, and preserved for use in cooking as well as for the lighting of lamps. It is said to be pure and limpid, free from any disagreeable taste or smell, and capable of being kept for a year without turning rancid. In Trinidad the young are esteemed a great delicacy for the table by many, though some persons object to their peculiar scent, which, says Léotaud (*Ois. de la Trinidad*, p. 68), resembles that of a Cockroach (*Blatta*), and consequently refuse to eat them. The old birds also, according to Mr. E. C. Taylor (*Ibis*, 1864, p. 90), have a strong Crow-like odor. But one species of the genus *Steatornis* is known.

In addition to the works above quoted valuable information about this curious bird may be found under the following references:—L'Herminier, *Ann. Sc. Nat.*, 1836, p. 60, and *Nouv. Ann. Mus.*, 1838, p. 321; Hautessier, *Rev. Zool.*, 1838, p. 164; J. Müller, *Monatsb. Berl. Acad.*, 1841, p. 172, and *Archiv für Anat.*, 1862, pp. 1–11: Des Murs, *Rev. Zool.*, 1843, p. 32, and *Ool. Orn.*, pp. 260–263; Blanchard, *Ann. Mus.*, 1859, xi. pl. 4, fig. 30; König-Warthausen, *Journ. für Orn.*, 1868, pp. 384–387; Goering, *Vargasia*, 1869, pp. 124–128; Murie, *Ibis*, 1873, pp. 81–86. (A. N.)

GUACO, Huaco, or Guao, also Vejuco and Bejuco, terms applied to various Central and South American and West Indian plants, in repute for alexipharmic and curative virtues. The Indians and negroes of New Granada believe the plants known to them as guaco to have been so named after a species of kite, thus designated in imitation of its cry, which they say attracts to it the snakes that serve it principally for food; they further hold the tradition that their antidotal qualities were discovered through the observation that the bird eats of their leaves, and even spreads the juice of the same on its wings, during contests with its prey. The disputes that have arisen as to what is "the true guaco" are to be attributed mainly to the fact that the names of the American Indians for all natural objects are generic, and their genera not always in coincidence with those of naturalists. Thus any twining plant with a heart-shaped leaf, white and green above and purple beneath, is called by them guaco (R. Spruce, in Howard's *Neueva Quinologia*, "Cinchona succirubra," p. 22, note). What is most commonly recognized in New Granada as guaco, or *Vejuco del guaco*, would appear to be the *Mikania Guaco* of Humboldt and Bonpland (*Pl. Équinox.*, ii. 86, pl. 105, 1809; D. C., *Prodr.*, v. 193), a climbing Composite plant of the tribe *Eupatoriaceæ*, affecting moist and shady situations, and having a much-branched and deep-growing root, variegated, serrate, opposite leaves, and dull-white flowers, in axillary corymbs. The whole plant emits a disagreeable odor. J. Fauré (*Journ. de Pharm.*, xxii. 291, 1836) obtained from leaves of a Mexican guaco, besides a wax-like matter, a substance analogous to tannin, and other bodies, a light-brown bitter resin, *guacin*, soluble in alcohol and partly so in water, and stated by Pettenkofer to possess emetic properties, and to give off an intoxicating odor when triturated with sulphuric acid (Watts, *Dict. of Chem.*, ii. 945). Guaco has been highly recommended for the treatment of bites of venomous reptiles and insects, and in cholera, chronic dysentery, gonorrhœal and syphilitic affections, atonic deafness, abscess, sciatica, sprains, gout, and other complaints. Its efficacy against poisoning by snakes, first carefully experimented on by Mutis[1] about 1787, has been frequently since attested; and in parts of New Granada much infested by those pests, a kind of inoculation with it is practised by some persons, the juice of the leaves being applied, at intervals of a fortnight during several months, to incisions in the hands, feet, and sides of the chest, two large teaspoonfuls of the same juice having beforehand been administered internally.[2] It is stated that the Indians of Central America, after having "guaconized" themselves, *i. e.*, taken guaco, catch with impunity the most dangerous snakes, which writhe in their hands as though touched by a hot iron (B. Seemann, *Hooker's Journ. of Bot.*, v. 76, 1853). The odor alone of guaco has been said to cause in snakes a state of stupor and torpidity; and Humboldt, who observed that the near approach of a rod steeped in guaco-juice was obnoxious to the venomous *Coluber corallinus*, was of opinion that inoculation with it imparts to the perspiration an odor which makes reptiles unwilling to bite.

The *huaco hembra* and *huaco macho* of Mexico are the species *Mikania angulata* and *M. repanda*, La Ll., respectively. Among the best remedies for snake-bites, according to Martius (*Reise*, i. 279, 1823; *Syst. Mat. Med. Brasil.*, p. 44, 1843), is the recently expressed juice of *Eupatorium Ayapana*, Ventenat (D. C., *Prodr.*, v. 169), a native of the Amazons. On the Orinoco the most esteemed guaco is an *Aristolochia*, distinguished often as *guaco del monte* from the Mikaniæ, or *guaco del rastrojo*, so called from their trailing about stubble and deserted "chacras." A similar plant, with highly aromatic root and stem, is known in the Andes as *Machácin-huásca*, or snake-vine. The guaco denominated in the Peruvian Andes *bejuco* (climber) *de la estrella*, and *contrayerba* (counter-herb, or antidote) *de bejuco*, is the *Aristolochia fragrantissima* of Ruiz (Howard, *loc. cit.*, p. 9; D. C., *Prodr.*, xv., pt. i., 463). The tincture of the root and stem of a Mexican guaco (Pharm. Society's Coll., 497*a*), also an *Aristolochia*, is administered in hydrophobia. Among allied species accredited with the properties of guaco are *A. anguicida*, L., a native of Cartagena in Colombia; *A. cymbifera*, Mart.; *A. macroura*, Gomez; *A. trilobata*, L.; *A. sempervirens*, L., supposed to be the plant with which the Egyptian jugglers stupefy snakes; *A. serpentaria*, L., or Virginian snake-root; *Asarum canadense*, L., the Canada snake-root, or "wild ginger," and *Asarum virginicum*, Willd. The guaco or *arbol* of Panama is the species *Cratæva tapioides*, D. C., called *tetlathian* by the Mexican Indians. In the West Indies and Mexico *Comocladia dentata*, Juss., is employed as guaco; *C. integrifolia*, L., the *brésillet* of some authors, resembles it in properties. According to E. Otto (*Reiseerrinerungen an Cuba*, etc., pp. 75, 76, 1842), *C. ilicifolia*, Swartz, a small tree with excessively noxious sap, is the guaco of Trinidad in Cuba, where it is used in cholera and yellow fever.

See, besides the works above quoted, P. d'Orbies y Vargas, *Tilloch's Phil. Mag.*, xii. 36, 1802; Le Guevel de la Combo, *Journ. d'Agric. . . . des Pays-Bas*, xv. 90, 1823; J. L. Alibert, *Nouv. Élém. de Thérap.*, ii. 583, 5th ed., 1826; Descourtilz, *Flore pittoresque et médicale des Antilles*, iii. 11, pl. 197, 1827; "Du Guaco," etc., *Bull. de Thérap.*, ix. 331, 1835; J. L. Chabert, *Apuntes sobre el Chólera-Morbus, y su curacion con la Mikania-huaco ó Guaco*, etc., Mexico, 1850; B. Seemann, *Die Volksnamen d. Amerik. Pflanzen*, Han., 1851; Orfila, *Traité de Toxicol.*, ii. 868, 5th ed., 1852; E. W. Pritchard, *Med. Times*, 1852, ii. 522, 651; and *Pharm. Journ.*, 2d ser., iii. 288, 1862; A. Stokes, *Med. Circular*, Dec. 15, 1852, p. 474; Lindley, *Veg. Kingd.*, p. 793, 1853; T. K. Chambers and R. Temple, *Journ. Soc. Arts.*, 1856–57, p. 44; T. Redwood, *Suppl. to the Pharmacopœia*, p. 469, 1857; M. T. Parola, *Med. Times*, 1859, i. 643; E. Reclus, *Rev. des Deux Mondes*, March 15, 1860, p. 446; N. Pascal, *Du Guaco . . . dans les Maladies Vénériennes*, etc., 1863 (1st ed. 1861); and A. Bonnière, *Notice sur le Guaco*, etc., 1868. (F. H. B.)

GUADALAJARA, a province of Spain, in New Castile, bounded on the N. by the provinces of Segovia, Soria, and Saragossa, on the E. by Saragossa and Teruel, on the S. by Cuenca, and on the W. by Madrid. In the north are some of the loftiest summits of the Guadarrama range, having their culminating point in the Peña de la Bodera; the rest of the province, forming the upper basin of the Tagus, and watered by its affluents the Alblanqueja, Tajuña, Henares, and Jarama, is comparatively level. The soil varies considerably, but is generally of a good character. Pasture occupies the larger part of the surface on the higher tracts; and the mountains, though unduly denuded, still bear considerable forests of oak and cork. The plain around Tamajon is specially adapted for cereals; and the neighborhood of Alcarria matures all kinds of crops proper to

[1] Mutis's plant is believed by N. Pascal to have probably been the above mentioned *Mikania Guaco*, and not, as supposed by Guillemin, the *Spilanthes ciliata* of Kunth, called guaco in Central America.

[2] According to J. Hancock (*Observations on Brit. Guiana*, p. 24, 1835), the operation is not of Indian origin.

the latitude. Iron and lead are the only minerals; the former is very abundant and has been worked from the remotest periods; the latter occurs but in small quantities. The principal productions are wheat, barley, oil, wine, silk, saffron, and flax; but the chief wealth of the province consists in sheep and wool. Manufactures and trade have been declining for many years. The province is divided into nine administrative districts; but besides Guadalajara, the capital, it has no town of importance except the episcopal see of Siguenza. The area is 4676 English square miles; and in 1900 the estimated population was 200,186.

GUADALAJARA, a city of Spain capital of the province of the same name, is situated on an elevation not far from the eastern bank of the river Henares, which is here spanned by a stone bridge built on Roman foundations in 1758. It is a station on the Madrid and Saragossa Railway, 38 miles N. E. from Madrid, and 2395 feet above the level of the sea. It has ten churches, several convents, including that of San Francisco, founded originally by Doña Berenguela for the Templars in 1200, handsome town and county buildings (casas consistoriales) built in 1585, and a college of engineers; besides the usual hospitals, barracks, and schools. There is also a fine palace of the ducal house del Infantado, built in 1451; and the Panteon or burying-place of the dukes of Mendoza, begun in 1696 and finished in 1720 at a cost of £180,000, rivals in its richness the tombs of the Escorial. An extensive Roman aqueduct supplies public fountains; and there are four alamedas or promenades. The principal manufactures are soap, earthenware, and woollens. The cloth manufacture, which was formerly carried on in behalf of the Government, is now in private hands. The trade of the place is chiefly in grain, flax, fruit, cloth, and silk. Population, 11,600. Guadalajara is the Arriaca or Caraca of the Romans; when taken by the invading Moors it was called Wada-l-hajarah (the river of stones), of which its present name (sometimes in the mediæval chronicles spelt Godelfare) is a corruption. It was recaptured in the days of the Cid.

GUADALAJARA, or in the older spelling GUADALAXARA, a city of Mexico, the capital of the state of Jalisco, is situated in the Atemarac valley not far from the Rio Grande de Santiago, about 280 miles W. N. W. of the city of Mexico, in 20° 41′ 10″ N. lat. and 103° 21′ 15″ W. long. Owing to its considerable elevation above the sea-level (according to the *Boletin del Ministerio de Fomentos*, 1876, 1552 metres, but according to older authorities 1580 metres), Guadalajara enjoys an excellent climate. On the whole it is well laid out, and its streets are kept in tolerably good condition. All the houses, whether built of stone, brick, or adobe, are plastered and whitewashed, and hardly a dozen of them attain the height of three stories. In the outskirts of the town the buildings are of an inferior type. The Plaza Mayor is a square about 300 feet in each direction, one side of which is occupied by the cathedral, another side by the *casa de gobierno del estado* or state buildings, and the remaining sides by *portales* or arches in the shelter of which are some of the main shops of the city. The cathedral, commenced in 1571 and finished in 1618, is a rather fine structure with two steeples and a large dome between them covered with figures in colored tiles. The interior is gloomy but impressive. No small interest attaches to the Hospital de San Miguel de Belen, which comprises, not only a hospital proper with male and female wards, but a lunatic asylum and a school for little children. Contiguous to it is the principal cemetery of the city, which is arranged in rather an unusual fashion: three sides of the area are bounded by walls and colonnades, and the inner surface of the walls is divided into six tiers of niches or *gavetas* in which the dead are deposited. Another remarkable institution is the hospicio, occupying twenty-four large blocks of building, and not only affording an asylum for foundlings and orphans, for the blind, the deaf and dumb, and the infirm of all ages, for old people unable to secure a livelihood, but also serving as a reformatory and training school. It presents a fine appearance with its dome and pillared portico. Its inmates number upwards of 1000, 700 being children, and 200 old men and women. Among the other public buildings and institutions of Guadalajara are the university (formerly the Jesuit college), eleven conventual establishments, a theological seminary, an academy for the fine arts, a mint, a theatre, and a bull-ring. The favorite promenade is the *paseo* which runs for a mile and a quarter through the city, and terminates northward in the alameda or public garden. Guadalajara is a fairly busy town, with paper-mills and woollen and cotton factories; but all the principal establishments are in the hands of Frenchmen, Germans, or Englishmen. The confectionery of the town is held in high repute, and the Indians of the neighborhood are remarkable for the artistic ability with which they mould figures in clay or rags. The silk embroidery produced in the hospicio is also worthy of mention. Guadalajara was founded in 1531 by Nuñez Guzman, and was made a bishop's see in 1549. The population, which was only 19,500 in 1800, had increased to 46,804 by 1841, and to 101,208 by 1900. At Puente Grande in the neighborhood, the Rio Grande forms a magnificent waterfall; and the bridge of Calderon is famous for the defeat of the insurgents under Hidalgo in June, 1811. Several excellent views of Guadalajara will be found in Geiger, *A Peep at Mexico*. On the 11th of March, 1875, Guadalajara was visited by a severe earthquake, which did damage to nearly every large building in the town. An account of the mint of Guadalajara, founded in 1811, is given in *Bol. Soc. de geogr. de la rep. Mexicana*, for 1871. In 1877 the value of the new coin was 1,467,660 piastres or dollars, 5000 piastres being in copper and the rest in silver. New machinery driven by steam was imported from France in 1878. The total import trade of the town was reckoned at 3,280,000 piastres in 1878,—Great Britain having about 40 per cent. of the amount, France 25 per cent., the United States 10, and Germany 8. Full details on the money transactions of the city will be found in the *Preussisches Handelsarchiv*, 1879.

GUADELOUPE, an island of the Antilles in the West Indies, belonging to France, is situated 62 miles from Martinique, between 15° 59′ 30″ and 16° 20° 18″ N. lat. and between 61° 31′ 23″ and 61° 50′ 32″ W. long. The sailing distance from Brest is 3750 nautical miles. A narrow channel, called La Rivière Salée, or Salt Stream, with a width of from 100 to 400 feet, separates the island into two portions, Guadeloupe proper or Basse Terre and Grande Terre. The former or western portion measures 28 miles from N. to S., and from 12 to 15 miles from E. to W., and its coast-line is estimated at 87 miles. The latter or eastern portion measures 22 miles from N. to S, and 34 from S. E. to N. W., and its coast-line is estimated at 106 miles. Basse Terre has a mountainous surface of volcanic origin, attaining its greatest altitude in La Soufrière, a still active volcano, 4870 feet in height; while Grande Terre is generally flat, with no elevations higher than 115 feet, and consists entirely of calcareous formations. In the rainy season the streams are subject to floods or "spates," which, according to M. Casponi (*Rev. Mar. et Coloniale*, 1871), come on so suddenly that it is hardly safe to travel in the dry beds, lest, to use the local phrase, the *galion* descend. Basse Terre, as is natural, is traversed by a considerable number of streams,—the Goyave, the Lézarde, the Moustic, the Petite Goyave, the Sainte Marie, the Trou au Chien, the Capsteire, etc.,—while Grande Terre is almost destitute of springs, and both men and cattle are dependent for their water supply on the ponds and marshes. The mean temperature of the island is 79° Fahr.,—the maximum in the shade ranging from 86° to 91°, and the minimum from 68° to 72°. July, August, and September are the hottest months. At Basse Terre, about 180 feet above the sea-level, the thermometer in July shows a mean of 80·8° Fahr., in August 82·5°, and in September 82·6°. Like the rest of the West Indian islands, Guadeloupe is subject to terrible storms. That of 1825 almost entirely destroyed the town of Basse Terre, and that of 1865 proved equally disastrous to Grand Bourg. The rainfall is very heavy, on the coast no less than 86 inches per annum. Area, 688 square miles.

Along with its dependencies, the smaller islands of Marie Galante, Désirade, and Les Saintes, Guadeloupe forms a separate colonial government. The following table gives the area of the several portions:—

	Hectares.		Acres.
Guadeloupe or Basse Terre	94,631	=	233,844
Grande Terre	65,631	=	162,181
Marie Galante	14,927	=	37,067
Désirade	2,720	=	6,720
Les Saintes	1,422	=	3,514
Petite Terre	343	=	848
Saint Martin (French portion)	5,177	=	12,775
Total	184,851	=	456,949

Of the total area 85,248 acres were under cultivation in 1873; 1932 acres were hattes or cattle-farms, 30,640 acres savannahs, and 106,258 acres woods and forests; while 69,689 acres were fallow. To the sugar-cane, which is the staple of the colony, 48,711 acres were devoted; to coffee, 8659 acres; to cotton, 1855 acres; to cocoa, 1146 acres; to rocou or arnatto, 1632 acres; and to tobacco, 29½ acres. Manioc, which forms one of the principal sources of food in the colony, occupied 11,614 acres; and 11,246 acres were assigned to other articles of direct consumption. In the same year (1873) it was calculated that 43,780 people were employed in the sugar plantations, 5160 in the coffee plantations, 504 in the cotton plantations, and 1088 in the rocou plantations. The whole value of the ground is stated at about £200,000, of the buildings and plants at £1,560,000, and of the live stock at £263,200. The total produce of sugar of all kinds was 679,300 cwts.; the syrup and molasses amounted to 568,326 gallons, and the tafia or rum to 298,850 gallons. The produce of coffee, cocoa, and rocou was respectively 13,564, 2102, and 10,663 cwts. The manioc or cassava amounted to 282,412 cwts., and the other food substances, such as yams, bananas, arrow-root, etc., to 118,340 cwts. Tobacco, vanilla, and cloves were also produced in small quantity, as well as 4542 cwts. of campeachy wood. The value of the whole was estimated at £1,134,226, and the net value at £298,437. Administratively the colony is divided into three arrondissements of Basse Terre, Pointe à Pitre, and Marie Galante. The town of Basse Terre, situated in 15° 59′ 30″ N. lat. and 66° 24′ 31″ W. long., with a population of 12,000, is the capital, and the seat of the bishopric, which was founded in 1850; and Pointe à Pitre, situated in 16° 14′ 12″ N. lat. and 66° 11′ 41″ W. long., and containing a population of 16,000, is the principal port. A fine military harbor, popularly known as the Gibraltar of the Antilles, is situated in the group of Les Saintes. There is a militia, originally constituted in 1832, partly dissolved in 1851, and re-established in 1870.

During the twenty-five years from 1848 to 1872 the population of the colony remained almost stationary, the mean being only 132,000. Between 1873 and 1875 there was a notable increase, the mean for these years being 141,000. Owing probably to the influence of immigration, the masculine element is on the increase,—there being now 92 men to 100 women instead of 90 as formerly. Married people form only 20 per cent. of the population. According to Dr. Charles Walther, with every 1000 European immigrants in 1864 there were introduced 25 women; for every 1000 Africans, 496 women; for every 100 Indians, 253; and for every 1000 Chinese, 9. Between 1848 and 1872 there have been 30 births to every 1000 of the population, except during the five years from 1863 to 1867, when the ratio was only 27·6. If the non-reproductive part of the population be excluded, the births range from 41 to 46 per 1000, while in England the corresponding number is 61. It is estimated that probably 25 per cent. of the births are illegitimate. During the years from 1848 to 1852, immediately after the abolition of slavery, there were a great many marriages, especially among the liberated population; as many indeed as 2000 per annum; but, to use the words of Dr. Rey, "cette belle ardeur matrimoniale" soon came to an end. In 1870, 1871, and 1872 there were only three marriages to 1000 inhabitants. Pop. (1901) 182,110.

History.—Guadeloupe was discovered by Columbus in 1493, and received its name in honor of Santa Maria de Guadalupe in Estremadura in Spain. In June, 1635, L'Olive and Duplessis took possession of the island in the name of the French Company of the Islands of America, and after Duplessis's death, about six months later, L'Olive engaged in a war of extermination against the Carib inhabitants. In 1674 Guadeloupe was united to the domains of the crown, and for a long time it remained a dependency of Martinique. Successful resistance was made to attacks by the English in 1666, 1691, and 1703, but on 27th April, 1759, the inhabitants capitulated to Admiral Moore and General Barington, and the island remained in British possession till 1763. On 12th April, 1782, the French, under Admiral de Grasse, were defeated by Rodney in the neighborhood of the island. In 1775 Guadeloupe was finally separated from Martinique, but it remained under the common authority of the governor-general of the Windward Islands. The English under Sir John Grey and John Jervis obtained possession on 21st April, 1794, but they were expelled on the 2d of June by Chrétien and Victor Hugues, commissioners of the National Convention, who were powerfully supported by the native population (see "Délivrance de la Guadeloupe en 1794" in *Rev. Mar. et Col.*, 1870). About this time the island contained about 107,226 inhabitants, and the commerce was worth £1,274,600. After the peace of Amiens the first consul sent an expedition under General Richepanse for the purpose of re-establishing slavery in Guadeloupe, but the negroes heroically defended their liberty for months. A new period of British possession was begun by the victory of February 3, 1810, and though by the treaty of March, 1813, the island was made over to Sweden, and in the course of 1814 the French general, Boyer de Peyreleau, gained a temporary footing, in terms of the first peace of Paris, it was not till July, 1816, that Britain finally withdrew her forces. Between 1816 and 1825 a special code of laws for Guadeloupe was printed. Municipal institutions were introduced into the island in 1837 (November 20).

See Moreau de Jonnes, *Histoire Physique des Antilles;* Boyer de Peyreleau, *Les Antilles françaises et particulièrement la Guadeloupe*, Paris, 1823, 3 vols.; A. Budan, *La Guadeloupe Pittoresque*, Paris, 1863, folio, a fine series of views with descriptive text; P. S. Dupuy, *Eaux thermo-minerales de la Guadeloupe;* "Guadeloupe et dépendances," in *Rev. Maritime et Coloniale*, 1876 (tome 48); H. Rey, "Études sur la colonie de la Guadeloupe, topographie médicale, climatologie, démographie," in *Rev. Mar. et Col.*, 1878; "La Guadeloupe à l'exposition" in *Journal du commerce maritime*, 1878; *Annuaire de la Guadeloupe*, 1868, etc.; Gaffarel, *Les Colonies françaises*, Paris, 1880.

GUADIX, a city of Spain, in the province of Granada, situated on an elevated plateau on the northern slope of the Sierra Nevada, and above the left bank of the river Guadix. It is surrounded by ancient walls, and was formerly dominated by a Moorish castle, now in ruins. It is said to have been the first episcopal see erected in Spain; it still is a bishopric, suffragan to Granada, but the cathedral is architecturally unimportant. The town was once famous for its cutlery; but its modern manufactures (chiefly earthenware, hempen goods, and hats) are inconsiderable. It has some trade in wool, cotton, flax, corn, and liqueurs. The population is estimated at 12,200. The warm mineral springs of Graena, much frequented by Spaniards during the summer season, are situated 4½ miles to the westward. Guadix, along with Almeria and other places constituting the domain of El Zagal, was formally surrendered without a siege to Ferdinand the Catholic in December, 1489.

GUADUAS, a town of Colombia, South America, state of Cundinamarca, is situated in the beautiful valley of the Magdalena, on the road between Bogota and Honda, 45 miles N. W. of the former town, and more than 8000 feet above sea-level. The name signifies in the original the bamboo cane, a plant which grows in great abundance in the neighborhood. The town possesses a pretty church, and an old monastery now used as a prison. The staple articles of trade are sugar, coffee, cochineal, and oranges and other fruits. The population is about 8000.

GUAIACUM, a genus of trees of the natural order *Zygophylleæ*. The guaiacum or lignum vitæ tree (Germ., *Guajakbaum, Franzosenbaum, Pockenholzbaum;* Fr., *Gayac, Gaïac*), *G. officinale*, L., is a native of the West Indies and the north coast of South America, where it attains a height of 20 to 30 feet. Its branches are numerous, flexuous, and knotted; the leaves opposite and pinnate, with caducous stipules, and entire, glabrous, obovate or oval leaflets, arranged in 2 or, more rarely, 3 pairs; the flowers are in axillary cymes, and have 5 oval pubescent sepals, 5 distinct pale-blue[1] petals three times the length of the sepals, 10 stamens, and a 2-celled superior ovary; and the fruit is about ¾ inch long, with a leathery pericarp, and contains in each of its two cells a single seed. *G. sanctum*, L., grows in the Bahamas and Cuba, and at Key West in Florida. It may be distinguished from *G. officinale* by its smaller and narrow leaflets, which are in 4 to 5 pairs, by its shorter and glabrous sepals, and mucronate quinquelocular and 5-winged fruit. *G. arboreum*, DC., the guaiacum tree of Colombo, is found in the valley of the Magdalena up to altitudes 800 metres (2625 feet) above sea-level, and reaches considerable dimensions. Its wood is of a yellow color merging into green, and has an almost pulverulent fracture; the flowers are yellow and conspicuous; and the fruit is dry and 4-winged (J. Triana and J. E. Planchon, "Prodromus Floræ Novo-Granatensis," *Ann. des Sci. Nat.*, Bot., 5me sér., tom. xv.).

The *lignum vitæ* of commerce, so named on account of its

[1] The guaiacum tree is described by Garcias da Horta (*Aromat. et Simpl. Hist.*), and by Antonius Gallus (Luisinus, *De Morbo Gallico*, p. 392, Ven., 1566, fol.), as having yellow flowers.

high repute as a medicinal agent in past times, when also it was known as *lignum sanctum* and *lignum Indicum*, *lignum guaycanum*, or simply *guayacan*, is procured from *G. officinale*, and in smaller amount from *G. sanctum*. It is exported in large logs or blocks, generally divested of bark, and presents in transverse section very slightly marked concentric rings of growth, and scarcely any traces of pith; with the aid of a magnifying glass the medullary rays are seen to be equidistant and very numerous. The outer wood, the sapwood or alburnum, is of a pale yellow hue, and devoid of resin; the inner, the heartwood or duramen, which is by far the larger proportion, is of a dark greenish-brown, contains in its pores 26 per cent. of resin, and has a specific gravity of 1·333, and therefore sinks in water, on which the alburnum floats. Owing to the diagonal and oblique arrangement of the successive layers of its fibres, the wood cannot be split; and on account of its hardness, density, and durability it is much valued for the manufacture of ships' pulleys, rulers, skittle-balls, mallets, and other articles.

Chips or turnings of the heartwood of *G. officinale* (*guaiaci lignum*) are employed in the preparation of the *decoctum sarsæ compositum* of British pharmacy. They may be recognized by being either yellow or greenish-brown in color, and by turning bluish-green when treated with nitric acid, or when heated with corrosive sublimate, and green with solution of chloride of lime. They are occasionally adulterated with boxwood shavings. Lignum vitæ is imported chiefly from St. Domingo, the Bahamas, and Jamaica. The foliage of guaiacum trees is stated by Dr. Asa Gray to be employed in the West Indies instead of soap to scour and whiten floors. The bark was formerly used in medicine; it contains much calcium oxalate, and yields on incineration 23 per cent. of ash. Guaiacum resin, the *guaiaci resina* of pharmacopœias, is obtained from the wood as an exudation from natural fissures or from incisions; by heating billets about 3 feet in length, bored to permit of the outflow of the resin; or by boiling chips and raspings in water to which salt has been added to raise the temperature of ebullition. It occurs in rounded or oval tears, commonly coated with a grayish-green dust, and supposed to be the produce of *G. sanctum*, or in large brownish or greenish-brown masses, translucent at the edges; fuses at 85° C.; is brittle, and has a vitreous fracture, a specific gravity of 1·2289 (W. Brande, *Phil. Trans.*, 1806, p. 89), and a slightly balsamic odor, increased by pulverization and by heat; and is at first tasteless when chewed, but produces subsequently a sense of heat in the throat. It is readily soluble in alcohol, ether, chloroform, creasote, oil of cloves, and solutions of caustic alkalies; and its solution gives a blue color with gluten, raw potato parings, and the roots of horse-radish, carrot, and various other plants. The alcoholic tincture becomes green with sodium hypochlorite, and with nitric acid turns in succession green, blue, and brown. With glycerin it gives a clear solution (B. Squire, *Pharm. Journ.*, May 3, 1879, p. 894), and with nitrous ether a bluish-green gelatinous mass. It is blued by various oxidizing agents, *e.g.*, ozone, and, as Schönbein discovered, by the juice of certain fungi.

To test for blood or hæmoglobin, the tincture, which may be prepared from 1 part of the resin to 6 parts of 80 per cent. alcohol (*Med. Times*, 1873, i. p. 660), is employed according to the method first suggested by Dr. John Day, of Geelong, Australia. A drop of the tincture is added to a small quantity of the liquid to be examined, and with this a few drops of ozonic ether (solution of hydrogen peroxide in ether) are then shaken. The ether dissolves the resin, which, acted on by the hæmoglobin, becomes of a bright blue color. Misleading reactions may sometimes result from the use of white bibulous paper, or from the presence of bile, when the test is applied in cases of hæmaturia (Finlayson, *Clinical Manual*, p. 391, 1878). Guaiacum resin, according to Hadelich (*Erdmann's Journ. f. prakt. Chemie*, lxxxvii., 1862, pp. 321–343), has the following percentage composition:—*guaiaconic acid*, $C_{38}H_{40}O_{10}$, a substance giving a transient blue color with oxidizing agents, 70·35; *guaiuretic acid*, $C_{20}H_{26}O_4$, 10·5; *guaiac beta-resin*, 9·76; gum, 3·7; insoluble ash constituents ·79; minute quantities of *guaiacic acid*, $C_{12}H_{16}O_6$, with *guaiac yellow* and impurities, 4·9. Acted on by heat it yields the decomposition products *guaiacene*, C_6H_8O, and *guaiacol*, $C_7H_8O_2$, and *kreasol*, $C_8H_{10}O_2$, the first at 118° C., and the other two at 205°–210° C. (*cf.* Chemistry, vol. v. p. 489), and, at a still higher temperature, *pyroguaiacin*, $C_{38}H_{44}O_6$.

Guaiacum wood was first introduced into Europe by the Spaniards in 1508, and Nicolaus Poll, writing in 1517 (see Luisinus, *De Morbo Gallico*, p. 210, Ven., 1566), states that some three thousand persons in Spain had already been restored to health by it. The virtues of the resin, however, were not known until a later period, and in Thomas Paynel's translation (*Of the Wood called Guaiacum*, etc., p. 9, ed. of 1540) of Ulrich von Hutton's treatise *De Morbi Gallici curatione per administrationem ligni guaiaci* (1519) we read of the wood:—"There foloweth fro it, whan it hourneth a gomme, which we yet knowe not, for what pourpose it serueth." Flückiger and Hanbury (*Pharmacographia*, p. 95) state that the first edition of the *London Pharmacopœia* in which they find the resin mentioned is that of 1677. The decoction of the wood was administered in gout, the stone, palsy, leprosy, dropsy, epilepsy, and other diseases, but principally in the "morbus gallicus," or syphilis, for which it was reckoned a certain specific, insomuch that at first "the physitions wolde not allowe it, perceyuynge that theyr profite wolde decay therby" (Paynel, *op. cit.*, p. 8). Minute instructions are given in old works as to the mode of administering guaiacum. The patient was confined in a closed and heated chamber, was placed on the lowest possible diet, and, after liberal purgation, was made twice a day to drink a milk-warm decoction of the wood. The use of salt was specially to be avoided. A decoction of 1 lb of guaiacum was held to be sufficient for the four first days of the treatment. The earlier opinions as to the efficacy of guaiacum came to be much modified in the course of time, and Dr. Pearson (*Observations on the Effects of Various Articles of the Mat. Med. in the cure of Lues Venerea*, chap. i., 2d ed., 1807) says:—"I never saw one single instance in which the powers of this medicine eradicated the venereal virus." He found its beneficial effects to be most marked in cases of secondary symptoms. Guaiacum resin is an ingredient in the *mistura guaiaci*, *tinctura guaiaci ammoniata*, and *pilula hydrargyri subchloridi composita* of the *British Pharmacopœia*. It is administered in cutaneous diseases, more especially those of a syphilitic character; for long-standing gouty and rheumatic affections, as in the nostrum known as "Cholsea pensioner;" in some forms of neuralgia; in sciatica (*Lancet*, 1864, i. p. 459); bronchorrhœa; tonsillitis (see *inter alia*, *Lancet*, 1864, ii. p. 735); and in sore-throat, or in incipient sore-throat of whatever kind, in the form of the simple resin (Broadbent, *Lancet*, 1867, i. p. 393); and has been found serviceable in amenorrhœa and ovarian complaints of inflammatory origin (Cleland, *Braithw. Retrosp.*, 1873, i. p. 347); and formerly (Graily Hewitt, *Dis. of Women*, p. 387, 3d ed., 1872), was much employed in dysmenorrhœa. Copland (*Med. Dict.*, ii. 656) regards the decoction or tincture of guaiacum as the best of diaphoretics, especially when the skin is cool as well as dry. Pearson found that if a patient exposed himself freely to the air, guaiacum acted as a diuretic, instead of as a diaphoretic. Guaiacum causes, when administered, dryness in the mouth, thirst, and a feeling of warmth in the stomach. According to Pearson, it increases the temperature of the skin and quickens the pulse. It has seemingly a considerable influence in lessening excessive secretion from mucous surfaces. In large doses it occasions headache, pyrexia, great heat at the epigastrium, and purging and vomiting. Guaiacum resin is sometimes adulterated with common resin, and has itself been used to sophisticate the resin of scammony and of jalap.

See, besides the above-quoted works, Macfadyen, *The Flora of Jamaica*, p. 187, 1837; J. Lindley, *Flora Medica*, p. 214, 1838; Asa Gray, *Genera of the Plants of the United States*, vol. ii. p. 121, pl. 148 and 149, 1849; Berg and Schmidt, *Offizin Gewächse*, ii. pl. xiv. b. 1863; Grisebach, *Flora of the Brit. West Ind. Islands*, p. 134, 1864; E. J. Waring, *Manual of Practical Therapeutics*, 3d ed., 1871; Bentley and Redwood, *Pereira's Elem. of Mat. Med. and Therap.*, p. 892, 1874; Bentley and Trimen, *Medicinal Plants*, pt. 30, tab. 41, 1878; and Lanessan, *Hist. des Drogues*, i. pp. 194–201, 1878. For lists of numerous early treatises on guaiacum, see Reuss, *Repertorium*, tom. xi. p. 142, 1816, and E. J. Waring, *Bibliotheca Therapeutica*, ii., New Syd. Soc., 1879. (F. H. B.)

GUALDO TADINO, a town of Italy, in the province of Perugia and circondario of Foligno, with a station on the line from Ancona to Rome about 58 miles from the former city. It is picturesquely situated in the lap of the Apennines on the post-road that leads to the Furlo Pass. The cathedral and several of the other churches possess paintings by Nicolo and Matteo da Foligno of the 15th century. In 1901 the inhabitants of the commune numbered 12,026. Gualdo has inherited the distinctive epithet of Tadino (which prevents it being confounded with Gualdo near Maccrata, or Gualdo Cattaneo near Spoleto) from the ancient Roman town of Tadinum, the ruins of which, discovered in 1750, are situated in the vicinity, not far from the church of Sta. Maria Tadina. It was near Tadinum that Narses gained his famous victory over Totila in 552. Recovering from the effects of the Gothic and Lombard invasions, the town, which even then was defended by walls, became for a time an independent commune; but it ultimately passed under the control of Perugia. In 1815 it was incorporated with the Roman States, and in 1833 it was made a city by Gregory XVI.

GUALEGUAY, a town of the Argentine republic, department of Entre-Rios, is situated on the Gualeguay river, which falls into the Parana, and is navigable up to this point, 120 miles N.N.W. of Buenos Ayres. It is a prosperous and increasing town, and has an active shipping trade in beef, mutton, hides, wool, tallow, and timber. In 1874 the total value of exports was £268,970. The population is about 10,000.

GUALEGUAYCHÚ, a city of the Argentine republic, department of Entre-Rios, is situated on the Gualeguaychú river, which there falls into the Uruguay, 120 miles north of Buenos Ayres. Like Gualeguay, it depends for its prosperity chiefly on the sheep and cattle grazed in the neighboring country, and its export trade includes beef, mutton, hides, wool, tallow, and bone manure. The total value of the exports in 1874 was £163,968. The population is about 13,700.

GUAMANGA. See Huamanga.

GUAN, a word apparently first introduced into the ornithologist's vocabulary about 1743 by Edwards,[1] who said that a bird he figured (*Nat. Hist. Uncommon Birds*, pl. xiii.) was "so called in the West Indies," and the name has hence been generally applied to all the members of the Subfamily *Penelopinæ*, which are distinguished from the kindred Subfamily *Cracinæ* or Curassows by the broad postacetabular area of the pelvis, as pointed out by Prof. Huxley (*Proc. Zool. Society*, 1868, p. 297), as well as by their maxilla being wider than it is high, with its culmen depressed, the crown feathered, and the nostrils bare—the last two characters separating the *Penelopinæ* from the *Orcophasinæ*, which form the third Subfamily of the *Cracidæ*,[2] a family belonging to that taxonomer's division *Peristeropodes*[3] of the Order *Gallinæ*.

The *Penelopinæ* have been separated into seven genera, of which *Penelope* and *Ortalida* (properly *Ortalis*), containing respectively about sixteen and nineteen species, are the largest, the others numbering from one to three only. Into their minute differences it would be useless to enter; nearly all have the throat bare of feathers, and from that of many of them hangs a wattle; but one form *Chamæpetes*, has neither of these features, and *Stegnolæma*, though wattled, has the throat clothed. With few exceptions the Guans are confined to the South-American continent; one species of *Penelope* is however found in Mexico and at Mazatlan, *Pipile cumanensis* inhabits Trinidad as well as the mainland, while three species of *Ortalis* occur in Mexico or Texas, and one, which is also common to Venezuela, in Tobago. Like Curassows, Guans are in great measure of arboreal habit. They also readily become tame, but all attempts to domesticate them in the full sense of the word have wholly failed, and the cases in which they have even been induced to breed and the young have been reared in confinement are very few.[4] Yet it would seem that Guans and Curassows will interbreed with poultry (*Ibis*, 1866, p. 24; *Bull. Soc. Imp. d'Acclimatation*, 1868, p. 559; 1869, p. 357), and what is more extraordinary is that in Texas the hybrids between the Chiacalacca (*Ortalis vetula*) and the domestic Fowl are asserted to be far superior to ordinary Game-cocks for fighting purposes. More information on this subject is very desirable. (A. N.)

GUANACO (*Auchenia guanacus*), one of the four species of ruminant animals which represent in South America the camels of the East, and which resemble them in the possession of canine teeth in both lower and upper jaws. The Guanaco is the largest species, standing nearly 4 feet high at the shoulders. It is an elegant creature, with gracefully curved neck and long slender legs; its body is covered with long soft hair of a fawn color above and almost pure white beneath. It is found throughout the southern half of South America, from Peru in the north to Cape Horn in the south, but occurs in greatest abundance in Patagonia. It lives in herds usually of from six to thirty, although these occasionally contain several hundreds, while solitary individuals are sometimes met with. They are exceedingly timid, and therefore wary and difficult of approach; like many other ruminants, however, their curiosity sometimes overcomes their timidity, so as to bring them within range of the hunter's rifle. Their cry is peculiar, being described by Cunningham (*Natural History of the Strait of Magellan*, 1871) as something between the belling of a deer and the neigh of a horse. The chief enemies of the guanaco, according to the same authority, are the Patagonian Indians and the puma, as it forms the principal food of both. Its flesh is palatable although wanting in fat, while its skin forms the chief clothing material of the gigantic Patagonians. According to Darwin, who studied it in its native wilds, the guanaco is readily domesticated, and in this state becomes very bold and will attack man, striking him from behind with both knees. In the wild state, however, they never seek to defend themselves, and if approached from different points, according to the Indian fashion of hunting them, they get completely bewildered and fall an easy prey. They take readily to the water, and have been observed swimming from one island to another, while Byron in his *Narrative* states that he has seen them drinking salt water. They have a singular habit of dropping their dung during successive days on the same spot—a habit which is greatly appreciated by the Peruvian Indians, who use those deposits for fuel. They seem also to have favorite localities in which to die, as appears from the great heaps of bones bearing no sign of having been gnawed by the puma, which have been found in particular spots.

GUANAJUATO, or Santa Fe de Guanajuato, a city of Mexico, capital of the state of Guanajuato, is situated in 21° 0′ 50″ N. lat. and 100° 54′ 27″ W. long., at a height of 7200 feet above the sea. Built as it is at the meeting-place of three mountain gorges, and obliged by lack of space to climb the underfalls of the surrounding heights, Guanajuato has a highly picturesque appearance. The houses of the lower town are four or five stories in height, most of the streets are narrow and tortuous, and the principal is small though beautiful. The cathedral, the Jesuit church, the mint dating from 1812, the new theatre built in 1874, the university, and the gymnasium are worthy of mention. The Alhondiga de Granaditas, originally a corn magazine, was occupied as a fort in the War of Independence, and acquired peculiar interest as the spot where the patriot Hidalgo met his death. Guanajuato, founded in 1554, owed its existence and prosperity to the fact that it is the centre of the greatest silver-mining district in the world. Of the individual mines perhaps the most famous is the Valenciana, with a shaft 2000 feet deep, which is in process of being cleared of the water by which it has long been flooded. The population, which includes a considerable number of foreigners, formerly amounted to 100,000, but in 1869 was only 63,500. Pop. (1900) 41,486.

GUANCAVELICA. See Huancavelica.

GUANO. The deposits of guano, or *huano*, known locally as *huaneras*, are found in characteristic condition and abundance upon a large number of the islands lying off Peru and upon certain parts of the mainland. They occur in Bolivia and to the north of Peru also, but are there generally poorer in quality, if not always less in quantity. For the production and preservation of good guano two conditions are requisite—a rainless or nearly rainless climate and abundance of fish in the waters of the ocean. Both conditions are fulfilled on parts of the Bolivian and Peruvian coasts. The penguins, gannets, divers, cranes, cormorants, flamingoes, and other fish-eating birds thus find ample supplies of food; while their excreta retain their soluble and more valuable constituents. But even Peruvian guano is not exclusively excrementitious, nor wholly the produce of birds. These marine and maritime *huaneras* are the breeding-places, the resorts, and the cemeteries not only of sea-birds, but of many other sea-animals,—seals, sea-lions, etc., frequenting many guano lands and islands, and adding considerably during life and when dead to the deposits. In Peruvian guano, it is true, the evidences of its origin are often obscure, but the somewhat complex sources of this

[1] Edwards also gives "Quan" as an alternative spelling, and this may be nearer the original form, since we find Dampier in 1676 writing (*Voy.*, ii. pt. 2, p. 66) of what was doubtless an allied if not the same bird as the "Quam." The species represented by Edwards does not seem to have been identified by the latest authorities.

[2] See the excellent *Synopsis*, extensively laid under contribution for this article, by Messrs. Sclater and Salvin in the *Proceedings of the Zoological Society* for 1870 (pp. 504–544), while further information on the *Cracinæ* has since been given by the former of those gentlemen in the *Transactions* of the same society (ix. pp. 273–288, pls. xl.–liii.). Some additions have since been made to the knowledge of the family, but none of very great importance.

[3] It would be here out of place to dwell upon the important bearings on the question of geographical distribution which the establishment of this division has tended to show. For this reference must be made to Prof. Huxley's original paper (*ut supra*), or to the epitome of it given in the *Zoological Record* (v. pp. 34 and 99).

[4] *Cf.* Dixon (*The Dovecote and the Aviary*, pp. 223–273, London, 1857), who argues that the reported success of the Dutch towards the end of the last century in domesticating these birds was an exaggeration or altogether a mistake. His two chapters are well worth reading.

material are well shown in the West-African guano islands. On these Mr. T. R. Eden found (1845) three varieties of guano, the lowest being a crust or rock guano, the next above this being a seal guano, containing much seal-fur, and the uppermost layer being a bird guano, in which there were many mummified bird skins and large quantities of feathers.

The dung of bats, which has been found in large quantities in many caverns, both in Europe and in certain parts of France, the Pyrenees and Italy, in New Zealand, and on the North American continent, has been designated "bat-guano."[1] Further, the term guano, even when employed to describe the marine and maritime deposits previously mentioned, includes a considerable variety of substances very different in chemical composition and in manure value. For the deposits of guano occurring on the rainless or nearly rainless islands and coasts of Peru vary much in the proportion of their constituents—such variation being due less to differences in the origin of the deposits than to subsequent changes. Exposure to the action of the sea and of sea-mist, and the pressure of superincumbent layers, are not without influence on the nature of the guano, very different qualities being found at different depths.

Although allusions to guano occur in the writings of travellers in the 17th and 18th[2] centuries, the credit of directing the attention of Europe to this curious and useful product is due to Humboldt. In 1804 he brought from the Chincha Islands a specimen which Klaproth and then Fourcroy and Vauquelin analyzed. But it was not until the publication in 1840 of Liebig's work on chemistry in its relations to agriculture and physiology had demonstrated the importance of artificial manures that a lively interest in this Peruvian fertilizer was awakened. In that year a firm of merchants of Lima sent a large cargo of guano to England; but it was not until 1842 that the regular trade in guano began. Messrs. Gibbs & Co. imported 182 tons in that year, while in 1862 the amount was no less than 435,000 tons. The price was lowest (£9 per ton) in 1848–9. It rose successively, in the years 1854 to 1856, from £10 to £13, and has since remained at about the last sum for the best qualities. Happily the Peruvian Guano Company are now permitted to sell this manure according to the results of analysis, and not, as before, at a fixed price irrespective of the variable qualities of different cargoes. Each unit per cent. of nitrogen is set down as worth 19s. 2d. per ton; while the phosphates, calculated as tricalcic phosphate, are reckoned as worth 2s. 3½d. per unit per ton. The only drawback to this plan lies in the rather exaggerated price which it assigns to the low qualities of Peruvian guano, namely, those which are poor in nitrogen but rich in phosphates—containing perhaps 40 to 60 per cent. of these compounds, which may be much more cheaply purchased in other forms. Still it must be urged that the phosphates of Peruvian guano are more useful than those from most other sources, on account of their physical condition, and their solubility. After all, however, the high phosphatic guanos are not much appreciated by farmers, who prefer to use bones and super-phosphates as manure for grass land and root crops.

For a long time the group of Peruvian islands known as the Chinchas furnished nearly all the guano that found its way to Europe. When these deposits, amounting to 7 million tons or more, were practically exhausted,—only 150,000 tons of deep deposits remaining in 1872,—their further working was stopped except for use in Peru itself. Then the guanos on the Macabi and Huanape islands were exported to Europe, in four years (1870 to 1874) about 1 million tons having been shipped and about half a million tons remaining in 1875. Since then the Lobos islands, situated about 70 miles north of Macabi, have been worked, as have also the islands of the Ballestas group. Even in 1871 three-fourths of the cargoes of nitrogenous guano were from Huanape, but the amount of nitrogen generally present in them was rather low, often not exceeding 10 per cent. of "potential" ammonia, while the percentage of water was remarkably high—sometimes not less than 25 per cent. The Ballestas guanos of the same year were drier and contained one-third more nitrogen.

[1] This bat guano generally contains much water (over 60 per cent.) with about 5 per cent of phosphates, and 3 to 7 per cent. ammonia.

[2] *The Art of Metalls*, by A. A. Barba, published in an English translation in 1670, in London, mentions guano from Arica and Iqueyque.

In spite of many testings and surveys, the amount of Peruvian guano still remaining to be exported has not been even approximately determined. Not only do contiguous deposits differ much in composition, but it is frequently impossible to ascertain what is guano and what is sand or rock. Sometimes the layers of guano are too thin to be worth removing, in other places they fill up ravines to a much greater depth than would be imagined. An estimate of the total quantity of Peruvian guano remaining in 1877 gave over 2 million tons available for commerce, but this figure presumably includes all varieties, both nitrogenous and phosphatic. Most of the guano lately and now exported comes from the following groups of islands, or places on the coast—Macabi, Huanape, Ballestas, Punta de Lobos, Pabellon de Pica, and Huanillos, and, since 1877, particularly from the last two localities.

In the article AGRICULTURE (vol. i. p. 309) some statistics of guano imports were given. According to the British Consular Reports (1878, No. iv. pp. 525–539) the quantities of Peruvian guano sold of late years were, in tons—

1869	574,790	1874	336,476
1870	451,501	1875	373,688
1871	363,200	1876	378,663
1872	402,097	1877	310,042
1873	342,425		

The amounts of Peruvian guano taken by different countries during 1876 and 1877 were as follows:—

	1876.	1877.
England and her colonies	130,598	100,954
France and her colonies	102,165	72,067
Germany	63,724	23,455
Bolgium	48,246	71,473
Spain	28,359	23,455
Italy	3,594	5,440
Holland	1,977	3,658

In 1872, when the number of countries contributing guano was very large, the imports into the United Kingdom were as follows:—

	Tons.		Tons.
Peru	74,401	Australia	1,168
Pacific Islands	17,475	British West Indies	1,050
Bolivia	14,068	St. Helena	981
West Coast of Africa	3,201	Chili	503
Dutch West Indies	1,562	United States	458
Brazil	1,232	Other places	2,545

The following are amongst the more obvious characteristics of good Peruvian guano. Although at the present time it is by no means of uniform appearance or of constant composition, yet it may be stated that the best qualities, which most closely resemble the former supplies from the Chinchas, are light in color, do not weigh much more than 60 lb per bushel, are friable, and do not cohere strongly when pressed between the fingers. Small soft lumps are often observed in good samples; when these are broken a white or pale-colored substance is seen in the centre. This lighter-colored matter contains carbonate and other ammoniacal salts; in some adulterated samples its appearance is imitated by means of gypsum. The hard lumps found in guano are of very varying composition, some being highly phosphatic and others highly siliceous. The ash left on burning a good Peruvian guano is white or gray; a red ash generally indicates adulteration with ochre or ferruginous earth. An unusual proportion of water commonly points to damage by sea-water or rain, a kind of injury which is the more serious, since it is usually accompanied by a considerable loss of ammonia. If more than a mere trace of chlorine be found in a sample of guano, damage by sea-water may be suspected. Although a good guano commonly contains more than half its weight of organic matter and of other substances driven off by a red heat, yet when a still larger quantity of such volatile matters is found their presence may be, and often is, a sign of admixture with peat.

Guanos have been often submitted to analysis,—much more frequently, however, for the sake of determining their agricultural value than their precise chemical components. Their worth as manure practically depends, so far as analysis can show, upon their richness in nitrogen and phosphates. The nitrogen, we know, exists in several forms, of which uric acid or rather urates, with salts of ammonia (the urate, oxalate, carbonate, and phosphate), are the most important. But besides these compounds a peculiar base or animal alkaloid known as **guanine** ($C_5H_5N_5O$) is present in most samples of Peruvian

guano; it is not unlikely that the nitrogen of this body is capable of direct assimilation by plants. A considerable though variable quantity of nitrates and nitrites has been recognized in some guanos, ranging, when expressed as potassium nitrate, from no more than $\frac{1}{10}$ per cent. up to 5 and even 6 per cent. Other nitrogenous compounds present are those indeterminate substances which originate from the decay of the osseids of bone, skin, cartilage, and feathers, and of the proteids of flesh. These intermediate products of decay are ultimately resolved into ammonia salts and nitrates. Some guanos, notably those of the West-African coast (Ichaboe, for example), contain many undecomposed feathers, which cannot possibly yield their nitrogen to vegetation for some time. On this account less than half of the 8 to 12 per cent. of so-called potential ammonia in these guanos is as effective as that in the genuine Peruvian samples. The phosphates of guano are numerous, including tricalcic, dicalcic, ammonio-magnesic, and ammonic phosphates. The solubility of great part of the phosphates in guano helps to make its action more intense and immediate; as much as 10 to 13 per cent. of phosphorus pentoxide has been found to be soluble in some instances. Such is said to be often the case with the guano of Tarapacá; Baker Island and Jarvis Island guanos are similar. This solubility arises partly from the composition of the phosphates present, some of which are naturally moderately soluble in ordinary water; but it arises partly also from the presence of ammonium oxalate, by which the solubility of the calcic phosphates is increased. The carbon dioxide which the decaying organic matter of guano continually evolves also aids in effecting the solution of those phosphates which are not soluble in pure water.

As at least part of the nitrogen of guano exists in the form of the volatile carbonate, it will be found that this manure deteriorates sometimes very much on being kept. One sample of Chincha guano imported in 1865 contained nitrogen equal to 20½ per cent. of ammonia; of this 10½ per cent. was lost when the guano was exposed to the heat of boiling water, and 9½ per cent. when the sample was merely kept for a year in a powdered condition in an ordinary bottle. With so strongly ammoniacal a guano as this, the fixation of the volatile nitrogenous compounds by means of an acid is highly desirable. Oil of vitriol is employed in different proportions and in different ways for this purpose. About 5 or 6 lb of oil of vitriol diluted with water and mixed with sand or peat may be added to each cwt. of guano. Such a process was patented in 1859 by Dr. Richardson of Newcastle. In this way the ammonia of the volatile carbonate is fixed in the form of sulphate, the oxalates and phosphates of the guano remaining unaffected. But sometimes, as in the manufacture of "dissolved guano," a larger quantity of oil of vitriol is used—say 25 to 30 lb to each cwt. of raw guano. In this case a kind of rich superphosphate is obtained in which 20 per cent. or thereabouts of "bone-phosphate made soluble" is present in association with nitrogen equal to 9 or 10 per cent. of ammonia. Such a preparation is Ohlendorff's dissolved Peruvian guano, while "sulphated" and "ammonia-fixed" guanos contain less oil of vitriol, and generally some inert substance like sawdust, which reduces their concentration as manures considerably. "Phospho guano" is in reality a superphosphate made from Mejillones or other phosphatic guano, and enriched by the addition of ammonium sulphate. This Mejillones (Bolivian) guano contains about ½ per cent. of nitrogen and 55 per cent. phosphates. "Native guano" is a term applied to the dried and prepared sludge or deposit obtained in the treatment of town sewage by the "A.B.C." process—one of the many precipitation processes now in use. It has little in common with true guano. "Fish guano" is prepared chiefly from the refuse of the cod of the Newfoundland and Norwegian fisheries. It is rich both in nitrogen and in phosphates, often containing 8 per cent. of the former and 30 per cent. of the latter; but its oily nature causes its action as manure to be uncertain and slow.

Although it is usual and convenient to classify guanos into two groups according to their richness in nitrogen or phosphates respectively, there is no sharp line of demarcation between these classes. Indeed the guano from a single spot may show every gradation from nitrogenous to phosphatic. For instance, three samples taken from a deposit at Punta de Lobos gave amounts of nitrogen corresponding to the following percentage of ammonia in the several layers—surface, ·81 per cent.; middle, 3·15 per cent.; deepest, 15·67 per cent. Three samples from another working in the same huanera gave these figures —3 per cent. ammonia at 8 feet, 8 per cent. at 20 feet, and 12 at 40 feet. A cargo averaging 12 per cent. of potential ammonia, that is, containing an amount of nitrogen which, if expressed as ammonia, equals 12 parts in the hundred of guano, may be regarded as satisfactory; but immense quantities of guano are now exported from Peru, containing not more than 8 or 10 per cent. of ammonia. And there are lower qualities still, with 6 to 8 per cent. of ammonia; and these pass into more phosphatic varieties, with but little organic matter and nitrogen, but yet from their softness and fine state of division capable of being applied, without previous mechanical or chemical treatment, to the land. But when we are dealing with what are called "rock" or "crust" guanos, we not only have an almost complete absence of nitrogen and of organic matter, but the hardness of the material is such as to involve its being first ground and then treated with oil of vitriol to turn it into a superphosphate before it can become available as manure. With the highly phosphatic yet powdery and soft guanos of Peru and Bolivia such treatment is rarely necessary, but it is essential with Navassa (Caribbean Sea) and with the Sombrero Island (Gulf of Mexico) guanos. The latter variety contains no nitrogen, and is very hard, but contains on an average no less than 75 per cent. of tricalcic phosphate. It has been said that the imports into Great Britain of this Sombrero phosphate have been so large that the whole island has been transported thither.

Some notion of the main constituents of Peruvian and Bolivian guanos may be gathered from the following figures, which roughly represent the nature and percentage proportions of the chief constituents of fair samples from several localities:—

	Angamos.	Chincha.	Pabellon de Pica.	Punta de Lobos.	Bolivia.
Moisture	11	16	17	16	13
Organic matter and combined water	53	52	45	34	23
Whereof is nitrogen equal to ammonia	17.5	17	12	7.5	4
Tricalcic phosphate	19	22	19	29	42
Phosphorus pentoxide in alkaline salts	1	3	4	3	3
Alkalies, etc., by difference	9	6	12	13	12

One specimen of Angamos guano actually contained 25 per cent. potential ammonia and but 6 per cent. phosphates reckoned as tricalcic phosphate. It will indeed be seen how generally with the diminution of the nitrogenous organic matter the phosphates increase, and *vice versa*. Analyses of guanos from many different countries exhibit the same feature. But even the phosphatic guanos are less rich in phosphates than one might expect, owing to the intrusion of siliceous matter. In some guanos analyzed by Nesbit more than 30 per cent. of sand occurred. Californian guanos gave this analyst from 1½ to 8½ per cent. ammonia, and about 30 per cent. phosphates. In Falkland Island guano he found about ¾ to 2¾ per cent. ammonia and 20 to 25 per cent. phosphates. In the case of so variable a material as guano neither analyses of individual specimens nor averages can be considered as really representative. But it is instructive to note how low a proportion of nitrogen is present in many of the guanos from different countries:—Algoa Bay, ·5 per cent of potential ammonia; Ascension Island, 6·0; Queensland, 1·0; Chili, 1·4; Ecuador, ·8; Mexico, ·4; Patagonia, 2·7; Tasmania, 2·5.

In the guanos imported during 1847–48 Mr. J. T. Way found the following average percentages of ammonia (calculated from total nitrogen) and of phosphates (calculated as tricalcic phosphate):—

		Ammonia.	Phosphates.
Peru	(13 samples)	17·41	24·12
Ichaboe	(11 ")	7·30	30·30
Patagonia	(14 ")	2·54	44·60
Saldanha Bay	(20 ")	1·62	56·40

Dr. Voelcker's analyses of samples taken in 1874 from the under-mentioned places gave about 25 per cent. phosphates, and of ammonia 8 to 12 per cent. in guanos from Pabellon de Pica, 3 to 12 per cent. from Lobos, and 8 to 12½ per cent. from Huanillos.

The Lobos guanos, having since then become of generally inferior quality, have been but sparingly imported during the last few years. The percentage of ammonia in recent cargoes of guano from Punta de Lobos has been 5 to 6, from Huanillos 9, and from Pabellon de Pica 11 to 12.

The analysis of guano for commercial purposes is generally limited to the quantitative determination of three constituents,—the nitrogen, the soluble phosphorus pentoxide, and the insoluble phosphates; the latter are usually reckoned as tricalcic phosphate. The processes of analysis require a few special precautions. One of these consists in mixing the guano in the combustion tube itself when making a nitrogen determination by Will and Varrentrapp's method; otherwise a loss of ammonia may occur.

As a manure the nitrogenous guano of Peru is rich, active, and stimulating. It has a decided tendency to cause an excessive development of foliage, and is therefore peculiarly fitted for application to grass and to other plants the development of the stem and leaf of which is desired. Its effects on clover are less marked. Mixed with superphosphate it may be applied to potatoes or root-crops, and to most of the plants of the kitchen garden; for many plants cultivated for their flowers it may be used also, but with great care and moderation, mixed with water or dry soil. On light and calcareous lands sown with swedes, turnips, or mangolds, guano has frequently been found to burn

and destroy the young plants or even to prevent the germination of the seed; "dissolved" guano is less liable to cause this injury.

Guano, with another very useful natural product, namely, nitrate of soda, constitutes the chief source of revenue for Peru.

The following papers and reports in the *Journal of the Royal Agricultural Society* contain interesting information on guano, ser. i. vols. ii. p. 301, x. p. 196; xxv. p. 186; ser. ii. vols. i. p. 213; v. 92; vi. 142, 403; vii. 367; viii. 220; ix. 261; x. 541. Native guano is discussed, ser. ii. vol. vi. p. 415. The *Jahresbericht der Agricultur-Chemie* contains a digest of most of the important papers on guano published on the Continent; see, *e. g.*, 1858–9, pp. 231–238; 1860–1, pp. 186–191; 1862–3, pp. 150–157; 1867, p. 189; 1870–2, pp. 190–195; 1873–4, iii. pp. 10–26. A pamphlet published in 1874 by Dunlop & Co., London, gives some important statistics and reports on the Peruvian guano then remaining; as also does the Commercial Blue Book, No. 23, 1878, pp. 525 to 539. (A. H. C.)

GUARANA, so called from the Guaranis, an aboriginal American tribe, the plant *Paullinia sorbilis*, Mart., of the natural order *Sapindaceæ* and tribe *Sapindeæ*, indigenous to the north and west of Brazil. It has a smooth erect stem; large pinnate alternate leaves, composed of 5 oblong-oval leaflets; inflorescence in narrow panicles of short-stalked flowers, having 4 or 5 sepals and 4 petals, 8 stamens, and a cylindrical 3-celled ovary; and fruit ovoid or pyriform, about as large as a grape, and containing usually one seed only, which is shaped like a minute horse-chestnut. What is commonly known as guarana, guarana bread, or Brazilian cocoa, is prepared from the seeds as follows. In October and November, at which time they become ripe, the seeds are removed from their capsules and sun-dried, so as to admit of the ready removal by hand of the white aril; they are next ground in a stone mortar or deep dish of hard sandstone; the powder, moistened by the addition of a small quantity of water, or by exposure to the dews, is then made into a paste with a certain proportion of whole or broken seeds, and worked up sometimes into balls, but usually into rolls not unlike German sausages, 5 to 8 inches in length, and 12 to 16 oz. in weight. After drying by artificial or solar heat, the guarana is packed between broad leaves in sacks or baskets. Thus prepared, it is of extreme hardness, and has a brown hue, a bitter astringent taste, and an odor faintly resembling that of roasted coffee. An inferior kind, softer and of a lighter color, is manufactured by admixture of cocoa or cassava. Rasped or grated into sugar and water, guarana forms a beverage largely consumed in S. America. Its manufacture, originally confined to the Mauhés Indians, has spread into various parts of Brazil.

The properties of guarana as a nervous stimulant and restorative are due to the presence of what was described as a new principle, and termed *guaranine*, by Dr. T. Martius, but which was proved by Berthemot and Deschastelus (*Journ. de Pharm.*, vol. xxvi., 1840, p. 518 *sq.*) to be identical with *caffeine* or *theine*, $C_8H_{10}N_4O_2 + H_2O$. Of this alkaloid guarana yields 5·07 per cent., against 2·13 in good black tea, ·8 to 1 in coffee beans, and 1·2 in maté or Paraguay tea (Stenhouse, *Pharm. Journ.*, xvi. p. 213); for medical purposes it may in fact be regarded as "practically a convenient form of impure caffeine" (F. E. Anstie, *Braithw. Retrosp.*, 1873, i. p. 35). Besides this substance, which is stated to exist in it in the form of tannate, guarana yields on analysis the glucoside saponin, with tannin, starch, gum, three volatile oils, and an acrid green fixed oil (Fournier, *Journ. de Pharm.*, vol. xxxix., 1861, p. 291). As a medicine, guarana was first described in 1817 by Cadet de Gassicourt, to whom a specimen was sent from Brazil (see *Bull. Gén. de Thérap.*, lii., 1857, p. 497 *sq.*), in which country it is in popular repute as a stomachic, febrifuge, and aphrodisiac, and more especially as a specific for dysentery and diarrhœa, in which latter disease it is given in very large doses—4 to 8 or 10 grammes (*Bull. Gén. de Thérap.*, liii. p. 139). It is said by Martius (*Syst. Mat. Med. Veget. Brasiliensis*, p. 59, Leipsic, 1843) to diminish fever by its tonic effects on the nerves, to invigorate the stomach and intestines, to restrain excessive mucous discharges, to increase the action of the arteries and heart, and to promote diaphoresis. In migraine, or sick-headache, it has oftentimes been found a most serviceable remedy (see *inter alia*, *Brit. Med. Journ.*, 1872, i. pp. 421 and 426; *Practitioner*, Aug. and Sept., 1873, pp. 100–102, 161–175); and it has been recommended in lumbago when the pain is of a stinging nature (Rawson, *Braithw. Retrosp.*, 1871, ii. p. 33), and in sciatica and blennorrhœa.

See Spix and Martius, *Reise in Brasilien*, vol. iii. pp. 1061 and 1098, Munich, 1831; Hooker's *Journ. of Botany*, vol. iii., 1851, pp. 193–4; Bentley and Trimen, *Medicinal Plants*, pt. 4, tab. 67, 1876; and, on the preparation of "Guaranine," *Journ. de Pharm.*, 4th ser., xviii. p. 224. On the "Antagonism between Guaranino and Meconate of Morphia," see J. H. Bennett, *Rep. on the Antag. of Medicines*, p. 86, 1875. Further bibliographical references will he found in Prof. P. Mantegazza's excellent article, "Del guaranà, nuovo alimento nervoso," *Ann. Univ. di Med.*, April to June, 1865, vol. 192, pp. 99–153.

GUARANTEE, or GUARANTY, in English law, is a promise to be answerable for the debt of another should he fail to make payment, or generally to be answerable for the performance of any duty by another person. The debt or duty must be owing by another, who is primarily bound, and the guarantor is only liable in the event of his failure of performance. Guarantees are required to be in writing by the Statute of Frauds (29 Car. II. c. 3), which enacts (§ 4) that "no action shall be brought whereby to charge the defendant upon any special promise to answer for the debt, default, or miscarriage of another, unless the agreement upon which such action shall be brought shall be in writing, signed by the party to be charged by the contract, or some other person thereunto by him lawfully authorized." The test of the applicability of this section is whether the original debtor continues liable. If his liability is gone, and the person promising to pay the debt becomes immediately and primarily liable, then the promise need not be in writing. Thus where a debtor had been taken in execution for a debt, and a third person promised to pay the debt if the debtor were discharged from custody, it was held that writing was not necessary, inasmuch as the discharge operated as a satisfaction of the original debt, and the person making the promise alone remained liable. The default for which liability may be assumed by another person includes any case of breach of duty, and is not confined to cases of non-performance of contracts. A promise to guarantee comes under the general rule which requires enforceable agreements to be founded on consideration, *i. e.*, a corresponding promise or performance on the other side (see CONTRACT). It was formerly held that the consideration must appear in the memorandum of writing, not necessarily in express terms, but at any rate as a matter of fair and reasonable inference. Thus a promise to pay for goods to be supplied to another was held to disclose a consideration, viz., the future supply of goods. But when the promise was to pay for goods already supplied, no consideration was disclosed. By the Mercantile Law Amendment Act (19 and 20 Vict. c. 97), passed in consequence of representations made by merchants in Scotland and the North of England, who found the difference between Scotch and English law as to written contracts a source of great inconvenience, this section of the Statute of Frauds was repealed. The Mercantile Law Amendment Act also declares that a guarantee given to or for a firm shall cease on any change taking place in the persons constituting the firm, unless a continuance of the promise is expressly stipulated or of necessity to be inferred. The corresponding Act for Scotland (19 and 20 Vict. c. 60) requires all guarantees, securities, or cautionary obligations, and all representations as to the character of any person made with the view of obtaining credit, money, etc., for such person to be in writing in order to be binding, and establishes the same rule as the English Act with reference to guarantees to or for a firm.

GUARATINGUETA, a town of Brazil, in the province of São Paulo, situated near the right bank of the Parahiba, about 40 miles N. E. of the city of São Paulo. It was founded in 1651 by the Captain Mor Dionizio da Costa. The houses are almost all constructed of mud, and there are few buildings of any note except the churches, of which the chief is dedicated to St. Anthony. A considerable traffic is fostered by the fertile character of the surrounding district and the situation of Guaratingueta on the road between São Paulo and Rio de Janeiro. Population 7400. According to Spix and Martius the name of the town is equivalent to "the place where the sun turns," and refers to its vicinity to the tropic of Capricorn. See Milliet de Saint-Adolphe, *Diccion. Geogr. do imperio do Brazil*, 1870.

GUARDI, FRANCESCO (1712–1793), a Venetian painter, was a pupil of Canaletto, and followed his style so closely that his pictures are very frequently attributed to his more celebrated master. Nevertheless, the diversity, when once perceived, is sufficiently marked—Canaletto being more firm, solid, distinct, well-grounded, and on the whole the higher master, while Guardi is noticeable for spirited

touch, sparkling color, and picturesquely sketched figures —in these respects being fully equal to Canaletto. Guardi sometimes colored Canaletto's designs. He had extraordinary facility, three or four days being enough for producing an entire work. The number of his performances is large in proportion to this facility, and to the love of gain which characterized our painter. Many of his works are to be found in England; seven in the Louvre; four, of exceptional merit, in the Manfrini Palace, Venice.

GUARDIAN AND WARD. See INFANT.

GUARIENTO, sometimes incorrectly named Guerriero, was the first Paduan painter who distinguished himself. The only date distinctly known in his career is 1365, when, having already acquired high renown in his native city, he was invited by the Venetian authorities to paint a Paradise, and some incidents of the war of Spoleto, in the great council-hall of Venice. These works were greatly admired at the time, but have long ago disappeared under repaintings. His works in Padua have suffered much. In the church of the Eremitani are allegories of the Planets, and, in its choir, some small sacred histories in dead color, such as an Ecce Homo; also, on the upper walls, the life of St. Augustine, with some other subjects. A few fragments of other paintings by Guariento are still extant in Padua. In the gallery of Bassano is a Crucifixion, carefully executed, and somewhat superior to a merely traditional method of handling, although on the whole Guariento must rather be classed in that school of art which preceded Cimabue than as having advanced in his vestiges; likewise two other works in Bassano, ascribed to the same hand. The painter is buried in the church of S. Bernardino, Padua.

GUARINI, GIOVANNI BATTISTA (1537–1612), the author of the *Pastor Fido*, was born at Ferrara on the 10th of December, 1537, just seven years before the birth of Tasso. He was descended from Guarino of Verona (see next article). The young Battista studied both at Pisa and Padua, whence he was called, when not yet twenty, to profess moral philosophy in the schools of his native city. He inherited considerable wealth, and was able early in life to marry Taddea de' Beudedei, a lady of good birth. In 1567 he entered the service of Alphonso II., duke of Ferrara, thus beginning the court career which was destined to prove a constant source of disappointment and annoyance to him. Though he cultivated poetry for pastime, Guarini aimed at state employment as the serious business of his life, and managed to be sent on various embassies and missions by his ducal master. There was, however, at the end of the 16th century no opportunity for a man of energy and intellectual ability to distinguish himself in the petty sphere of Italian diplomacy. The time too had passed when the profession of a courtier, painted in such glowing terms by Castiglione, could confer either profit or honor. It is true that the court of Alphonso presented a brilliant spectacle to Europe, with Tasso for titular poet, and an attractive circle of accomplished ladies. But the last duke of Ferrara was an illiberal patron, feeding his servants with promises, and ever ready to treat them with the brutality that condemned the author of the *Gerusalemme Liberata* to a madhouse. Guarini spent his time and money to little purpose, suffered from the spite and ill-will of two successive secretaries,—Pigna and Montecatini,—quarrelled with his old friend Tasso, and at the end of fourteen years of service found himself half-ruined, with a large family and no prospects. When Tasso was condemned to S. Anna, the duke promoted Guarini to the vacant post of court poet. There is an interesting letter extant from the latter to his friend Cornelio Bentivoglio, describing the efforts he made to fill this place appropriately. "I strove to transform myself into another person, and, like a player, reassumed the character, costume, and feelings of my youth. Advanced in manhood, I forced myself to look young; I turned my natural melancholy into artificial gayety, affected loves I did not feel, exchanged wisdom for folly, and, in a word, passed from a philosopher into a poet." How ill-adapted he felt himself to this masquerade life may be gathered from the following sentence: "I am already in my forty-fourth year, the father of eight children, two of whom are old enough to be my censors, while my daughters are of an age to marry." Abandoning so uncongenial a strain upon his faculties, Guarini retired in 1582 to his ancestral farm, the Villa Guarina, in the lovely country that lies between the Adige and Po, where he gave himself up to the cares of his family, the nursing of his dilapidated fortunes, and the composition of the *Pastor Fido*. He was not happy in his domestic lot; for he had lost his wife young, and quarrelled with his elder sons about the division of his estate. Litigation seems to have been an inveterate vice with Guarini; nor was he ever free from legal troubles. After studying his biography, the conclusion is forced upon our minds that he was originally a man of robust and virile intellect, ambitious of greatness, confident in his own powers, and well qualified for serious affairs, whose energies found no proper scope for their exercise. Literary work offered but a poor sphere for such a character, while the enforced inactivity of court life soured a naturally capricious and choleric temper. Of poetry he spoke with a certain tone of condescension, professing to practise it only in his leisure moments; nor are his miscellaneous verses of a quality to secure for their author a very lasting reputation. It is therefore not a little remarkable that the fruit of his retirement—a disappointed courtier past the prime of early manhood—should have been a dramatic masterpiece worthy to be ranked with the classics of Italian literature. Deferring a further account of the *Pastor Fido* for the present, the remaining incidents of Guarini's restless life may be briefly told. In 1585 he was at Turin superintending the first public performance of his drama, whence Alphonso recalled him to Ferrara, and gave him the office of secretary of state. This reconciliation between the poet and his patron did not last long. Guarini moved to Florence, then to Rome, and back again to Florence, where he established himself as the courtier of Ferdinand de' Medici. A dishonorable marriage, pressed upon his son Guarino by the grand-duke, roused the natural resentment of Guarini, always scrupulous upon the point of honor. He abandoned the Medicean court, and took refuge with Francesco Maria of Urbino, the last scion of the Montefeltro-della-Rovere house. Yet he found no satisfaction at Urbino. "The old court is a dead institution," he writes to a friend; "one may see a shadow of it, but not the substance in Italy of to-day. Ours is an age of appearances, and one goes a-masquerading all the year." This was true enough. Those dwindling deadly-lively little residence towns of Italian ducal families, whose day of glory was over, and who were waiting to be slowly absorbed by the capacious appetite of Austria, were no fit places for a man of energy and independence. Guarini finally took refuge in his native Ferrara, which, since the death of Alphonso, had now devolved to the papal see. Here, and at the Villa Guarina, his last years were passed in study, lawsuits, and polemical disputes with his contemporary critics, until 1612, when he died at Venice in his seventy-fifth year.

The *Pastor Fido* is a pastoral drama composed not without reminiscences of Tasso's *Aminta*. The scene is laid in Arcadia, where Guariui supposes it to have been the custom to sacrifice a maiden yearly to Diana. But an oracle has declared that when two scions of divine lineage are united in marriage, and a faithful shepherd has atoned for the ancient error of a faithless woman, this inhuman rite shall cease. The plot turns upon the unexpected fulfilment of this prophecy, contrary to all the schemes which had been devised for bringing it to accomplishment, and in despite of apparent improbabilities of divers kinds. It is extremely elaborate, and, regarded as a piece of cunning mechanism, leaves nothing to be desired. Each motive has been carefully prepared, each situation amply developed. Yet, considered as a play, the *Pastor Fido* disappoints a reader trained in the school of Sophocles or Shakespeare. The action itself seems to take place off the stage, and only the results of action, stationary tableaux representing the movement of the drama, are put before us in the scenes. The art is lyrical, not merely in form but in spirit, and in adaptation to the requirements of music which demands stationary expressions of emotion for development. The characters have been well considered, and are exhibited with great truth and vividness; the cold and eager hunter Silvio contrasting with the tender and romantic Mirtillo, and Corisca's meretricious arts enhancing the pure affection of Amarilli. Dorinda presents another type of love so impulsive that it prevails over a maiden's sense of shame, while the courtier Carino brings the corruption of towns into comparison with the innocence of the country. In Carino the poet painted his own experience, and here his satire upon the court of Ferrara is none the less biting because it is gravely measured. In Corisca he delineated a woman vitiated by the same town life, and a very hideous portrait has he drawn. Though a

CENTRAL AMERICA

SCALE OF MILES

0 50 100 200 300

Submarine Cables .....

Railroads .....

Size of type indicates relative importance of places

Hammond's 8 x 11 Map of Central America
Copyright, 1904, by C.S. Hammond & Co., New York

A 90 B C D 85 E F 80 G H J 75 Longitude West from Greenwich

1 2 3 4 5 6 7 10 15

Gulf of Campeche
Sebancuy
Carmen
Chicbul
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Palenque
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Tical
L. Peten
La Libertad
Flores
San Cristobal
S. Bartolme
Dolores
Lacantun R.
Chixoy R.
Pasion R.
MEXICO
GUATEMALA
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Soconusco Vol.
Tapachula
Quezaltenango
San Benito
Retalhuleu
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Champerico
Fuego Vol.
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Momostenango
Sta. Cruz de Quiche
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Amatitlan
New Guatemala
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Michatoya R.
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Ometepe I.
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Brito
La Virgen
S. Juan del Sur
Papagayo Gulf
C. Elena
Culebra Gulf
C. Velas
Orosi Vol.
COSTA RICA
Liberia
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Nicoya
Nicoya Pen.
Gulf of Nicoya
Herradura B.
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Cartago
Irazu Vol.
Turrialba
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Matina B.
S. Carlos
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Morrosquillo Gulf
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Cauca R.
Magdalena R.
COLOMBIA

satirical element was thus introdueed into the *Pastor Fido* in order to relieve its ideal picture of Areadia, the whole play is but a study of eontemporary feeling in Italian soeiety. There is no true rustieity whatever in the drama. This correspondence with the spirit of the age secured its success during Guarini's lifetime; this made it so dangerously seductive that Cardinal Bellarmine told the poet he had done more harm to Christendom by his blandishments than Luther by his heresy. Without anywhere transgressing the limits of decorum, the *Pastor Fido* is steeped in sensuousness; and the immodesty of its pietures is enhaneed by rhetorical eoneealments more provocative than nudity. Moreover, the love deseribed is effeminate and wanton, felt less as passion than as lust enveloped in a veil of sentiment. We divine the eoming age of *cicisbei* and *castrati*. Of Guarini's style it would be difficult to speak in terms of too high praise. The thought and experienee of a lifetime have been eondensed in these five acts, and have found expression in language brilliant, classieal, chiselled to perfection. Here and there the taste of the 17th century makes itself felt in frigid coneeits and forced antitheses; nor does Guarini abstain from sententious maxims which reveal the moralist rather than the poet. Yet these are but minor blemishes in a masterpiece of dietion, glittering and faultless like a polished bas-relief of hard Corinthian bronze. That a single pastoral should occupy so prominent a place in the history of literature seems astonishing, until we reflect that Italy, upon the close of the 16th century, expressed itself in the *Pastor Fido*, and that the influenee of this drama was felt through all the art of Europe till the epoch of the Revolution. It is not a mere play. The sensual refinement proper to an age of social decadenee found in it the most exact embodiment, and made it the eode of gallantry for the next two centuries.

The best edition of the *Pastor Fido* is that of Venice (Ciotti), 1602. The most convenient is that of Barbéra, Florence, 1866. For Guarini's miscellaneous *Rime*, the Ferrara edition, in 4 vols., 1737, may be consulted. His polemical writings, *Verato Primo* and *Secondo*, and his prose comedy called *Idropica*, were published at Venice, Florence, and Rome, between 1588 and 1614. (J. A. S.)

GUARINO, or Guarinus (1370–1460), of Verona, one of the Italian restorers of elassical learning, was born in 1370 at Verona, and studied Greek at Constantinople, where for five years he was the pupil of Manuel Chrysoloras. When he set out on his return to Italy he was the happy possessor of two eases of preeious Greek MSS. whieh he had been at great pains to collect; it is said that the loss of one of these by shipwreek eaused him such distress that his hair turned gray in a single night. He employed himself as a teacher of Greek, first at Verona and afterwards in Venice and Florenee; in 1436 he beeame, through the patronage of Lionel, marquis of Este, professor of Greek at Ferrara; and in 1438 and following years he acted as interpreter for the Greeks at the councils of Ferrara and Florenee. He died at Ferrara 14th December, 1460, aged ninety.

His principal works are translations of Strabo and of some of the *Lives* of Plutarch, a compendium of the Greek grammar of Chrysoloras, and a series of commentaries on Persius, Juvenal, Martial, and on some of the writings of Aristotle and Cicero. See Rosmini, *Vita e Disciplina di Guarino* (Brescia, 1805–6).

GUARINO, also known as Varinus, and surnamed from his birthplace Favorinus, Phavorinus, or Camers (*c.* 1450–1537), lexicographer and seholar, was born at Favora near Camerino about 1450, studied Greek and Latin at Florenee under Politian, and afterwards beeame for a time the pupil of Lascaris. Having entered the Benedictine order, he now gave himself with great zeal to Greek lexieography, and in 1496 published his *Thesaurus cornucopiæ et horti Adonidis*, a colleetion of thirty-four grammatical tracts in Greek. He for some time aeted as tutor to Giovanni dei Medici (afterwards Leo X.), and also held the appointment of keeper of the Medicean library at Florence. In 1514 Leo appointed him bishop of Noeera. In 1517 he published a translation of the *Apophthegmata* of Joannes Stobæus, and in 1523 appeared his *Etymologicum Magnum, sive Thesaurus universæ linguæ Græcæ ex multis variisque autoribus collectus*, a compilation which has been frequently reprinted, and which has laid subsequent scholars under great though not always acknowledged obligations. Guarino died in 1537.

GUASTALLA, a town of Italy, in the province of Reggio, at the influx of the Crostolo into the Po, about 24 miles N. E. of Parma. It is the seat of a bishop, and possesses a eathedral, San Pietro, an extensive but ruined castle of the 16th century, eight churches, a civil hospital, a gymnasium, a publie library (*La Biblioteca Muldotti*) with 18,000 vols., a school of musie, and a theatre. A statue of Ferrante I. of Gonzaga, by Leone Leoni of Arezzo, adorns the marketplace. The inhabitants are largely engaged in the growing of rice, for whieh the marshy land around the town is speeially adapted; and they also manufaeture silk, flannel, and linen. In 1901 the population of the town proper was only 2715, but that of the commune was 11,091.

Guastalla, or, as the older forms of the name appear, Guarstalla or Wardstalla, was founded by the Lombards in the 7th century. It acquired some fame in the Middle Ages as the seat of the council held by Paschalis II. in 1106. In 1307 it is said to have been deprived of its fortifications by Giberto of Correggio, and they were not restored till 1636. Maria Visconti of Milan, to whose territory it belonged, raised the town and district to the rank of a countship, and bestowed it on Guido Torelli, the husband of his cousin. In 1539 the Torelli family was displaced by Ferrante (Ferdinand) of Gonzaga, and in 1541 the new occupant got Charles V. to make the countship immediately dependent on the empire. In 1621 it was made a duchy. The last duke of Guastalla of the Gonzaga family died in 1746; and though the Spaniards had in the previous year taken possession of the town in the name of Queen Elizabeth, Maria Theresa made good her claim to the imperial fief. At the peace of Aix-la-Chapelle it was ceded to the duke of Parma; and its subsequent history is practically that of Parma and Piacenza. In 1796 it was incorporated in the French Cisalpine Republic, and in 1805 it gave the title of princess to Napoleon's sister Pauline. Parma, Piacenza, and Guastalla were handed over by the peace of Vienna to Marie Louise, the wife of Napoleon; and on her death they passed to Charles of Bourbon. In 1848 Guastalla was added to Modena; and in 1859, along with Modena, it was incorporated with Italy. The area of the duchy was about 125 square miles.

GUATEMALA, or more rarely Guatimala, was formerly a captain-generalcy of Spanish America, which included the fifteen provinces of Chiapas, Suchitepeques, Escuintla, Sonsonate, San Salvador, Vera Paz and Peten, Chiquimula, Honduras, Nicaragua, Costa Rica, Totonicapan, Quesaltenango, Solola, Chimaltenango, and Sacatepeques, — or, in other words, the whole of Central America and part of the present territory of Mexico. The name is now restricted to a small part of the area which constitutes an independent republic. Plate III.

The republic of Guatemala is situated between 13° 42′ and 18° N. lat., and between 88° and 93° 5′′ W. long. Conterminous on the N. with Mexico and Yucatan, it is bounded towards the E. and S. E. by Belize or British Honduras, the Gulf of Honduras, and the republics of Honduras and San Salvador; and towards the S. W. it is washed by the Pacific. The Yucatan frontier is only partially fixed, and though the Mexican frontier was nominally determined as early as 1772, the interpretation of the terms of the agreement is still open to much debate.[1] Towards British Honduras the boundary is fixed by the treaty of April 30, 1858, according to which it runs up the mid-channel of the river Sarstoon to the Graeias a Dios Falls, thence in a right line to Garbutt's Falls on the river Belize, and thence again in a right line due north to the Mexican frontier. The area of Guatemala is estimated in the year of 1900 at 48,290 square miles; an accurate statement is impossible, not only on account of the dubiety of frontier, but from the fact that the surveys are very imperfect. All the maps of the country contain a great deal of hypothetical material, especially in the filling up of the orographical details.

Mountains.—A large proportion of Guatemala may be generally described as mountainous. The main or central chain, which is usually considered a continuation of the Andes, runs in a wavy line from south-east to north-west, keeping on the whole parallel with the Pacific coast at a distance of 40 or 45 miles. Its mean elevation is about 7000 feet, but none of its summits attain to 14,000. Though it forms the main watershed of the country between the Pacific and the Atlantic versant or slope, it is pierced in one or two places by rivers. In the neighborhood of the capital it bears the name of Sierra de las Nubes; in the north-west it is known as the Sierra Madre; and it enters the Mexican (ex-Guatemalian) state of Chiapas as the mountains of Istatan.

[1] The question is argued at length in *Boletin de la Sociedad de Geografia Mexicana*, 1875.

A range called the Sierra de Chama, which, however, changes its name frequently from place to place, strikes eastward from the Sierra Madre towards Belize, where it is known as the Cockscomb; another similar range, the Sierra de Santa Cruz, continues east to Cape Cocoli between the Rio Dulce and the Sarstoon; and a third the Sierra de las Minas or in its eastern portion Sierra del Mico stretches between the Rio Dulce and the Rio Motagua. Between Honduras and Guatemala the frontier is formed by the Sierra de Copan. There are no real plateaus in Guatemala such as give its character to the Mexican region, the so-called plateaus of Quesaltenango, Pacicia, Guatemala, etc., being merely broad valleys amid the mountains; but the general relief of the country is of the most varied description, the mountains descending in all kinds of terraces and underfalls. The number of volcanic summits is very great: Bernouilli gives a list of 14 or 15, and Foledo makes the number no less than 31. The following are those that are decidedly active:—Pacaya, in 14° 21′ 30″ N. lat. and 90° 44′ 34″ E. long., on the southern shores of lake Amatitlan, with its cone on the southern slope; Volcan de Fuego, 12,821 feet in height, in 14° 27′ 25″ N. lat. and 90° 53′ 30″ E. long., near old Guatemala; Atitlan, 11,849 feet in height, in 14° 36′ N. lat. and 91° 14′ E. long.; Quesaltenango, 9358 feet in height, in 14° 53′ 30″ N. lat. and 91° 53′ 30″ E. long.; and Tajumulco, in 15° 9′ 58″ N. lat. and 92° 6′ 7″ E. long. The last was observed in eruption by Bernouilli on occasion of the great earthquake of 1863. Like Quesaltenango, which is surrounded by an extensive *malpais*, it furnishes great supplies of sulphur. More famous, however, than any of these is the Volcan de Agua or Water Volcano, so called because in 1541 it destroyed the city of Old Guatemala by a deluge of water. It is situated in 14° 36′ 48″ N. lat. and 90° 53′ 30″ E. long. The statement of Humboldt that it rises above the snow-line is a mistake, for that would be a height of about 14,500 feet, whereas the actual height of the mountain, according to Poggendorff's revision of Captain Hall's trigonometrical measurement, is only 13,108 feet. When Dr. Scherzer and Dr. Wagner ascended the mountain on August 4, 1854, they found no traces of snow or ice, and though three weeks later a thin coating of snow appeared on the outer slopes of the crater, it was gone again in four days. The source of the great flood of water was probably a crateral lake.[1]

Rivers.—Guatemala is richly watered. On the western side of the sierras the versant is short, and the streams, while very numerous, are consequently small and rapid; but on the eastern side a number of the rivers attain a very considerable development. The Motagua, whose principal head stream is called the Rio Grande, has a course of about 250 miles, and is navigable to within 90 miles of the capital, which is situated on one of its confluents the Rio de las Vacas. It forms a delta on the south of the Gulf of Honduras. Of similar importance is the Polochic, which is about 180 miles in length, and navigable about 20 miles above the river-port of Tclemán. Before reaching the Golfo Amatico it passes through the Izabal Lake and the Golfete Dulce. A vast number of streams, among which are the Chisoy, the Guadalupe, the Rio de la Pasion, unite to form the Usumacinta, whose noble current passes along the Mexican frontier, and flowing on through Chiapas and Tabasco, falls into the bay of Campeachy. The Chiapas follows a similar course.

Lakes.—There are several extensive lakes in Guatemala. The Lake of Peten or Laguna de Flores, in the centre of the department of Petcn, is an irregular basin about 27 miles long, with an extreme breadth of 13. In an island in the western portion stands Flores the capital of the department, well known to American antiquaries for the number of ancient idols which have been recovered from its soil. On the shore of the lake is the stalactite cave of Jobitsinal, of great local celebrity; and in its depths, according to the popular legend, may still be discerned the stone image of a horse that belonged to Cortes. The Lake of Izabal, already mentioned as the terminus of the Polochic river, is about 36 miles long, and would be of considerable value as a harbor if the bar at the mouth of the Rio Dulce did not prevent the upward passage of seafaring vessels. As a contrast the Lake of Atitlan is a land-locked basin encompassed with lofty mountains and possessing no visible outlet for its waters, which are replenished by numerous streams. It is about 18 miles long, with a maximum breadth of 9 or 10 miles, and it lies about 5300 feet above the sea-level. "On its banks," says Mr. Boddam Whetham, "stand eleven villages, whose situations are so varied that their climates and productions are those of the cold, the temperate, and the tropical regions, and whose inhabitants speak different dialects."[2] About 8 or 9 miles south of the capital lies the Lake of Amatitlan, with the town of the same name at its western extremity. It lies about 3980 feet above the sea, and has a length of 9 miles and a breadth of about 3. On the borders of San Salvador and Guatemala there is the Lake of Guija, about 20 miles long and 12 broad, at a height of 2100 feet above the sea. It is connected by the river Ostuma with the Lake of Ayarza which lies about 1000 feet higher at the foot of the Andes. The large lakes, according to Dollfus, are not of crateral origin.

Geology and Mines.—The best and indeed the only elaborate account of the geology of the country is given by Dollfus and Montserrat,[3] who were members of the great French expedition for the exploration of the Mexican region. According to these savants, who, however, confess that their studies are only provisional, the basis rock is the granite which, along with trachytes and porphyries of very various character, intermingled with and overlaid by directly volcanic products, constitutes the great band of the Sierra Madre. From the main ridge towards the Atlantic there is a rich development of mica schists and calcareous formations of sedimentary origin and probably Jurassic age, while the versant of the Pacific is almost covered with modern alluvium washed down along the rapid slopes. Mastodont and elephant remains have been discovered in the tuffs. The country as a whole may be said to owe its shape to the porphyries. Though some of the strata are essentially metalliferous, Guatemala possesses few mines of importance. During the Spanish rule about 40 million pesos of silver were obtained at Alotepeque in Chiquimula; and the works are still carried on, though with poorer results. Lead is found extensively in Huehuetenango and Vera Paz; beds of excellent coal exist in Izabal; marble is quarried at San Juan in Guatemala, and on the Rio Hondo in Zacapa; and lithographic stone is met with in the last-mentioned department.

Climate.—Except in the marshy lagoons along the Pacific, which are inhabited by groups of fishers and salt-gatherers, the climate of Guatemala is considered a healthy one. The peculiar relief of the country gives rise to a large amount of local differences in the matter of heat and cold; but the whole may be rudely divided into a tropical or low-lying region, a temperate or middle region, and a cold or elevated region. The tropical region, or *tierra caliente*, extends from the level of the sea to an elevation of about 1300 feet; the temperate, or *tierra templada*, from 1300 to 4900 feet; and the cold, or *tierra fria*, from 4900 to 8200 feet. Fortunately for the future of Guatemala the templada is by far the most extensive. In the caliente the rainy season lasts four months. During that period the south-west wind prevails, and is often tempestuous like the Cordonazo de San Francisco, or "flagellation of St. Francis," on the coast of Mexico; during the dry season the north wind is the most usual. The rainy season lengthens as we ascend to the templada; the Boca Costa district indeed has a rainy season of seven months, from May to November, and the dry season is not completely dry. Higher still, in the tierra fria, the rain lasts five months, from May to October, and the dry season is quite worthy of the name. At Guatemala, the only place where meteorological observations have been made through a long series of years, the minimum thermometer readings varied from 41° to 45° Fahr. in the five years 1859 to 1863, and the maximum from 84° to 87°. The hottest months are April and May. In the summer, or rainy season, the morning has usually a clear sky; about 2 or 3 o'clock in the afternoon the clouds begin to gather in great cumulus masses; suddenly the lightning flashes out and the rain crashes down; and by evening the sky is clear and starry. In the middle of the rainy season there is often a pause of two or three weeks. At Guatemala the mean annual rainfall for the five years 1859 to 1863 was 54 inches; at Boca Costa it is upwards of 78 inches.[4]

Animals.—The fauna of Guatemala is more closely connected with the fauna of South than with that of North America. As

[1] See Wagner, *Wissenschaftlichen Reisen im tropischen Amerika.*

[2] See *Across Central America*, 1877, p. 103.

[3] *Voy. géol. dans les républiques de Guatemala et San Salvador*, Paris, 1868.

[4] See Dollfus, *Voy. géol.*, and "Versuch einer wissenschaftl. Begründung der klim. Verhältnisse Central Amerikas," in Koner's *Zeitschrift f. Erdkunde*, 1869.

the country is a small one, and its limits are purely conventional, there are comparatively few species that it can claim as peculiarly its own. It is almost entirely free from the presence of animals that are dangerous to man. Of the cat tribe it possesses the jaguar (*Felis onza*), popularly called the tiger; the cuguar (*Felis concolor*), popularly called the lion; the tigrillo (*Felis tigrina*), which is sometimes kept tame; and four other species. Several species of monkeys (*Mycetes* and *Ateles*) are sufficiently numerous in the warm coast region. The Mexican deer (*Cervus mexicanus*) has a wide range both in the lowlands and highlands. Besides the tapir there are two pigs, the marrano de monte (*Sus torquatus*) and the jabali or javali (*Sus labiatus javali*). The *Edentata* are represented by a species of armadillo, the "oso colmenero" or honey-bear (*Myrmecophaga tamandua*) and the *Myrmecophaga didactyla;* and among the rodents may be mentioned, besides rats, hares, and rabbits, the fruit-eating cotorra and tepescuinte (*Dasyprocta aguti* and *Cœlogenys paca*), and the troublesome *Geomys mexicana*. The *Hydrochœrus capybara* is common in all the larger streams. Much annoyance is caused to the agriculturist by the little marsupial called the tacuacine, or the *Didelphys carcinora*, its allied species. The bats are so numerous that villages have sometimes had to be left to their undisputed occupancy. For the bird collector there is a rich harvest in Guatemala. As the seasons change it is visited by a great variety of birds of passage, and it possesses a great many resident species besides. In the city of Coba there are several families which live by preparing bird-skins for sale and export (Bernouilli). From forty to fifty species of birds of prey are already known; among which it is sufficient to mention *Corogyps atratus*, the commonest of the vultures, which acts as a universal scavenger, the *Cathartes aura*, the beautiful *Polyborus vulgaris*, and the king of the vultures (*Sarcorhamphus papa*). Neither the condor of the southern continent nor the great eagles of the northern are known in Guatemala. Of the great passerine order there are upwards of 400 species, including 36 species of humming-birds, 13 of woodpeckers, and 8 of the trogons. One of this last genus, the quetzal, quijal, or quesal (*Trogon resplendens*) is of special note, not only from the fact that its yellow tail-feathers, 2 feet long, were formerly worn as insignia by the Indian princes, but because it has been adopted as the emblematical figure on the national arms of Guatemala. The gallinaceous order is well represented, and comprises several peculiar species, as the pavo de cacho and the peten turkey (*Melcagris ocellata*), which has a bronze sheen on its plumage; and the palmipeds, it is almost needless to add, are unusually numerous in a country so richly furnished with lagoons and rivers and lakes.

There are two species of alligator, one in the Pacific and the other in the Atlantic versant. Snakes are met with in great variety, but only about a fourth of the species are venomous, and even the bite of the rattlesnake is said to be less deadly than in the north. The *Crotalus horridus* is one of the most common. Five species of salamanders are known, 9 of the frogs, and 5 of the toads. Fourteen species of fish have been found in Lake Peten, 7 in Lake Amatitlan, 13 in the river Motagua, 10 in the Polochic, and 13 in the Usumacinta.

The general character of the country induces a rich profusion of insect life. Of the *Coleoptera*, the Camelicorns, the Longicorns, the Curculionids, and the Chrysomelines are said to be best represented, and of the *Lepidoptera* the prevalent genera are — *Ageronia, Papilio, Heliconia, Sphynx*, and *Bombyx*. There are five species of bees, and the European honey-bee, known as aveja de Castilla or bee of Castile, has been naturalized. Ants are common, and may sometimes be seen marching in a column 3 or 4 miles long. Mosquitoes unfortunately are in several districts equally abundant.

Most of the domestic animals of Guatemala—the horse, the ox, the goat, the sheep, the pig, the dog, the rabbit, the common fowl, the peacock, and the pigeon—are of European origin, and are popularly grouped together as *animales de Castilla*. Horses are small but excellent. Cattle are largely imported from Soconusco and Honduras. The favorite swine is the black. Singing-birds are commonly kept in the Guatemalian houses, and the species most sought after are the sensontle, the guarda-barranco (*Myiadestes obscurus*), the pitureal, and the caraban. The last of these is as good as a watch-dog, as "no stranger can enter the yard without being greeted by its shrill cries."[1]

Industrial Produce.—As may be judged from the description of the configuration of the country and its climate the natural productions of Guatemala are sufficiently varied. Foledo gives a list of upwards of 100 kinds of timber trees. Maize and haricot beans (frijol), which form the main sustenance of the people, are grown in all the departments, and in some places there are two harvests a year. Rice and wheat are less extensively distributed. For the foreign trade the coffee plant is the most important product. While in 1859 the whole export was only 390 cwt., by 1876 it had increased to upwards of 185,200 cwt. Meanwhile the cultivation of indigo (añil or jiquilite) and cochineal, which were formerly the principal sources of wealth, is losing ground. Cocoa is most cultivated in the north-west; the nibs are used as small change throughout the country. Good tobacco is grown, but the quantity is small. Sugar is rising into favor. Vanilla, chile, aloes, agave, rhubarb, ipecacuanha, castor oil, scammony, and colocynth are all obtained in the country. The absence of capitalists is one of the chief hindrances to the development of industry and trade.

[1] The naturalists who have done most for Guatemalian exploration are Salvin, Morelet, Sumichrast, Bocourt, Sallé, and Bernouilli.

Political Divisions.—The following table from Foledo exhibits the 20 departments into which the republic of Guatemala is divided, their estimated areas, their respective capitals, their population, and the population of the capitals. Altogether the republic contains 10 cities, 22 towns, 304 townships, and 1794 hamlets, etc. Population in 1903, 1,842, 134.

Department.	Area, Sq. Miles.	Population.	Capitals.	Population.
Guatemala	700	100,000	Guatemala	50,000
Sacatepequez	250	48,000	Antigua	15,000
Amatitlan	200	38,000	Amatitlan	14,000
Escuintla	1,950	30,000	Escuintla	10,000
Chimaltenango	800	60,000	Chimaltenango	6,300
Sololá	700	80,000	Sololá	15,000
Totonicapam	700	114,000	Totonicapam	25,000
Quiché	1,300	75,000	S. Cruz del Quiché	6,300
Quezaltenango	450	94,000	Quezaltenango	22,000
Suchitepequez	2,500	69,000	Suchitepequez	11,500
Huehuetenango	4,550	90,000	Huehuetenango	16,000
San Marcos	750	100,000	San Marcos	12,600
Peten	13,200	14,000	Flores	2,200
Vera Paz	11,200	100,000	Salamá	8,000
Izabal	4,500	3,400	Izabal	750
Chiquimula	2,200	70,000	Chiquimula	12,000
Zacapa	1,400	28,000	Zacapa	4,000
Jalapa	450	8,600	Jalapa	4,000
Jutiapa	1,700	38,000	Jutiapa	7,000
Santa Rosa	1,100	38,500	Cuajiniquilapa	5,000
Total	50,600	1,198,500		

Administration.—The constitution of Guatemala is republican and representative. The council of state consists of 24 members elected by the house of representatives, which consists of 52 members elected by the people. The parliamentary period, and the term of office for the president, who is the head of the executive, is four years. The revenue, which in 1874 amounted to 2,601,000 dollars or £520,000, is mainly derived from import duties, domains, and monopolies; a large part of the expenditure, 2,542,600 dollars or £508,520, is occasioned by the army, which has a nominal strength of 3000, besides a militia of 13,000. The public debt, including the English loan of £500,000 raised in 1859, amounted in 1875 to 4,363,227 dollars or £872,645.

Religion and Education.—The national religion is the Roman Catholic, but there is absolute toleration of other creeds. The Government pays a regular subvention to the church. In the 17 vicariates into which the country is divided there are 111 parishes. Since the rise of the liberal government great progress has been made in educational matters. In 1871 there were 253 schools, with 6130 male and 1944 female pupils; by 1874 the schools had increased to 541, the male pupils to 14,216, and the female to 6312.

Population.—Out of the total population of 1,200,000 it is calculated that about 720,000 are Indians, 300,000 Ladinos, and 180,000 whites. According to Foledo (1874) the foreigners did not exceed 829,—of whom 191 were Mexicans, 164 Spaniards, 103 Frenchmen, 71 Italians, 64 Germans, and 50 Englishmen. The native population is naturally of a quiet and inoffensive disposition. Crimes of violence are rare. A certain easy fatalism is the prevailing mood; but during political excitement it gives way to fanatical outbursts. "Viva la religion, y mueran los estranjeros" is then the cry. Cock fighting and bull baiting are the favorite amusements.

Roads.—The means of communication between one part of the country and another are very poor. In the whole republic it was calculated that in 1874 there were 1365 miles of carriageable roads, and the number of bridges was stated at 432. But a great proportion of the roads, while hardly passable in the dry season, become little better than mitigated swamps in the rainy season; and many of the bridges are of the slightest construction and in a pitiable state of repair. Nearly a week is the time taken by the ordinary wagons to accomplish the journey from San José to Escuintla, a distance of about 90 miles. According to the terms of a contract with the government, a railroad between San José and Escuintla was begun in 1875, and is now completed. The telegraph has been more extensively introduced. There were in 1904, 281 postoffices and in 1906, 3,420 miles of telegraph lines.

Harbors.—The country is poorly furnished with ports,—Izabal, Santo Tomas, Livingston, Gualan, and Panzos exhausting

the list on the Atlantic; and San José Barra de los Esclavos, Tecojale, San Geronimo, San Luis, and Champerico that on the Pacific. Izabal, situated in 15° 24′ N. lat. and 89° 9′ W. long., is of little use, as it is separated from the sea by the bar of the Rio Dulce. Santo Tomas in 15° 38′ 3″ N. lat. and 88° 36′ 6″ W. long., has a fine position at the southern extremity of the Golfo Amatico, which is at once spacious and well protected. Livingston is at the mouth of the Rio Dulce, in 15° 48′ N. lat. and 88° 46′ W. long. Gualan is a river port in the Motagua, and Panzos lies below Teleman on the Polochic. Of the Pacific ports San José is the most noteworthy as the usual landing-place for strangers on their way to the capital. It is situated in 13° 56′ N. lat. and 90° 42′ W. long. A fine pier was built in 1868, but vessels have usually to anchor about a mile out, and the roadstead is not very secure. Champerico, opened to foreign trade in 1870, is also a simple roadstead. It is situated in the department of Suchitepequez, in 14° 17′ N. lat. and 91° 57′ W. long. Istapa, formerly the principal port on the north coast, has been almost abandoned since 1853.

Antiquities.—Though it has no ancient remains so remarkable as those of Copan in Honduras, or Palenque in Chiapas, Guatemala preserves many traces of its earlier inhabitants. A careful summary of what is known in regard to them is given in Bancroft's *Native Races of the Pacific States of North America*, vol. iv. On the left bank of the Motagua are the ruins of an ancient city visited in 1840 by Mr. Catherwood and in 1854 by Dr. Scherzer. They resemble the ruins of Copan, and contain mounds, terraces, colossal heads, idols, pillars, and altars. Ruins are also to be seen at Chapuleo and Chinamita in the same valley, at Cinaca Mecallo, and at the hacienda of Carrizal about 20 miles north of Guatemala. A few leagues to the west are the ruins of Mexico with a vast cave divided into chambers. An ancient aqueduct is mentioned at Rosario, 8 or 10 miles south of Lake Amatitlan and another at the foot of the Volcan de Fuego. Sololá is said to occupy the site of Tecpan Atitlan; and in the neighborhood of Tecpan Guatemala are the substructions and debris of Patmamit, the old Cakchiquel capital. Utatlan, the Quiché capital, has left near Santa Cruz del Quiché sufficient to confirm the early Spanish accounts of its greatness. The absence of sculptures is a striking feature. Rude mounds mark the site of Zakuleu, the chief town of the Mams, near Huehuctenango. At the junction of the Pacalah with the Chisoy Brasseur de Bourbourg in 1856 found pyramidal mounds and long lines of fortifications. The half-explored country of Peten is reputed to conceal many evidences of its former civilization, and about 40 miles north-east of the lake about a league is occupied by the ruins of Tikal.[1]

History.—In 1820 Guatemala began to shake off the Spanish yoke, and in 1822–23 it supported the Mexican patriot Iturbide. A confederation of the Central American states was effected in 1824, slavery was abolished, and a democratic constitution was established. On the assassination of the vice-president Flores in 1827 the San Salvadorians marched against the city of Guatemala; and though they were repulsed then they returned in 1829, and after a severe battle established their general Morazan as president. Guatemala recovered its independence under Carrera, who in 1851 defeated the Hondurians and Salvadorians at La Arada, near Chiquimula, and was recognized as the pacificator of the republic. In 1851 the new constitution still in force was promulgated, and Carrera was appointed president till 1856, a dignity which was afterwards in 1854 bestowed upon him for life. His rivalry with Barrios, president of Salvador, resulted in open war in 1863. In the battle of Coatepeque the Guatemalians suffered a severe defeat, which was followed by a truce. Honduras now joined with San Salvador, and Nicaragua and Costa Rica with Guatemala. The contest was finally settled in favor of Carrera, who besieged and occupied the San Salvador capital, and made himself dominant also in Honduras and Nicaragua. During the rest of his rule, which lasted till his death in April, 1865, he continued to act in concert with the clerical party, and endeavored to maintain friendly relations with the European Governments. Carrera's successor was General Cerna, who had been recommended by him for election. In the struggle between Spain and Chili Guatemala maintained a strict neutrality. The liberal party began to rise in influence about 1870, and in May, 1871, Cerna was deposed by Granados. The archbishop of Guatemala and the Jesuits were driven into exile as intriguers in the interests of the clerical party; and General Barrios having been chosen president in 1872 the order was declared extinct and its property confiscated. All cities except those on the frontier of Chiapas, San Salvador, and Honduras, were opened to foreign commerce. An alliance was formed with San Salvador for offence and defence. In 1876 Barrios invited representatives from the other Central American republics to meet at Guatemala to deliberate on their amalgamation; but the commission separated amid a clash of arms, and war was soon raging between Guatemala, San Salvador, and Honduras. Guatemala was enabled by her superior resources to come forth victorious from the conflict.

[1] Compare Bastian, *Reisen*, etc., Berlin, 1878.

Besides the numerous works of Brasseur de Bourbourg and Squier, who have devoted so much attention to Central America, see the interesting narrative of Thomas Gage, the English missionary; Juarros, *Compendio de la historia de Guatemala*, 1808–1818, 2 vols. (new ed., 1857), which in Bailly's English translation (Lond., 1823) long formed the chief authority; Larrazabal, *Apuntamientos sobre la agricultura y commercio del reyno de Guatemala*, N. Guat., 1811; Obert, *Mém. . . . statistique de l'état de Guatemala*, Brussels, 1840; Ximenez, *Las historias del origen de los Indios de Guatemala*, Vienna, 1857; Gavarrete, *Catecismo de Geografia de la repub. de Guatemala*, 1860 (republished by the *Sociedad Economica*); Alfred de Valois, *Mexique, Havana, et Guatemala*, Paris, 1862; Orozco y Berra, *Geografia de las linguas y Carta etnografica de Mexico*, Mexico, 1866; Mechlin & Warren, *Report of a Journey from Belize to the City of Guatemala*, Belize, 1872; Foledo, *Geografia de Centro America*, Guatemala, 1874; Laferrière, *De Paris à Guatemala*, Paris, 1877. The most valuable maps of Guatemala are Van der Gehucht's *Mapa general*, etc. (New York, 1859), Bourgeois and Feusier's appended to Foledo's *Geografia* (1874), and Au's (Hamburg, 1876). The last is perhaps the best. A geological map is given by Dollfus and Montserrat. (H. A. W.)

Guatemala, properly Santiago de Guatemala, or Guatemala le Nueva, or the New, is the capital of the above republic. It is situated at a height of 5270 feet above the sea in a fertile meseta or plateau, which is crossed by the valley of the Rio de las Vacas or Cow River, so called from the first specimens of the bovine race introduced by the Spaniards. On almost all sides it is surrounded by barrancas or ravines. The latitude is stated as either 14° 36′ or 14° 37′ N., and the longitude as 90° 24′ or 90° 30′ W. of Greenwich. Like most Spanish American towns it is laid out in wide and regular streets, and it has extensive suburbs. The houses, though usually of only one story, are solidly and comfortably constructed, and many of them are furnished with large gardens and courts. Among the open spaces the chief are the Plaza Major, which contains the cathedral, erected in 1730, the archiepiscopal palace, the Government buildings, the mint, and other public offices, and the Plaza de la Concordia, recently laid out by the Ministerio de Fomento, and now the favorite resort of the inhabitants. The theatre, founded in 1858, which is one of the best of Central America, is situated in the middle of another square. Besides the cathedral, the most important churches are those of San Francisco, La Recoleccion or church of the La Recollets, La Merces, with a black image of the Virgin, greatly reverenced by the Indians, and Santo Domingo, the oldest church in the town. The educational and benevolent institutions comprise the university, the normal school, the national school for girls founded in 1875, the polytechnic school, the general hospital, the orphanage, the hospicio, the maternity hospital, and the Colegio de Belen for the education of girls. The military college is located in the old convent of the Recollets. An excellent museum, founded in 1831, is maintained by the Sociedad Economica, which in various ways has done great service to the city and the country. There are two fortresses in the city, the Castello Matamoros, built by Carrera, and the Castello de San José, used as a state prison. Water is brought from a distance of about 8 miles by two old aqueducts. The general prosperity of Guatemala has procured it the name of the Paris of Central America. Though it has neither railway nor river communication with either coast, it carries on a busy trade; and it also possesses cigar factories, wool and cotton factories, breweries, and other industrial establishments. The population is stated in 1904, at 96,560. It is only since 1775 that New Guatemala has been in existence.

Old Guatemala, frequently called merely Antigua, was destroyed by the Volcan de Agua in 1774, but still remains the chief town of the department of Sacatepequez. It is situated in a beautiful valley in 14° 32′ 58″ N. lat. and 90° 44′ 5″ W. long. Till the fatal outbreak of the volcanic forces it was one of the richest and most beautiful cities of Spanish America, possessing about 100 churches and convents and more than 60,000 inhabitants. The ruins are still almost majestic, and many of the buildings appear as if they had been fortresses. Among those best preserved are the ancient residence of the Spanish governors, now occupied by the administration, and the university building, now the national college. Great damage was done to the place by the earthquake of September, 1874. The population is about 20,000. An older Guatemala was situated at Ciudad Vieja or Almalonga, but seventeen years after it was founded by Alvaredo it was carried away by the great inundation to which the Volcan de Agua owes its name

GUAVA (from the Mexican *guayaba*) is the name applied to the fruits of species of *Psidium*, a genus belonging to the natural order *Myrtaceæ*. The species which produces

the bulk of the guava fruits of commerce is *Psidium Guayava*, Radd., a small tree from 15 to 20 feet high, a native of the tropical parts of America and the West Indies. It bears short-stalked egg-shaped or oblong leaves, with strongly marked veins, and covered with a soft tomentum or down. The flowers are borne on axillary stalks, and the fruits vary very much in size, shape, and color, numerous forms and varieties being known and cultivated. The variety whose fruits are most valued is that which is sometimes called the white guava (*P. Guayava*, var. *pyriferum*). The fruits are pear-shaped, about the size of a hen's egg, covered with a thin bright yellow or whitish skin filled with soft pulp, also of a light yellowish tinge, and having a pleasant sweet-acid and somewhat aromatic flavor. *P. Guayava*, var. *pomiferum*, produces a more globular or apple-shaped fruit, sometimes called the red guava. The pulp of this variety is mostly of a darker color than the former and not of so fine a flavor, therefore the first named is most esteemed for eating in a raw state; both, however, are used in the preparation of two kinds of preserve known as guava jelly and guava cheese, which are made in the West Indies, and imported thence to England; the fruits are of much too perishable a nature to allow of their importation in their natural state. The two varieties here mentioned have been described by some botanists as distinct species. They have both been introduced into various parts of India, as well as in other countries of the East, where they have become perfectly naturalized. Though of course much too tender for outdoor planting in England, the guava thrives there in hot-houses or stoves.

Psidium Cattleyanum, Sab., a tree of from 10 to 20 feet high, supposed to be a native of Brazil, but originally brought to Europe from China, is known as the purple guava. The fruit, which is very abundantly produced in the axils of the leaves, is large, spherical, of a fine deep claret color; the rind is pitted, and the pulp is soft, fleshy, purplish, reddish next the skin, but becoming paler towards the middle, and in the centre almost or quite white. It has a very agreeable acid-sweet flavor, which has been likened to that of a strawberry.

GUAYAQUIL, or SANTIAGO DE GUAYAQUIL, the principal seaport of the republic of Ecuador, South America, is situated on the western bank of the Guayaquil river, about 20 miles from its mouth, in 2° 12′ 24″ S. lat. and 79° 51′ 24″ W. long. The site forms part of a low and level tract of ground bounded on the north by the hills of Santa Ana; and the streets are for the most part laid out with great regularity. To the north lies the old town, mainly inhabited by the poorer classes; to the south the new town. As the houses are generally built of wood or bamboo and mud, the risk of conflagrations is unusually great; and a strong fire-brigade is maintained. Since 1870 the town has been drained, the river has been dredged, and an abundant supply of good water has been brought from a distance. The principal streets are lighted with gas. None of the public buildings are of any architectural interest. All the churches, with the exception of Santo Domingo, are built of wood. There are two colleges (San Vicente and San Ygnacio), a civil hospital (De la Caridad), a new and commodious military hospital, municipal buildings, and a custom-house.

As its harbor is one of the best on the Pacific coast, and permits vessels of large tonnage to come up to the town, Guayaquil is the centre of the foreign trade not only of Ecuador but of part of Peru, and has regular steamship communication both with American and European ports. Bamboos, cocoa, coffee, hides, india-rubber, ivory-nuts, orchilla, and Panama hats are the staple articles for the outgoing cargoes; and there is a demand for pine-apples, oranges, and other fresh fruits for Chili and Peru. The average value of the exports in the five years from 1867 to 1871 was £520,785; and the value of the imports increased from £434,860 in 1867 to £1,168,656 in 1871. In 1876 there entered 79 British vessels, other 57 foreign vessels, and 30 national vessels, with a tonnage respectively of 118,560, 25,979, and 2222. One of the greatest hindrances to a development of the export trade is the want of proper roads from the interior. It is only recently that the carriage road to Quito has been completed. Below the town there is a large astillero or shipbuilding yard of great repute on the Pacific coast. The Guayaquil bank, with a capital of $1,000,000 in native currency, dates from 1868, and the Banco de Credito Hipotecario, with a capital of $500,000, from 1872. The population of the town is from 70,000 to 80,000, mainly mulattos, mestizos, and Indians.

Santiago de Guayaquil was so called because it was founded on St. James's Day, 25th July, 1531. Declared a city by Charles V. on October 6, 1535, it was officially constituted the same year by Balalcazar; and two years later it was restored by Francesco Orellana. In the course of the 17th and 18th centuries the main facts in its history are the attacks of pirates and disasters by fire. The Dutchman Jacob Clerk was the assailant in 1624, the Frenchman David in 1686–87, William Dampierre in 1707, and Clapperton in 1709. As late as 1741 the only defences were three indifferent forts in the river; but in 1763 the town was made the seat of a governor, and a good castle and other fortifications were constructed. The following year a great fire destroyed property to the value of 2,000,000 pesos. In 1837 Guayaquil was made the see of a bishop.

See Villavicencio, *Geographia del Ecuador*.

GUAYRA, LA, or LA GUAIRA, a town of Venezuela, in the province of Caracas, about 8 miles from the city of Caracas, in 10° 36′ N. lat. and 71° 46′ W. long. It is situated on a low-lying strip of coast, but at the same time has a certain amount of picturesqueness as seen against the background of the Cordilleras. Being one of the four principal ports (*puertos habilitados*) of the country, it enjoys a degree of commercial prosperity; but its trade, which is mainly in the hands of Germans, is almost exclusively of the transit description. Its imports are principally from Hamburg and Bremen. There is regular steamboat communication with Puerto Cabello, Maracaibo, and St. Thomas. The population is about 4000. The railway to Caracas, though contracted for, has been stopped. The municipality maintains 19 schools, in which 370 boys and 260 girls are educated free of expense.

GUBBIO, a city of Italy, in the province of Umbria, about 20 miles N. of Perugia. Built along the western ledges of Monte Calvo, it shares alike in the grandeur of the mountains and the beauty of the plain, and its churches and palaces are brought into relief by the varying elevation of the site. Its ancient walls are still retained, and a certain mediæval impress lingers about the place. Besides the cathedral of SS. Mariano and Giacomo, which consists of a small single nave and has a fine wheel window, San Francisco may be mentioned for the sake of the Conception by Fr. Signorelli, S. Agostino for a Madonna del Soccorso by Ottaviano Nelli, and S. Maria Nova with the same artist's finest work—a votive fresco. Portions still remain of the old palace of the dukes of Urbino, built for Federigo by Luciano Lauranna. The palazzo municipale or del commune is a fine building erected between 1332 and 1346 after the designs of Matteo Giovanello, surnamed Gattapone. Like Urbino and Faenza, Gubbio was formerly noted for its majolica, and it was Maestro Giorgio of Gubbio who rediscovered the ruby glazing for which this ware is remarkable. The manufacture has been resumed in modern times. In the neighborhood of the town there is a great reservoir, La Bottacione, capable of containing 4,720,000 cubic feet of water. The population of Gubbio in 1901 was 5673 in the town and 26,320 in the commune.

The ancient Umbrian city of *Ikuvio*, *Iguvium*, or *Eugubium* occupied a site a little further out in the plain, to the left of the Via Flaminia. There is no mention of it in Roman history till the time of its subjugation. It was the place selected by the senate for the detention of the Illyrian king Gentius and his sons, and it was an important post in the wars between Cæsar and Pompey. The site is still marked by ruins, among which are those of the theatre discovered in 1789 by Ranghiasci (*Discoprimento*, Perugia, 1790), and further explored in 1863 (*Boll. dell' Institut. di corr. arch.*, tom. xii.). It is also known that the town possessed temples to Diana, to Vesta, to Janus, to Pallas, and to the Sun and Apollo; and about 8 miles to the north was the celebrated temple of the Apennine Jove. The modern city was raised from the decay into which it had fallen by Otto the Great, whose charter may be seen in Reposati's *Della Zecca di Gubbio*, Bologna, 1773. In 1155 it was besieged by Frederick Barbarossa, but was saved by the intercession of St. Ubaldo. The temporal government of the town, which had previously been in the hands of the papal legate, the bishop, or the prior of the cathedral, was then placed by the emperor in the hands of the people. The first podesta appears in 1163. During the 14th century the prosperity of Gubbio was greatly advanced; it obtained jurisdiction over 130 castles, had great influence over the neighboring cities, and possessed about 30,000 inhabitants. In 1384 it surrendered to Montefeltro, and thus became incorporated with the duchy of Urbino. An account of the school of painting which flourished in Gubbio in the 15th century is given by Ranghiasci Sebastiani in vol. iv. of the Siena edition of Vasari, and by Amico Ricci in his *Memorie di belle arti in Gubbio*, Bologna, 1831. Reference may also be made to *Statuta civitatis Eugubii*, Gerona, 1686; Greffolini, *De*

gestis Eugubinorum; Sarti, *De Episcopis Eugubinis,* 1755; and the Marchese Brancaleoni, "Dei palazzi municipali e pretorio di Gubbio" in *Archivio Storico,* 1867.

GUBEN, a town of Brandenburg, Prussia, capital of a circle in the government district of Frankfort, is situated at the confluence of the Lubist with the Neisse and at the junction of three different railways, 28 miles S.S.E. of Frankfort. It is the seat of a circle court and of a district office, and possesses three evangelical churches, an Old Lutheran church, a Catholic church, a synagogue, a gymnasium, a real-school of the first order, two higher female schools, an infirmary, and a theatre. The principal industries are the spinning and weaving of wool, dyeing, tanning, and the manufacture of pottery ware, hats, and machinery. The vine is cultivated in the neighborhood to some extent, and there is also some trade in fruit and vegetables. The population in 1905 was 36,636.

Guben is of Wendish origin. It is mentioned in the time of the emperor Henry II., and received town rights in 1235. It was surrounded by walls in 1311, about which time it came into the possession of the margrave of Brandenburg, from whom it passed to Bohemia in 1367. It was twice devastated by the Hussites, and in 1631 and 1635 it was occupied by the Swedes. In the latter year it came into the possession of the electorate of Saxony, and in 1815 it was, along with the rest of Lower Lausatia, united to Prussia.

GUDGEON (*Gobio*), a small fish of the family *Cyprinidæ* (see ICHTHYOLOGY), with narrow, cylindrical body, and with a small barbel at each corner of the mouth. These fishes are generally distributed over Europe, the most common being *Gobio fluviatilis,* called "goujon" in France, "grässling" or "gründling" in Germany, and "gobione" in Italy. They thrive in streams as well as lakes, always keeping to the bottom, and scarcely exceeding a length of 8 inches. Gudgeons differing but little from the European are equally common in China and Japan.

GUELDERLAND, GELDERLAND, or GUELDERS (in Dutch *Gerderland* or *Gelre,* in German *Geldern,* and in Latin *Geldria*), formerly a duchy of the empire, bounded by Friesland, Westphalia, Brabant, Holland, and the Zuydersee. At the beginning of the Christian era the land was held by Batavians and Chamavians, and a few centuries later both Saxons and Franks were added to its population. The Carolingian kings ruled over it by means of a number of counts, among whom those of Hameland, Teisterbant (Testrebante), and Nimeguen were the most prominent; but hitherto it has not been discovered how these counts are connected with the later dynasty of the counts of Guelderland and Zutphen, which makes its appearance in the 11th century. There is documentary proof at Braunweiler of the existence of a Count Otto at the end of the 10th century, and a charter of 1096 is sealed by Gerhard of Gelder. Count Gerhard II. of Gelder married Ermgard of Zutphen, and their son Henry succeeded to the double inheritance. Both Henry (1131–1182) and his son and successor Otto I. (1182–1207) considerably extended their domains, and Otto deserves to be remembered for the civic rights which by a happy innovation he bestowed on the town of Zutphen in 1190. Gerhard III. (1207–1229) obtained from the emperor Frederick II. the right of removing the toll of Arnheim to Lobith, where it long proved the principal source of income to the countship. Otto II., son of Gerhard III., greatly augmented his power and territory, and secured the internal stability of his government by erecting numerous free communes, such as Harderwijk, Arnheim, Emmerich, Lochem, etc. Reinald I. (1271–1326) had the chagrin of seeing the dukedom of Limberg, which fell to him by the death of his father-in-law, seized by John I. of Brabant in 1288; but from the emperor Henry VII. he received, in 1310, the right of bestowing full municipal privileges on any free communities he might establish, and in 1317 he was raised to the rank of prince of the empire by Frederick of Austria, which implied possession of legislative authority and liberty to coin his own money. A steady increase of power rewarded the exertions of Reinald II. (1326–1339), and shortly before his death (March 19, 1339) he received the hereditary title of duke of Guelderland from the emperor Louis of Bavaria. The new duchy, however, had an ill beginning of its history. Reinald III., the natural successor, found a bitter rival in his brother Edward, and in 1361, after a contest of eleven years, he was completely defeated in the battle of Tiel; and though ten years later, on Edward's death, he recovered his rightful position, he survived his restoration only three months. A protracted contest between the hostile factions was at length decided in favor of William a nephew of the last duke, and son of William of Juliers, who succeeded in 1378, but did not receive imperial recognition till 1383. Between 1384 and 1386 he assisted the Teutonic knights against the Prussians; and in 1393 he became duke of Juliers by the death of his father. He died 16th February, 1402, and was followed by his brother Reinald IV., whose reign of three and twenty years was mainly noticeable for several contests with Holland, the surrender of Emmerich and other portions of territory, and the gradual consolidation of the Guelderland states. Reinald IV. dying childless in 1423, the coronet passed to his grand-nephew Arnold, the son of John of Egmond. Arnold of Egmond was at first recognized by the emperor Sigismund in 1424, but in 1425 the emperor revoked his sanction, and gave his support to Adolphus of Cleves. In the war that followed the people of Guelderland stood true to Arnold, but his extravagance and carelessness brought the financial affairs of his duchy into confusion; and at length, in 1444, after the defeat of his forces by Adolphus at Linnich, he was constrained to pawn part of his territory to Cleves. The states had complained of the maladministration in a diet of 1436, and the malcontents ultimately, in 1456, found a leader in the duke's own son Adolphus, who, after an apparent reconciliation with his father, made the old man a prisoner in January, 1465, and confined him in the castle of Büren. A civil war now broke out, and Charles the Bold of Burgundy seized the opportunity for his own advantage; in 1471 Adolphus was forced to set his father at liberty; and Arnold, in return for the service done him, made over his duchy to the Burgundian duke for 20,000 gulden, only reserving the usufruct till the close of his own life. On 23d February, 1473, Arnold died, and Charles was duke of Guelderland. The town of Nimeguen made an heroic effort to oppose the Burgundian accession, but it fell after a lengthened siege. On Charles's death at the battle of Nancy in 1477, a party in the powerful city of Ghent became anxious to marry Charles of Egmont to their princess, Mary of Burgundy. Before the year was out, however, (29th June, 1477), the young man had perished before the walls of Tournay, against which he had led an army of Burgundians and Flemings to recover it from the French By his marriage with the Princess Mary, Maximilian of Austria considered himself the rightful possessor of Guelderland, and he succeeded by 1482 in quelling all opposition. But ten years later young Charles of Egmond, the son of Adolphus, set foot once more in his native country; the people soon flocked to his standard; and victorious campaigns proved the capacity of the leader and the enthusiasm of the soldiers. The fierce contest continued for years, and Charles carried the war into the enemy's territories. In 1507 he pushed into Holland and Brabant, in 1512 appeared before Amsterdam, and in 1514 made capture of Groningen. It was not till 1528 that Charles V. granted him the life-long occupation of Guelderland, Zutphen, Groningen, Coevorden, and Drenthe. In return he agreed that if he died childless his possessions should revert to the emperor; but such was his hatred of the house of Austria that towards the close of his life he planned to make France his heir. This, however, was prevented by the states of Guelderland insisting on his appointing as his successor William, the youthful son of the duke of Cleves and Juliers. Charles died 30th June, 1538, and William assumed the title of duke. But Charles V. was not disposed to give up the rights secured by the treaty of Gorinchem, and after a contest in which much damage was done to various parts of the Low Countries, William was obliged to surrender his claims on 7th September, 1543. On the rise of the Dutch republics most of Guelderland threw off the Spanish yoke. One "quarter" only, that of Roermonde, continued subject, and it received the name of Spanish Guelderland; the other three "quarters," Nimeguen, Zutphen, and Arnheim, became Dutch Guelderland, and had their provincial diets twice a year. By the peace of Utrecht Spanish Guelderland or the upper quarter (Overkwartier) passed to Prussia, including the town of Guelders, but excluding Venloo, which went to the Netherlands, and Roermonde, which went to Austria. By the peace of Paris (1814) the temporary divisions of the French revolutionary period were abolished, and all Guelderland

was incorporated with Holland except the portion which still forms the Prussian circle of Düsseldorf.

GUELDERLAND, the modern province of the Netherlands, has an area of 1965 square miles, and its population in 1821, 1835, 1840, 1860, and 1873 was respectively 269,926, 323,167, 345,762, 401,864, and 605.420. The largest towns are Nimeguen (52,147 in 1906), Arnheim (62,279), Zutphen, (18,500), Apeldorn (25,700), Ede (16,500), and Rheden (12,500); and there are at least eighteen other communes with more than 5000 inhabitants.

See Pontanus, *Historiæ Geldriæ* (Harderwijk, 1639); Van Spaen, *Historie van Gelderland* (Utrecht, 1814); Nijhoff, *Gedankwaardigheden uit de Geschiedenis van Gelderland* (Arnheim, 1830, etc., 6 vols.); Nijhoff, *Het vornaemste uit de geschiedenis von Gelderland* (Arnheim, 1869); J. C. Kremer, *De Graven van Hameland, en de Oorsprong der Graven van Nassau, Gelre, Cleve, en Zutphen* (Arnheim, 1873); Baron Sloet, *Oorkondenboek der Graafschappen Gelre en Zutfen;* P. H. Witkamp, *Aardrijkskundig Woordenboek van Nederland,* 1877.

GUELDER ROSE, so called from Guelderland, its supposed source, termed also Marsh Elder, Rose Elder, Water Elder (Germ., *Wasserholder, Schneeball;* Fr., *Viorne-Obier, l'Obier d'Europe*), the *Viburnum Opulus* of Linnæus, is a shrub or small tree of the natural order *Caprifoliaceæ*, and a native of Britain and other parts of Europe, and of Russian Asia. It is common in Ireland, but rare in Scotland. In height it is from 6 to 12 feet, and it thrives best in moist situations. The leaves are smooth, 2 to 3 inches broad, with 3 to 5 unequal serrate lobes, and glandular adnate stipules. In autumn the leaves change their normal bright green for a pink or crimson hue. The flowers, which appear in June and July, are small, white, and arranged in cymes 2 to 4 inches in diameter. The outer blossoms in the wild plant have an enlarged corolla, ¾ inch in diameter, and are devoid of stamens or pistils; in the common cultivated variety all the flowers are sterile and the inflorescence is globular, hence the term "Snowball Tree" applied to the plant, the appearance of which at the time of flowering has been prettily described by Cowper in his *Winter Walk at Noon.* The guelder rose bears juicy, red, elliptical berries, 4 lines in length, which ripen in September, and contain each a single compressed seed. In Northern Europe these are eaten, and in Siberia, after fermentation with flour, they are distilled for spirit. The plant has, however, emetic, purgative, and narcotic properties; and Taylor (*Med. Jurisp.*, vol. i. p. 448, 2d ed., 1873) has recorded an instance of the fatal poisoning of a child by the berries. Both they and the bark contain valerianic acid. The woody shoots of the guelder rose are manufactured into various small articles in Sweden and Russia. See Loudon, *Arboretum*, vol. ii., 1838; and Syme, *Eng. Bot.*, iv. p. 202, pl. 639.

GUELDERS, or GELDERN, a town of Rhenish Prussia, in the government district of Düsseldorf, chief and only town of the circle of Geldern, is situated on the Niers, 28 miles N. W. of Düsseldorf. Its industries include the manufacture of cloth and hats, wool-spinning, and wool, silk, and linen weaving. It has a Catholic and a Protestant church and two convents. The town was built in 1097, and was till 1343 the residence of the counts and dukes of Guelderland. It was fortified by Philip II., but its fortifications were razed by Frederick II. of Prussia in 1764. The population in 1905 was 6552.

GUELFS AND GHIBELLINES. The names Guelfo and Ghibellino, as applied to parties in Italy, are Italianized forms of names which at an earlier period designated parties in Germany. Guelfo is the Italian form of Welf, and Ghibellino the Italian form of Waiblingen, a castle of the emperor Conrad. In Germany these names, which are said to have been first used as battle-cries at the battle of Weinsberg in 1140, designated the struggle between the Welfs of Altdorf and the imperial line of the Hohenstaufen. In Italy the names acquired a different meaning, being generally applied respectively to the party of the pope and the party of the emperor. The conflict between the authority of the emperor and the independence of the Italian towns began before the names were used in Germany. These parties first came into prominence in the Lombard league of 1167. In the war which followed we find the following distribution of parties: on the Ghibellin side were Cremona, Pavia, Genoa, Tortona, Asti, Alba, Acqui, Turin, Ivrea, Ventimiglia, Savona, Albenga, Imola, Faenza, Ravenna, Forlì, Cesena, Rimini, the marquis of Montferrat, the counts of Lomello, Guasto, Bosio, etc.; on the side of the Guelfs were Venice, Treviso, Padua, Vicenza, Verona, Brescia, Ferrara, Mantua, Bergamo, Lodi, Milan, Novara, Vercelli, Alessandria, Piacenza, Parma, Reggio, Modena, Bologna. These names spread further in consequence of the bitter rivalry which existed between several pairs of Italian towns, for instance, between Rome and Tusculum, Pisa and Genoa, Ferrara and Mantua, Bergamo and Brescia. A further step in this direction was the division of the towns themselves into Guelf and Ghibellin parties. The struggle for the imperial throne between Philip of Swabia and Otto of Brunswick (1198–1208) enlisted the sympathies of Italy. The Guelfic towns Milan, Piacenza, Brescia, Reggio, Modena, took the part of the Welf Otto. The 13th century witnessed a great increase of the jealousies between rival towns, and more serious divisions of the leading families in the towns themselves. Examples of this were the quarrels between the Montecchi and Capelletti at Verona, the Lambertazzi and Geremei at Bologna, the Rossi and Coreggi at Parma, the Doria and Spinola, the Grimaldi and Fieschi at Genoa, the Buondelmonti and Amedei, the Donati and Uberti at Florence, the Colonna and Orsini at Rome, the Bagnacavalli and Polenta at Ravenna, the Delle Torre and Visconti at Milan, the Cancellieri and Panciatichi at Pistoia, the Salimbeni and Tolomei at Siena.

Of the principal towns in North and Central Italy, Arezzo was generally Ghibellin. Bergamo was torn in sunder by party quarrels; the Suardi fought against the Coleoni, and afterwards both these against the Rivoli and Bonghi; it was generally more Guelf than Ghibellin. Bologna was generally Guelf. Brescia was much divided. It was generally Guelf, but was conquered by the Ghibellins in 1322. It came under the power of the Visconti of Milan in 1337. Cremona was generally Guelf, but occasionally Ghibellin. Always unhappy, it was wasted by the most violent party conflicts. The family of Cavalcabò led the Guelf party in this town in the 14th century. Ferrara was Ghibellin under the Torelli; it became Guelf under the Este. Florence, after 1158, was the chief support of the Guelfs. The struggles which desolated it were between different branches of the Guelf—the Bianchi, and Neri, and others. Forlì was Guelf till 1315, afterwards Ghibellin under the Ordelaffi. Genoa was divided between the two parties. Lucca was generally Ghibellin, but had hard work to maintain its position against the attacks of Florence. Mantua was Guelf up to 1220, afterwards mainly Ghibellin. Padua was the enemy of Venice; in 1227 it was Guelf, fighting against the Ghibellin Vicenza; about 1318 it became Ghibellin under the house of Carrara. Parma was divided in its sympathies. It was generally more Guelf than Ghibellin. Pavia was Ghibellin unless compelled to be otherwise. Perugia became Guelf in 1198. It was much torn by party quarrels. Piacenza was generally Guelf. Pisa was chiefly Ghibellin during a great part of its history, Pistoia was divided up to 1267, after which time it became mainly Guelf. Ravenna was chiefly Guelf under the family of Polenta. Rimini belonged to the family of Malatesta, which was divided between Guelf and Ghibellin. Siena was at first Ghibellin; in 1270 it became Guelf. Venice was scarcely touched by these party quarrels. Verona was much divided. Up to 1259 it was mainly Guelf; under the Della Scala it was Ghibellin. Vicenza was Ghibellin after 1227; at a later period it followed the fortunes of Padua. Viterbo was Ghibellin after 1328.

It would be generally true to assert the principle that the Guelfs were more attached to liberty than the Ghibellins. The town of Alessandria was the creation of the Lombard league, a protest against the reduction of Italy under a German sovereign. Yet Dante, the keenest patriot, the most ardent aspirant towards the unity of Italy, was a Ghibellin. With him Ghibellinism meant (1) unity under a strong head, and (2) the abolition of the temporal power of the popes. No one, he thought, but an emperor could sit firmly in the saddle or guide the reins of so fierce a steed. The best hope of obtaining this object lay in Henry VII. of Luxembourg. But the object itself was probably impossible of realization. The death of Henry at Buonconvento extinguished the last hope of uniting Italy under the supremacy of Cæsar.

To give a full account of the party quarrels of Guelf and Ghibellin would be to write the history of mediæval Italy. The names began to die out gradually at the beginning of the 15th century. Twenty years before the two parties had

united in opposing John of Bohemia. The expedition of Charles IV. into Italy destroyed what shreds still remained of respect for the authority of the empire, and with the extinction of Ghibellinism Guelfism perished also; yet we find the name of Guelf appearing in Milan in 1404, after the death of Gian Galeazzo Visconti, and also in 1447, in the struggle between Ludovico Sforza and the Duchess Bona of Savoy. In the conquest of Milan by Louis XII., in the beginning of the 16th century, we find the supporters of the emperor and Sforza called Ghibellins by Roman writers, and the French party called Guelf.

Of the literary supporters of either cause we can only mention a few. Brunetto Latini, the master of Dante, was a Guelf. Dante himself, as we have seen above, was a Ghibellin; so was his friend Guido Cavalcanti. Petrarch was a Guelf; the three historians Villani are singularly impartial. For further information, see Wachsmuth, *Geschichte der Politischen Parteiungen*, vol. ii. (O. B.)

GUELPH, the chief town of Wellington county, Ontario, Canada, is situated in a fine agricultural district on an elevation on the river Speed, a branch of the Grand River, and on the Grand Trunk Railway and the Wellington, Gray, and Bruce division of the Great Western Railway, 45 miles west by south of Toronto. The river is navigable at this point, and there is a considerable shipping trade in wheat. Abundant water power is obtained for flour-mills, saw-mills, and woollen-mills, and there are also breweries, tanneries, and manufactories for agricultural instruments and sewing machines. The population in 1901 was 11,496.

GUERCINO. See BARBIERI.

GUÉRET, a town of France, chief town of the department of Creuse, is situated on a mountain declivity near the Creuse, about 250 miles south from Paris. It has a church of the 13th century, a communal college, a normal school, two hospitals, a botanical garden, a library, a picture gallery, and a museum for natural history and antiquities. The principal industries are the manufacture of beer, leather, potash, combs, and buttons; and there is a considerable trade in wood and cattle. Guéret grew up in the 8th century round an abbey founded by Clotaire in 720. The population in 1901 was 5987.

GUERICKE, OTTO VON (1602–1686), an experimental philosopher, distinguished by his original discoverics of the properties of air, was born at Magdeburg, in Prussian Saxony, November 20, 1602. Having studied law at Leipsic, Helmstadt, and Jena, and mathematics, especially geometry and mechanics, at Leyden, he visited France and England, and, returning to Saxony, took up the profession of engineer-in-chief at Erfurt. In 1627 he was elected alderman of Magdeburg, and in 1646 mayor of that city, and a magistrate of Brandenburg. It was whilst holding these offices that Guericke devoted his leisure to scientific pursuits, especially in pneumatics. Incited by the discoveries of Galileo, Pascal, and Torricelli, he attempted the creation of a vacuum, a desideratum in science from before Aristotle. He began by experimenting with a pump on water placed in a barrel, but found that when the water was drawn off the air permeated the wood. He then took a globe of copper fitted with pump and stopcock, and discovered that he could pump out air as well as water. Thus Guericke became the inventor of the air-pump (1650). This important discovery was publicly explained before the emperor Ferdinand III. at the imperial diet which assembled at Ratisbon in 1651. Guericke at the same time illustrated in a simple but effective way the force of atmospheric pressure. Placing side by side two hollow hemispheres of copper, he exhausted the air from between them by means of pump and stopcock, and it is recorded that thirty horses, fifteen back to back, were unable to pull them asunder. The apparatus used on this occasion is still preserved in the imperial and royal library at Berlin. Guericke further demonstrated, by the aid of the air-pump, that in a vacuum all bodies fall equally fast, that animals cannot exist therein, and other phenomena. He also invented the air-balance, and the anemoscope, a species of weathercock. The discovery of the property of electro-repulsion is also attributed to him; and he made successful researches in astronomy, predicting the periodicity of the return of comets. In 1681 he gave up office, and retired to Hamburg, where he died May 11, 1686.

His principal observations are given in his work, *Experimenta nova, ut vocant, Magdeburgica de vacuo spatio* (Amsterdam, 1672). He is also the author of a *Geschichte der Belagerung und Eroberung von Magdeburg*. See Hoffmann, *Otto von Guericke*, Magdeburg, 1874.

GUÉRIN, GEORGES MAURICE DE (1810–1839), a French poet, whose few compositions in prose and verse, published posthumously, show him to have posesssed a true and rare genius, was descended from a noble but poor family, and was born at the château of Le Cayla in Languedoc, 4th August, 1810. He was educated with a view to the church at a religious seminary at Toulouse, and then at the Collége Stanislas, Paris, after which he procured entrance to the society at La Chesnaye in Brittany, founded by Lamennais, bishop of Rennes. Here his most intimate companions were persons whose tastes were literary rather than ecclesiastical; and his dreamy and meditative temperament found its solace and happiness more in intercourse with nature than in theological study or the exercises of piety. It was therefore only after great hesitation, and without being satisfied as to his religious vocation, that under the influence of Lamennais he joined the new religious order in August, 1833; and when, in September of the same year, Lamennais, who had come under the displeasure of Rome, severed connection with the society, Guérin's doubts as to his vocation returned in full force, and on the 7th October he renounced his novitiate. Early in the following year he went to Paris, where he obtained an engagement on the periodical press, but finding it impossible to submit to the mental drudgery of continuous literary work he became a teacher at the Collége Stanislas. In November, 1838, he married a Creole lady of some fortune; but a few months afterwards he was attacked by a malady which proved to be consumption, and which terminated by death his short period of leisure and happiness, 19th July, 1839. In the *Revue des Deux Mondes* for May 15, 1840, there appeared a notice of Guérin by George Sand, to which she added two fragments of his writings—one a composition in prose entitled the *Centaur*, and the other a short poem. His *Reliquiæ*, including the *Centaur*, his journal, a number of his letters, and several poems edited by G. S. Trébutien, and accompanied with a biographical and critical notice by Sainte-Beuve, appeared in 1860 in two volumes; and a translation of it was published at New York in 1867. Though Guérin was essentially a poet, his prose is more striking and original than his poetry. Its peculiar and unique charm arises from his strong and absorbing passion for nature, a passion whose intensity reached almost to adoration and worship, but in which the pagan was more prominent than the moral element. According to Sainte-Beuve, "no French poet or painter has rendered so well the feeling for nature—the feeling not so much for details as for the *ensemble* and the divine universality, the feeling for the origin of things and the sovereign principle of life."

The name of EUGÉNIE DE GUÉRIN (1805–1848), the sister of Maurice, cannot be omitted from any notice of him, if only on account of the ties of love that united them; but her *Journals*, published in 1861, English translation 1865, and her *Lettres*, published in 1864, English translation 1865, indicated the possession of gifts of as rare an order as those of her brother, though of a somewhat different kind. In her case mysticism assumed a form more strictly religious, and she continued to mourn her brother's loss of his early Catholic faith. Five years older than he, she cherished a love for him which was blended with a somewhat motherly anxiety. In him she centred her chief earthly hopes, and after his death her only remaining earthly purpose was to rescue his name from oblivion by the collection and publication of the scattered fragments of his writing. She died, however, on the 31st May, 1848, before her task was completed.

See the notices by George Sand and Sainte-Beuve referred to above; Sainte-Beuve, *Causeries du lundi*, vol. xii., and *Nouveaux lundis*, vol. iii.; G. Merlet, *Causeries sur les femmes et les livres*, Paris, 1865; Selden, *L'Esprit des femmes de notre temps*, Paris, 1864; Marelle, *Eugénie et Maurice de Guérin*, Berlin, 1869; Harriet Parr, *M. and E. de Guérin, a monograph*, London, 1870; and Matthew Arnold's essays on Maurice and Eugénie de Guérin, in his *Essays in Criticism*.

GUÉRIN, JEAN BAPTISTE PAULIN (1783–1855), French painter, belongs to the group who specially represent the Restoration. Born at Toulon, on the 25th March, 1783, of poor parents, he learnt, as a lad, his father's trade of a locksmith, whilst, at the same time, he followed the classes of the free school of art. Having sold some copies to a local

amateur, Guérin started for Paris, where he came under the notice of Vincent, whose counsels were of material service. In 1810 Guérin made his first appearance at the Salon with some portraits, which had a certain success. In 1812 he exhibited Cain after the murder of Abel (formerly in Luxembourg), and on the return of the Bourbons, was much employed in works of restoration and decoration at Versailles. His Dead Christ (Cathedral, Baltimore) obtained a medal in 1817, and this success was followed up by a long series of works, of which the following are the more noteworthy: — Christ on the knees of the Virgin, 1819; Anchises and Venus, 1822 (formerly in Luxembourg); Ulysses and Minerva, 1824 (Musée de Rennes); the Holy Family, 1829 (Cathedral, Toulon); and Saint Catherine, 1838 (St. Roch). In his treatment of subject, Guérin attempted to realize rococo graces of conception, the liveliness of which was lost in the strenuous effort to be correct. His chief successes were attained by portraits, and those of Charles Nodier and the Abbé Lamennais became widely popular. Guérin died January 19, 1855. We possess no account of his life and works beyond that which is afforded by brief notices in contemporary biographical dictionaries.

GUÉRIN, Pierre Narcisse (1774–1833), French painter, was born at Paris, May 13, 1774. The artistic ideal of the first empire found complete expression in his work, the most famous examples of which show a peculiar combination of the dry pseudo-classic style, then popular, with stage pathos of a highly exaggerated character; yet from his atelier went forth, as if in necessary protest against the defects of their master, the leaders of the Romantic and Realistic movements,—Delacroix and Géricault. The first teacher of Guérin was Nicolas Brenet, whom he left to place himself under Jean Baptiste Regnault, the representative, as contrasted with David, of a distinct form of the classic reaction modified by a tincture of Italian tradition. Guérin became the most distinguished of his pupils, and carried off one of the three "grands prix" offered in 1796, in consequence of the competition not having taken place since 1793. The *pension* was not indeed re-established, but Guérin fulfilled at Paris the conditions imposed upon a *pensionnaire*, and produced various works, one of which brought him prominently before the public. This work, Marcus Sextus (Louvre), exhibited at the Salon of 1799, excited wild enthusiasm, partly due to the subject—a victim of Sulla's proscription returning to Rome to find his wife dead and his house in mourning—in which an allusion was found to the actual situation of the *émigrés*. Guérin on this occasion was publicly crowned by the president of the Institute, and before his departure for Rome (on the re-establishment of the École under Suvée) a banquet was given to him by the most distinguished artists of Paris. In 1800, unable to remain in Rome on account of his health, he went to Naples, where he painted the Grave of Amyntas. In 1802 Guérin produced Phædra and Hippolytus (Louvre); in 1810, after his return to Paris, he again achieved a great success with Andromache and Pyrrhus (Louvre); and in the same year also exhibited Cephalus and Aurora (Collection Sommariva) and Bonaparte and the Rebels of Cairo (Versailles). The Restoration brought to Guérin fresh honors; he had received from the first consul in 1803 the cross of the legion of honor, and in 1815 Louis XVIII. named him Academician. The success of Guérin's Hippolytus, of Andromache, of Phædra, and of Clytæmnestra (Louvre) had been ensured by the skilful selection of highly melodramatic situations, treated with the strained and pompous dignity proper to the art of the first empire; in Æneas relating to Dido the disasters of Troy (Louvre), which appeared side by side with Clytæmnestra at the Salon of 1817, the influence of the Restoration is plainly to be traced. In this work Guérin sought to captivate the public by an appeal to those sensuous charms which he had previously rejected, and by the introduction of picturesque elements of interest which, even ow, distract attention from the artificial mannerism too ainfully apparent in his treatment of tragic subject. But with this work Guérin's public successes came to a close. He was, indeed, commissioned to paint for the Madeleine a scene from the history of St. Louis, but his health prevented him from accomplishing what he had begun, and in 1822 he accepted the post of director of the École de Rome, which in 1816 he had refused. On returning to Paris in 1828, Guérin, who had previously been made chevalier of the order of St. Michel, was ennobled. He now attempted to complete Pyrrhus and Priam, a work which he had begun at Rome, but in vain; his health had finally broken down, and in the hope of improvement he returned to Italy with Horace Vernet. Shortly after his arrival at Rome Baron Guérin died, on July 6, 1833, and was buried in the church of La Trinità de' Monti by the side of Claude Lorraine. A careful analysis and criticism of his principal works will be found in Meyer's *Geschichte der Französischen Malerei*, but his life has not yet been made the subject of special treatment.

GUERNSEY, the second in size of the Channel Islands, is situated between 49° 25′ and 49° 31′ N. lat. and between 2° 30′ and 2° 41′ W. long., 30 miles W. of Normandy, and 51 miles S. of Portsmouth. The total area at low water is estimated at 15,560 acres, or rather more than 24 square miles, and of this about 11,600 acres are under cultivation. Gradually rising from the north to the south, the island attains its maximum elevation of 349 feet above mean tide at Haut Nez, above Point Icart. According to J. A. Bird's "Geology of the Channel Islands" in *The Geological Magazine*, London, 1878, it consists geologically of three very unequal portions, one characterized by a very felspathic syenite and gneiss, another by a hornblendic "granital," and a third by a micaceous syenite. The felspathic portion yields magnificent crystals of felspar, surpassing those of the porphyritic granites of Cornwall or Cumberland; and the hornblendic portion occasionally affords crystals of black hornblende in similar perfection. No Secondary or Tertiary rocks are found in position, but post-Tertiary clays containing flints are found all around the island and even on its summit, and Mr. Bird is disposed to assign them to the interglacial period of submergence. The soil of Guernsey is generally a light sandy loam, and the subsoil consists for the most part of angular gravel, except in certain places occupied by a curious clay, chiefly composed of a silicate of alumina, which proves destructive to vegetable life. While the island does not grow sufficient grain for its own consumption, it has a large export of fruits and other garden produce. Parsnips were formerly one of the principal items, but they are now less extensively cultivated, having been supplanted by potatoes and turnips. Grapes, which were exported to the amount of 50 tons in 1873, are the source of an increasing trade. Granite is largely shipped at St. Sampson.

For administrative purposes Guernsey is united with Alderney, Sark, Herm, and the adjacent islands in the bailiwick of Guernsey. The island proper is divided into the ten parishes of St. Peter Port, St. Sampson, Vale, Câtel, St. Saviour, St. Andrew, St. Martin, Forest, St. Peter du Bois, and Torteval. The administration is under the supervision of a lieutenant-governor appointed by the crown; and the parliamentary assembly consists of a bailiff, twelve jurats, a procureur or attorney-general, the beneficed clergy, and twelve delegates elected by the people. Taxation is very light, and the annual revenue amounts to about £10,000. Ecclesiastically the island is a deanery of the Winchester diocese of the Church of England. Pop. (1901), 40,477.

The only town of any great importance is St. Peter Port on the eastern coast. In 1861 it had a population of 16,338 (6968 males and 9420 females), and in 1871, 16,166 (6731 males and 9435 females). The sea frontage of the town extends for about a mile, and is protected in nearly all its length by a wall with an esplanade. On the improvement of the harbor, which was begun in the 13th century by order of King Edward I., a sum of £285,000 has been expended since 1854. It is formed by two piers, which enclose an area of 73 acres, the southernmost of the two running out to Castle Cornet and then sending out a breakwater for about 3000 yards. The whole of the works are of the most massive description. Among the principal buildings of the town, which has been greatly improved by the formation of a new street from the harbor up to the hill, are the Government house, the court-house, Elizabeth college, the town hospital, St. Stephen's church built in 1866, the Roman Catholic Church designed by Pugin, and the new vegetable market constructed at a cost of £16,000. On the higher ground above the town is a monument in memory of the Queen's visit to the island in 1846, and on the pier there was erected in 1863 a monument to the Prince Consort by Mr. Durham, a copy of the monument in the gardens of the Horticultural Society at South Kensington. St. Sampson, which is the only port besides St. Peter Port, is situated at the eastern end of the Braye du

Val, a depression which at no distant date used to form an arm of the sea at high tides, cutting the island into two unequal parts. The harbor accommodation has been improved at St. Sampson contemporaneously with that of St. Peter Port. To the south of the latter is the strong fort of St. George's with barracks for 5000 men, and smaller forts, batteries, and martello towers are to be found on suitable points all round the coast.

By the old Guernsey laws, all the male population from sixteen to sixty are obliged to serve in the militia; but the custom of paying exemption fines has gradually become so common that the real force is very far below its nominal limit. Guernsey is both populous and wealthy, and the wealth is very evenly distributed among the people. In 1873 the assessment value of the town parish was £3,564,750, or £2262 per head, and that of the rural parishes £1,831,620, or £1233 per head. Like the neighboring part of France, Guernsey still possesses numerous traces of its early inhabitants, in the form of sepulchral caves, dolmens, and maenhirs. The most remarkable group of the second class is in the north at Ancresse. Details will be found in Mr. Lukis's paper in vol. i. of the *Archæological Journal*, and in vols. i. and viii. of the *Journal of the Archæological Association*, as well as in the special chapter in Dr. Ansted's *Channel Islands*. The island is usually identified with the Sarnia of the latter Roman writers. Its present name would appear to be a corruption of the Norse for Green Isle. For details on its history see CHANNEL ISLANDS. An account of a number of its more eminent natives, many of whom have served with high distinction in the British army, will be found in *Sarnia, or brief Memorials of many of her Sons*, Guernsey, 1862. Among the better known families are the Saumarezes, the Tuppers, and the Careys.

Besides the works referred to under CHANNEL ISLANDS, see *Documents rélatifs à l'île de Guernsey*, Guernsey, 1814; *Views of Guernsey*, with descriptive letterpress, Edinburgh, 1867; John Jacob, *Annals of the Bailiwick of Guernsey*, London, 1830; Le Marchant, *Laws and Customs of Normandy as used in Royal Court of Guernsey*.

GUERRAZZI, FRANCESCO DOMENICO (1804–1873), Italian writer and politician, was born at Leghorn, August 12, 1804. He studied law at Pisa, and happened to become acquainted there with Byron, who produced a very strong impression on his lively imagination. Having taken his degree in law, he went back to Leghorn to practise his profession, but engaged at the same time in literary pursuits. In 1827 he published his first novel, *The Battle of Benevento*, a work displaying powerful imagination and strong patriotic feeling. While exiled in 1834 to Portoferraio, on the island of Elba, he wrote *Isabella Orsini* and *The Siege of Florence*, the latter producing great enthusiasm in Italy. The two compositions which followed, *Veronica Cibo* and *The New Tartufes*, are of inferior value. In 1844 Guerrazzi was again exiled to Portoferraio. When the revolution broke out in 1848, he was named deputy, then president of the counsel of ministers, and finally, in the beginning of 1849, along with Montanelli and Mazzoni, triumvir and dictator of Tuscany, He had to expiate these few months of power by years of imprisonment and exile. He was banished first to Corsica, where he wrote *Beatrice Cenci*, *The Tower of Nonza*, and *Fides;* and then to Genoa, where he composed the *Memento Homo*, *The Hole in the Wall*, *Messer Arlotto Mainardi*, *Paolo Pellicione*, *The Italian Plutarch*, *The Lives of Andrea Doria*, *Francesco Ferruccio*, *Pasquale Paoli*, *The Siege of Rome*, and *The Ass* (L'Asino), a humorous work. When the kingdom of Italy was constituted, Guerrazzi was several times sent to parliament as deputy. Towards the end of his life he withdrew to a villa he had on the sea-shore, near Cecina, not far from Leghorn, where he wrote his novel entitled *The Dying Century*. He died there on the 25th September, 1873, and was buried in the church of Montenero, near Leghorn. His letters are being collected for publication under the direction of the poet Joseph Carducci.

See Guerrazzi's own *Apology*, Florence, 1851; Bosio, *F. D. Guerrazzi and his Works;* Do Gubernatis, *Ricordi Biografici*, Florence, 1873; and Corona, *F. D. Guerrazzi*, Biella, 1873.

GUERRERO, formerly TIXTLA, the chief town of the state of Guerrero, Mexico, is situated at an elevation of about 5000 feet in a narrow and unhealthy valley in the Sierra Madre, 28 miles from the coast and 150 miles S. W. of Mexico. Mining is carried on, but not to any great extent, and coarse cloth is manufactured. The population in 1900 was 7,497.

GUESCLIN. See DU GUESCLIN.

GUEVARA, ANTONIO DE (*c.* 1490–1545), Spanish chronicler and moralist, was a native of the province of Alava, and passed some of his earlier years at the court of Queen Isabella. In 1528 he entered the Franciscan order, and he afterwards accompanied Charles V. during his journeys and residences in Italy and in other parts of Europe. After having held successively the offices of court preacher, court historiographer, bishop of Guadix, and bishop of Mondoñedo, he died in 1545. His earliest work, entitled *Relox de principes, o Marco Aurelio*, published in 1529, and, according to its author, the fruit of eleven years' labor, is a kind of romance designed, after the manner of Xenophon's *Cyropædia*, to delineate in a somewhat ideal way for the benefit of modern sovereigns the life and character of an ancient prince distinguished for wisdom and virtue. It was very often reprinted in Spanish; and before the close of the century had also been translated into Latin, Italian, French, and English. It is difficult now to account for its extraordinary popularity,—its thought being neither just nor profound, while its style is stiff and affected. It gave rise to a literary controversy, however, of great bitterness and violence, the author having ventured without warrant to claim for it an historical character, appealing to an imaginary "manuscript in Florence." Other works of Guevara are the *Decada de los Césares*, or "Lives of the Ten Roman Emperors," in imitation of the manner of Plutarch and Suetonius; and the *Epistolas Familiares*, sometimes called the "Golden Epistles," often printed in Spain, and translated into all the principal languages of Europe. They are in reality a collection of stiff and formal essays, which have long ago fallen into merited oblivion (see Ticknor, *Hist. of Span. Lit.*, vol. ii.).

In Spanish literature occurs also the name of LUIS VELEZ DE GUEVARA (1570–1644), who is said to have written nearly 400 comedies, of which however only a few, and these of little value, have been preserved. This Guevara is chiefly noteworthy as having been the author of a prose romance entitled *El Diablo Cojuelo*, which suggested to Le Sage the ideas and materials of his *Diable Boiteux*.

GUGLIELMI. There are several Italian musicians of this name, the most celebrated of them being Pietro, born at Massa Carrara in May, 1727. He received his first musical education from his father, and afterwards studied under Durante at the Conservatorio di San Loretto, Naples. His first operatic work was produced at Turin in 1755, and the success was such as falls to the lot of few primary efforts. Guglielmi's reputation was thenceforth established, and soon his fame spread beyond the limits of his own country, so that in 1762 he was called to Dresden to conduct the celebrated opera there. He remained for some years in Germany, where his works met with much success, but the greatest triumphs were reserved for him in England. He went to London in 1772, and stayed there five years, returning to Naples in 1777. He still continued to produce operas at an astounding rate, but was unable to compete successfully with the younger masters of the day. In 1793 he became maestro di capella at St. Peter's Cathedral, and died at Rome, November 19, 1804. He was a very prolific composer, and occupies a respectable if not absolutely first-rate position among the earlier masters of Italian comic opera. There is indeed in most of his scores a vein of humor and natural gayety not surpassed by Cimarosa himself. In serious opera he was less successful. But here also he betrays at least the qualities of a competent musician. Considering the enormous number of his works, his unequal workmanship and the frequent instances of mechanical and slip-shod writing in his music need not surprise us. The following are among the most celebrated of his operas:—*I due gemelli*, *La serva inamorata*, *La pastorella nobile*, *La bella peccatrice*, *Rinaldo*, *Artasesse*, *Didone*, and *Eneo e Lavinia*. He also wrote oratorios and miscellaneous pieces of orchestral and chamber music. Of his eight sons two at least acquired fame as musicians—Pietro Carlo (1763–1817), a successful imitator of his father's operatic style, and Giacomo, an excellent singer.

GUIANA, GUYANA, or GUAYANA, an extensive territory in the north-eastern part of South America, comprehending in its widest acceptation all the extent of country

lying between the rivers Amazon and Orinoco from 3° 30′ S. to 8° 40′ N. lat., and from 50° 22′ to 68° 10′ W. long. It is bounded on the N. by the Orinoco and the Atlantic, E. by the Atlantic, S. by the rivers Negro and Amazon, and W. by the Orinoco and the Cassiquiare. Its greatest length from east to west is about 1200 miles, its greatest breadth, from the mouth of the Orinoco to the confluence of the Rio Negro with the Amazon, about 800 miles; and the estimated area is 690,000 square miles. This vast territory is divided into Brazilian (formerly Portuguese) Guiana, Venezuelan (formerly Spanish) Guiana, and Colonial Guiana. The first two divisions, comprising about five-sixths of the entire region, are claimed by or included in Brazil and Venezuela respectively; and stretching eastward from the mouth of the Orinoco towards that of the Amazon lie the territories of British, Dutch, and French Guiana, which are in that order noticed below.

Columbus in 1498 decided that the Orinoco must flow through some vast continent. Vincent Yanez Pinzon, a Spanish navigator, is believed to have first sailed up the Amazon from the coast. Vasco Nuñez landed on the coast of Guiana in 1504, but the discovery is also claimed for Diego de Ordas, one of the captains of Cortez in the conquest of Mexico in 1531. Sir Walter Raleigh ascended the Orinoco in 1595 in search of the El Dorado. The first settlement is stated to be that of some Dutch people in 1580 near the river Pomeroon. This possession was contested by the Spaniards, but in 1613 a colony of Zealanders on the banks of the Essequibo was reported in a flourishing condition. English and subsequently French colonization was attempted up the Surinam river. The English returned in 1652 to Paramaribo, and in 1662 the whole colony was granted by Charles II. to Lord Willoughby. In 1669, however, Dutch Guiana covered all the territory now divided into British, Dutch, and French. In 1712 the French attacked the settlement and exacted a contribution. In 1732 Berbice received a constitution from the states-general, and in 1763 there was a formidable insurrection of negro slaves who had been introduced from Africa. In 1781 Rodney took possession; and though the colonies were restored to Holland in 1783, they surrendered again to the British in 1796. The Dutch resumed authority in 1802, and in 1803 the proper history of British Guiana began.

I. BRITISH GUIANA, when finally acquired in 1803, and formally ceded in 1814, consisted of the three colonies, Demerara, Essequibo, and Berbice, so named after the principal rivers which drain them. These were consolidated into one colony in July, 1831. It is bounded on the N. and N. E. by the Atlantic, E. by Dutch Guiana, from which it is separated by the river Corantyn, S. by Brazil, and W. by Venezuela. It lies between 0° 40′ and 8° 40′ N. lat., and 57° and 61° W. long., and has an estimated area of 90,277 square miles, but the boundaries are still disputed by Venezuela and Brazil. An engagement, however, exists between the British and Venezuelan Governments that neither shall occupy territory claimed by both. The colony has now three divisions, called counties:—Berbice, extending from the Corantyn about 95 miles along the sea-coast; Demerara, from the Abari about 65 miles, including Georgetown, the capital; and Essequibo, from the river of that name about 120 miles to the Barima near the Orinoco mouth. There is thus a length of coast of 280 miles, with an extent inland varying from 300 to 450 miles.

Surface.—From the coast-line seaward the ocean deepens very gradually, and at low tide extensive mud-flats and sandbanks are left bare. Traced inland, this fluvio-marine deposit is found to rise to 10 or 12 feet above high-water mark, and to end at an older deposit of sand and clay beds, which forms an extensive undulating country, rising to not more than 150 feet above the sea, and stretching back to where the solid rock strata underlying it crop out. Upon the rich alluvial soil of the depressed coast-land, and for a few miles up the rivers, the sugar estates are situated. They are not only protected by dams from the sea, but, as in wet weather water rapidly accumulates in the savannahs behind, they are similarly defended on that side also. A narrow sand reef, some little distance farther inland, running parallel with the coast-line, marks a previous sea limit, and still farther back a higher range of coarse white sand probably marks a yet earlier coast. The eastern portion of the colony from the sources of the Corantyn and Essequibo is a rough inclined plane, sloping down to the sea-level from a height of about 800 feet, the most elevated part being mountainous and rising to 2000 feet above the sea. This plain extends westward and northward, broken by ranges of mountains, its western portion constituting part of the extensive savannah which stretches eastward from Brazil. Two great parallel mountain systems cross the colony from west to east, the greater being that of the Pacaraima and Merumé mountains, and the lesser including the Canucu, Cumucumu, and Coratamung mountains, while the Sierra Acarai, a densely wooded chain rising to 2500 feet, forms the southern boundary of Guiana and the watershed between the Essequibo and the tributaries of the Amazon. The Pacaraima mountains, a wide extent of rough country traversed by broad valleys, extend from about 4° to 5° 30′ N. lat., and rise to 3000 feet between the Potaro and Siparuni rivers, and to 7500 feet at Roraima mountain, which rises, a perpendicular inaccessible wall of red sandstone, at the extreme western limits of the colony. The southern portion of Pacaraima shows rugged hills and valleys strewn with rocks, but to the north, where the sandstone assumes table-shaped forms, there are dense forests, and the scenery is of extraordinary grandeur. The Imataca range lies between the Cuyuni and Barima rivers in 7° to 8° N. lat. A sandstone formation can be traced from the northern Pacaraima mountains on the west to the Corantyn on the east. Interbedded with it are three great layers of greenstone. The surface of a very large portion of the colony is composed of gneiss, which is seen in large rounded bosses in the river beds. Schist of different kinds is associated with gneiss in many localities. Quartz-porphyry and felstone occupy extensive areas over the surface of the granite and underlying the gneiss. A large proportion of the surface rock in the interior is granite. The white sand at the sandhills on the Demerara and elsewhere is very pure and well adapted for glass-making. Gold has been found about 40 miles up the Cuyuni river. Attempts to work it have met with small success, and have been complicated with questions of boundary.

Rivers.—The colony is traversed by numerous large rivers, the principal being the Essequibo, Corantyn, Mazaruni, Cuyuni, Berbice, and Demerara. The Corantyn forms the boundary between British and Dutch Guiana. It rises in 2° N. lat., 100 miles eastward of the Essequibo, flows generally northward, and falls into the Atlantic by a broad estuary in 6° N. lat., 57° W. long. It is navigable for small vessels for 150 miles from its mouth, and is remarkable for its magnificent cataracts. The Cuyuni, coming from Venezuela, runs a course of 120 miles through territory claimed as British. The Essequibo rises in the Sierra Acarai, 0° 40′ N. lat., and after a course of at least 600 miles discharges

itself into the ocean by an estuary 15 miles in width, in 7° N. lat., 58° 40′ W. long. In this estuary are a group of islands where sugar is grown, several being from 12 to 15 miles long and 3 miles broad. The principal are Hog Island, Wakenaam, and Leguan; a smaller one is named Tiger Island. The entrance of the Essequibo is difficult owing to deposits of mud and sand. Its course lies through forests of gigantic vegetation. About 43 miles from its mouth it is joined by the Mazaruni, which is itself joined by the Cuyuni at 8 miles from its mouth. The cataracts, of which one of the greatest is the King William's Cataract of Schomburgk, in 3° 14′ 35″ N. lat., put a stop to the navigation of the Essequibo by large vessels about 50 miles up. In 3° 57′ 30″ N. lat. and 58° 3′ W. long. it receives the Repununi, which has a course of 220 miles. Another large tributary is the Potaro, upon which is the celebrated Kaieteur (Old Man's) Fall, so named from an Indian legend, and discovered on April 24, 1870, by Mr. C. B. Brown of the Geological Survey, who, owing to cataracts, took a fortnight to reach the fall from the coast up the Essequibo and Potaro. This fall, in 5° 8′ N. lat. and 59° 19′ W. long., is produced by the river flowing over a sandstone and conglomerate table-land 822 feet into a deep valley below. For the first 741 feet the water falls perpendicularly, as one great continuous whitish column, circled by rainbows, into a basin below, continuing thence over a sloping cataract 88 feet in height, and through the interstices of great blocks of rock, to the river-bed below. The head of the fall is 1130 feet above the sea. The river 200 yards above the fall is 400 feet wide, and the width of the fall itself varies, according to the season, from 240 to 370 feet. The Demerara or Demerary rises probably near 5° N. lat., and after a northward course nearly parallel with the Essequibo for more than 200 miles, enters the Atlantic near 6° 50′ N. lat. and 58° 20′ W. long. It is navigable for 85 miles, and at its mouth at Georgetown is 1½ miles across. A bar, or deposit of mud and sand, prevents the entrance of large vessels at low tide. Farther east is the Berbice, whose source is probably about 3° 40′ N. lat. It is 2½ miles wide at its mouth in 6° 21′ N. lat., 57° 12′ W. long., and is navigable for 175 miles by vessels drawing 7 feet of water. The Canje creek falls into the Berbice near its mouth. Several large streams called creeks fall directly into the Atlantic between the Berbice and the Demerara. The Boerasiri creek divides the counties of Demerara and Essequibo, and between the Essequibo and the Barima are the rivers or creeks Pomeroon, Morucca, and Waini.

Climate.—The climate, especially in the interior, is healthy. The even temperature is considered suitable for pulmonary complaints; and tubercular consumption is unknown. There are no hurricanes, and gales are not frequent. Occasionally there is a long drought, but the following order of seasons is generally maintained. From the middle of April to June there is a long season of heavy rains, which decrease in July; the long dry season lasts from August to November; December and January comprise the short rainy season, and February and March the short dry season. The winds during the rains are generally westerly. In the dry seasons they blow from the ocean and modify the heat. The thermometer seldom rises above 90° or falls below 75° Fahr. At Georgetown the mean annual temperature is 81° 2′. The rainfall in 1878 was 69·94 inches, the average having been 74 inches for 1873–77.

Population.—The census of 1871 was as follows:—113,570 born in British Guiana (including 70,000 to 80,000 negroes, 10,000 born of Indian and Chinese parents, and the "colored" population), 42,681 immigrants from India, 6295 Chinese, 7925 from Madeira and Azores, 13,385 negroes from West-Indian Islands, and 9635 Europeans and others; total 193,491, exclusive of aborigines, estimated at 7000. The estimated total population on 31st December, 1901, was 278 328, and further explorations have increased the estimated number of aboriginal Indians. The aborigines are remnants of Indian tribes, such as the Arawaks, Warraus, Caribs, and many others, scattered in the interior of the country. They maintain themselves by fishing and hunting. Traces of "Indian picture-writing," or sculptured figures, have been found in some granite blocks up the Essequibo. On December 31, 1877, 22,500 East Indian immigrants were working under a five years' indenture on the estates, and 26,000 not under indenture. Since 1857, 10,315 East Indian coolies (including women and children), with savings amounting to £260,479, have availed themselves of their right to return passage. A number re-emigrate to the colony. The Indian Government supervises the emigration. In the colony an immigration department regulates labor, wages, and general treatment. About 5000 are now annually introduced. Chinese have also been introduced with and without indenture.

Vegetation.—The vegetation is most luxuriant. The interior affords an exhaustless supply of valuable timber, such as the mora and greenheart, largely used for shipbuilding. The climate insures a continuous succession of tropical flowers and fruits. Many of the trees yield gums, febrifuges, oils, and juices of more or less value, among which may be mentioned caoutchouc, and a gum called "balata," with properties intermediate between those of caoutchouc and gutta percha. The bark of the crab tree is used for tanning. The silk-cotton tree, which grows 100 feet high and 12 feet round, yields a light-gray silky cotton, used for stuffing pillows. Among the palm trees are the picturesque mountain cabbage-palm, growing to the height of 100 feet; the cocoa-nut palm; the sago palm; the eta palm, much esteemed for its beauty and fruit; and the cockarite palm, which produces the most delicate cabbago of all the palm species. The mangrove tree, 15 to 20 feet high, skirts the sea-coast. The tobacco plant grows wild, and indigenous cottons are numerous. A little rice is grown. The fruit of the plantain and banana is largely used for food, and the stems furnish fibre for paper-making. Orange, lime, guava, cashew, and pine-apple are among the fruits. Indigo used to be cultivated. Arnotto, from which the well-known dye is obtained, is indigenous; and logwood and vanilla are also found. Maize, cassava, yams, papaw tree fruit, sweet potatoes, peppers, and other productions are valuable for food or medicine. The largest of the water lilies, the *Victoria Regia*, was first discovered in Guiana.

Animals.—Among the wild animals are the tapir or bush cow, the manatee (the flesh of which is sometimes eaten), the jaguar or "tiger," three kinds of ant-bear, the sloth, opossum, armadillo, acouri (or hare), numerous monkeys, and vampires, measuring 30 inches from point to point of extended wing. The cayman, alligator, or crocodile of South America, 15 to 20 feet long, abounds in the rivers and canals. Among other reptiles are the iguana (the flesh of which is said to be suitable for eating), many lizards, and snakes (some venomous). Tortoises and turtles are common on the banks of the streams and in sandy districts of the coast. The bird, insect, and fish life of Guiana is of indescribable richness and variety.

Produce, Industries, and Commerce.—There are 120 sugar and 12 small coffee estates in the colony. Cotton was formerly exported, but the cultivation has now ceased. Coffee, the export of which in 1830 was 9½ million lb, is not now produced for the foreign market. The deep rich soil has induced large investments in the formation of sugar estates; but the industry has undergone great fluctuations. Exports in 1839, when negro apprenticeship terminated, fell from an average of 66,000 to 38,443 hhds. The equalization of the English duties on free and slave-grown sugar still further restricted cultivation, exports in 1849 being only 32,000 hhds. In 1854 matters had begun to mend. The prospect of obtaining coolie laborers from India and China caused new capital to be introduced and fresh energy employed. Cultivation was improved and extended, vacuum pans came to be more used, steam ploughs and tile draining were successfully introduced. The value of machinery imported from 1867 to 1876 was £850,000. A quantity of 2 to 3 hhds. (of about 17 cwts.) per acre is often obtained, but the average is 30 cwts. The juice expressed by the powerful rollers is about 60 per cent. of the weight of canes. The "Demerara crystals" are very popular for their purity and saccharine strength, and command high prices. The sugar exports in 1876 were 119,891 hhds., fully equal to 100,000 tons; in 1877, 111,156 hhds.; and in 1878 (a year with prolonged drought), 86,075 hhds. Nearly all this last quantity went to the United Kingdom, but 20,000 and 32,000 hhds. went to the United States in 1876 and 1877 respectively. The rum exported in 1876 was 36,000 puncheons; in 1877 it was 32,531, and in 1878, 28,752. The quantity of rum issued for consumption in the colony in 1878 was 330,392 gallons. The export of molasses (of which less is made as the quality of the sugar improves) is principally to the United States and British provinces, the quantity being 14,320, 19,862, and 17,084 casks in 1876, 1877, 1878. The same years the timber exports (nearly all to the United Kingdom) were 464,436, 357,430, and 303,693 cubic feet. The woodcutting industry, under Government license, is a considerable one, as is shown by the export of about 5 million shingles annually. Up the rivers and creeks charcoal-burning is carried on; 32,266, 35,631, and 46,746 barrels of charcoal were exported in 1876, 1877, 1878. There are 1,250,000 cocoa-nuts exported yearly. In 1853 the total value of imports was £847,183; in 1877, £2,229,908 (£1,079,898 from the United Kingdom); in 1878, £2,150,714. The exports were, in 1853,

£1,014,944; in 1877, £3,049,157 (£1,954,766 to the United Kingdom); and in 1878, £2,507,571. The tonnage, inwards and outwards, was 234,089 tons in 1853, and 519,986 tons in 1877.

Government.—The government is vested in a governor appointed by the British crown and a court of policy, originally instituted by the Dutch in 1773 for Demerara, and including Essequibo in 1789. Berbice had until 1831 a separate constitution. The unofficial members of the court were elected by a college of kiezers or electors, who were themselves elected by duly qualified inhabitants. In 1795 this college commissioned some of their own members to act with the court of policy in financial matters. This resulted in an independent body, called financial representatives, being elected by the inhabitants who were qualified to vote for kiezers. The financial representatives and the court of policy meet in annual session as the "combined court," to discuss finance and pass the annual tax-ordinance. The civil list is not permanent, being renewed every seven years. All other ordinances or local laws are passed by the court of policy,—every ordinance being subject to confirmation by the queen. The colony is divided into five electoral districts, with a total of 863 registered electors. These districts elect for life one or two kiezers, seven in all, and one or two financial representatives, six in all. When a vacancy occurs in the court of policy the seven kiezers nominate two persons, one of whom is selected by the court. There are five unofficial members chosen as above, and five official members, viz., the governor, attorney-general, Government secretary, auditor-general, and immigration agent-general. The public revenue in 1853 was £250,017, and the expenditure £236,557. In 1877 the revenue was £389,872, and in 1878, £405,092. Half of this revenue is derived from import duties, and the remainder principally from wine and spirit duties, rum duty, and retail spirit licenses. The expenditure in 1877 was £380,566, and in 1878 £417,995. The public debt in 1877 was £323,563. Public and mercantile accounts are kept in dollars (4*s.* 2*d.* sterling) and cents.

The Roman Dutch law is in force in civil cases, modified by orders in council and local ordinances; the criminal law is based on that of Great Britain, and administered in the same way, except that there is no grand jury. The supreme court consists of the chief justice and two puisne judges. Appeal in cases involving £500 and upwards lies to the privy council. There are an inferior court of civil justice, courts of admiralty, and vice-admiralty, of petty debt (conducted by stipendiary magistrates), of bail and review (of magistrates' decisions). One judge sits in the supreme criminal court; and there is an inferior criminal court. Questions of law are decided by three judges in the court of crown cases reserved. Besides a police magistrate for Georgetown, there are thirteen districts, each with a stipendiary magistrate appointed by the secretary of state.

Towns.—For a notice of Georgetown, the capital (resident population 1891, 53,156), see vol. x. p. 387. The lighthouse, with revolving light visible for many miles, is at the north end, near the mouth of the river. The lightship is 11 miles off, in 6° 56″ N. lat. and 58° 1½′ W. long. The chief town of Berbice is New Amsterdam, on the east bank of the Berbice river. It is well laid out, and has a population of 6000. The Berbice lightship is in 6° 29′ 10″ N. lat. and 57° 23′ 40″ W. long.

Religion and Education.—The diocese of Guiana was established in 1842. The official list shows—1 bishop, 1 archdeacon, 10 rectors, 14 curates, 2 incumbents, and several missionary clergymen and chaplains to institutions. The Church of England has 69 churches or chapels. The Coolie Mission Association and Diocesan Society maintain missionaries and catechists. The Church of England claims 90,000 members. The Church of Scotland has 10 ministers. The Roman Catholics also have several churches and mission stations. The Church of England receives an annual grant of £10,000 from the public revenue, the bishop's salary (£2000) being paid from imperial funds; the Church of Scotland has £5000, and the Roman Catholic Church £2500 from public revenue. There are also 14 Wesleyan Methodist ministers, a Moravian mission, and several chapels of Congregational Dissenters and others belonging to the London Missionary Society. The system of education supported by the general revenue is denominational. There are 177 schools sanctioned by the board of education. The estimate for primary education in 1879 was £29,695. The Church of England has 81 schools, exclusive of those on estates for coolies.

See Schomburgk's *British Guiana;* Martin's *British Colonies;* Dalton's *History of British Guiana,* 1855; Waterton's *Wanderings in South America,* 1852; *Geological Survey Reports;* J. G. Sawkins, "On Geology of British Guiana" in *Quarterly Journ. of Geolog. Soc.,* London, 1871; Brown's *Canoe and Camp Life in British Guiana,* 1876; Brett's *Indian Tribes of Guiana,* 1876; *Colonial Office List; British Guiana Directory;* Bennet's *British Guiana;* Boddam-Whetham's *Roraima,* 1879. (J. L. o.)

II. Dutch Guiana, or Surinam, lies to the E. of British Guiana, from which it is separated by the Corantijn or Corantyn in 57° 5′ W. long. Its coast extends for upwards of 220 miles to the mouth of the Maroni or Marowijne, which forms the boundary towards French Guiana. The Dutch claim possession of 46,060 square miles; but of this extensive area, equal to more than four times that of Holland, not more than 3230, according to Wolbers, had been explored in 1868, the colonial territory did not comprise more than 640 square miles, and the actual area under cultivation was little over two hundred. In 1875 this last was 29,852 acres (47 square miles), and in 1876, 22,180. The principal settlements have been made in the lower valley of the Surinam, or between that river and the Saramacca on the W. and the Commewijne on the E. At its mouth the Surinam is 3 miles broad, and at Paramaribo, the capital, about half a mile. Ships of from 18 to 19 feet of draught can reach the anchorage in front of the town, which has room for 100 vessels. The water is of a dirty yellow color with brown bubbles on its surface, and its current can be traced far out at sea. As yet no one has seen the source of the Surinam, but it is understood to be high up in the Tumac Humac hills. The principal tributaries are the navigable Para on the left hand and the Paulus Creek on the right, both of which join it about 6 or 7 miles above Paramaribo.[1] The Marowijne or Maroni is a much larger river than the Surinam. Its water is clear as crystal, so that stones can be distinguished at a depth of 12 feet. Unfortunately its mouth, though about 4 miles broad, is full of sand-banks, and consequently it has been less visited than might have been expected from the excellent character of the country through which it flows. The banks are high enough to confine the floods, though at Armina, about 45 miles inland, the difference of level between the dry and the rainy season is 23 feet. Between the rivers of Dutch Guiana there are remarkable cross channels available during the floods at least. The Maroni is even connected with the Corantyn on the one hand (though there is 200 miles of country between) and with the Oyapock on the other. As it communicates with the Cottica, which is in turn a tributary of the Commewijne, a boat can pass from the Maroni to Paramaribo; thence by the Sommelsdijk canal it can reach the Saramacca; and from the Saramacca it can proceed up the Coppename, and by means of the Nickerie find its way to the Corantyn.

Climate.—The climate of Surinam has long enjoyed a reputation for exceptional unhealthiness which it does not appear to deserve. Though hot and moist like a Turkish bath, it seems congenial even to the European constitution. The mean temperature of the year is 80·4° Fahr., that of the coldest month 78° and that of the warmest 99°. On the average of the eight years from 1847 to 1854 the rainfall at Monbijou is 129 inches, at Paramaribo 101, at Gelderland 108, at Groningen 91, and at Nickeric 67. According to the tables at the end of the *Jaarboek* of the *Kon Nederlandsch Meteor. Instit.* (Utrecht), the greatest quantity falls in May, June, July, September, and December. There are no endemic diseases; and though cholera, fevers, and smallpox have appeared from time to time, they are not more violent than in more temperate regions. Leprosy and elephantiasis, introduced it is believed from Barbados, are not infrequent among the negro population. The former is locally known as boassi. In 1790 there were only 7 patients in the lazaretto of Voorzoorg, but by 1797 they had increased to 300, and in 1812 to 500. A new establishment was founded at Batavia on the right bank of the Coppename in 1823. Between 1831 and 1839 an average of 103 suspected persons were examined yearly, and 46 declared infected. In 1853 there were 448 inhabitants (216 males and 232 females) in the settlement; of these however, 112 were personally free from the disease, though born and brought up among the patients.

Population.—Between 1838 and 1852 the free population of Surinam increased from 8893 (4242 males and 4651 females) to 13,193 (6709 males and 6484 females). In 1855 the total number of slaves was 31,780, of whom 27,914 (13,556 males and 14,358 females) were on the plantations and 3866 (2027 males and 1839 females) in private service. Since the abolition in 1863 many attempts have been made to augment the working population of the colony. Up till 1874 the total number of immigrants was 9049, of whom at least 2028 died. In 1870 a convention was signed between

[1] An interesting account of a voyage up the Surinam by Zimmermann, with a good map on a large scale, will be found in *Tijdschrif van het Aardrijkskundig Genootschap,* 1877.

Holland and England for the regulation of the coolie traffic, and a Dutch Government agent for Surinam was appointed at Calcutta. In 1873, 2448 immigrants arrived from British India, and 1405 in 1874; but owing to dissatisfaction on the part of England with the Dutch arrangements there were none in 1875 and 1876. In December, 1875, the whole population was stated at 51,329 (26,074 males and 25,255 females), exclusive of about 17,000 bush negroes and an uncertain number of Indians. There were 706 Europeans besides the soldiers and seamen in garrison and harbor, and the immigrants amounted to 4007 (2834 males and 1173 females), and comprised 2959 from British India, 598 from the West Indies, 352 Chinese from China, and 67 from the Dutch Indies, and 37 settlers from the Netherlands.

The bush negroes (bosch-negers) are the descendants of runaway slaves. They consist of three tribes—the Aukanians, the Saramaccans, and the Bekou or Moesinga. The first, who number from 3000 to 4000, have their chief settlements in the district near the junction of the Lava and the Tapanahoni with the Upper Marowijne, but they are also settled on the Sara Creek, on the Upper Cottika, and on the Curmotibo. The Saramaccans, who are numerically about as important, dwell between the Saramacca and the Upper Surinam. The bush negroes retain curious traces of their former connection with Christianity, though they are and consider themselves pagans. Their chief god is Gran Gado (grand-god), his wife is Maria, and his son Jesi Kist. Various minor deities are also worshipped, Ampuka the bush-god, Toni the water-god, etc. Among themselves they speak a language based on a bastard English, mingled with many Dutch, Portuguese, and native elements. The Moravian missionaries have promoted its cultivation, but it is almost certain to give way before the Dutch.[1] Pop. in 1905, 75,465.

Vegetation.—A large portion of Dutch Guiana is covered with primeval forests; but hitherto the lack of labor and cost of transport have prevented the utilization of its vast supplies of timber and cabinet wood. In some years indeed the export of these materials is actually exceeded by the import. An idea of the wealth that awaits the future prospector may be obtained from Focke's paper in the *West Indië* for 1855, where a list is given of 77 different kinds. Among the more important are the bolletrie (*Lucuma mammosum*), known in the Netherlands as paardenfleesch or horse-flesh; the bruinhart (*Vouacapoua americana*, Aubl.); the barklak (*Lecythis ollaria*), which is never attacked by worms; the geelhart (*Nectandra Rodiæi*, Schomb.); the male and female letterwood; the purpuurhart (*Copaifera bracteata*, L.); the kankan tree (*Bombax Ceiba*); the locust or courbaril, which is good both for timber work and furniture; and the kopie (*Goupia tomentosa*), largely used for flooring. Besides the banana, to which the negro is indebted for a large part of his sustenance, maize, sorghum, or Curaçoa maizo, yams, kayers (*Arum esculentum*), arrowroot, okro or gumbo, the ground nut or pienda (*Arachis hypogæa*), Spanish pepper, the antrua (*Solanum macrocarpum*), the bilambi, the zuurzak (*Anona muricata*), the pomme de Cythère (*Spondias cytherea*), and the *Mammea americana* may be mentioned from the vast list of plants of interest for their edible products.[2]

Commerce.—The great staple of Surinam industry was formerly sugar. Between 1849 and 1863 the average quantity exported was 302,857 cwts.; in 1865, two years after the emancipation of the slaves, it sank as low as 151,842 cwts.; and though it has again increased, the average between 1864 and 1874 is only 212,906 cwts. In 1876 the production was 218,115 cwts., and the export 198,274 cwts. The first cocoa from Surinam was sent to Amsterdam in 1733; but it is only since about 1855 or 1860 that it has risen into favor with the colonists. In 1876 the production was no less than 262,907 cwts., and the export 26,062 cwts. Cotton and coffee are next in order, the former having a yield in 1876 of 3806 cwts. and the latter of 245 cwts. The total exports of the colony had a value of 2,762,568 gulden or florins; of which Great Britain took 969,945, the United States 872,277, and the Netherlands 505,064. Of the total imports, valued at 3,183,252 gulden, the mother country furnished the value of 1,228,408.

Minerals.—The gold-diggings of Surinam are beginning to attract attention, the commission of 1874 having found a rich auriferous district about the Marowijne. By May, 1876, 519,000 acres of land had been rented to private persons, and a fair amount of success has attended their labors. The lead, silver, and iron ores may yet prove of importance.

Administration.—In 1865 several changes were introduced into the government of Surinam. The Code Napoléon was adopted, subject to modification from time to time by orders in council. A house of assembly was constituted, the members of which were never to be less than nine nor more than thirteen, —four being appointed by the Government and the others by the electors. The franchise was given to all citizens paying 40 gulden of taxes. Elected members serve for six years. The ordinances of the governor in council become law only if passed in the assembly and sanctioned by the king; but a royal decree may overrule the strongest opposition of the assembly, and not unfrequently the national assembly of the Netherlands disallows what has been inserted in the budget by the colonial assemblies. Besides the supreme court at Paramaribo, there are three cantonal and three district courts. The president and four pormanent members of the supreme court are nominated by the crown.[3] "The king," says Mr. Palgrave, "is almost everything;" the "Lords," in a consultative capacity, are something; and the "Commons" are merely honorary

History.—The Dutch began to visit the coasts of Guiana about 1580, and we find Adriaan ter Haaf sending vessels thither in 1599. In 1614 the states of Holland granted to any Dutch citizen four years' monopoly of any harbor or place of commerce which he might discover in that region. The first settlement, however, in Surinam (in 1630) was made by an Englishman, whose name is still preserved by Marshal's Creek. When Cayenne was taken by the French in 1664 a number of Jews who had settled in that part of Guiana removed to the Surinam district, where they soon constituted an important and flourishing community. In 1666 the English settlement was taken by storm by the Zealanders under Crijnssen or Krijnssen (the name is spelt in various ways), and 100,000 lb of sugar were exacted as a ransom. By the peace of Breda the Dutch were formally recognized as masters of Guiana, and though the Willoughbys, who considered their rights infringed, did all they could to weaken the colony and draw off a large part of its English population to Jamaica, it continued to flourish, and was confirmed to the Dutch by the treaty of Westminster in 1674. For some time the Zealanders claimed that they alone had right to the country, but it was ultimately decided that the possession was a national one in the full sense of the word. The New Dutch West Indian Company, founded in 1674 to replace the older company which had failed, received Guiana by charter from the states general in 1682.[4] In the following year the company sold one-third of their territory to the city of Amsterdam, and another third to Cornelis van Aerssens, lord of Sommelsdijk. The new owners and the company incorporated themselves as the Chartered Society of Surinam, and Sommelsdijk agreed to fill the post of governor of the colony at his own expense. The lucrative trade in slaves was retained by the West Indian Company, but the society could import them on its own account by paying a fine to the company. Sommelsdijk's rule was marked by rare wisdom and energy. He repressed and pacified the Indian tribes; he erected forts and disciplined the soldiery; he constructed the canal which still bears his name; he established a high court of justice; he introduced the cultivation of the cocoa-nut; and in short he devoted himself in all ways to the welfare of the colony. But on 17th Juno, 1688, he was massacred in a mutiny of the soldiers. The "third" which Sommelsdijk possessed was offered by his widow to William III. of England, but it was ultimately purchased by the city of Amsterdam for 700,000 fl. In 1712 the French, under Cassard, sailed up the river and put Paramaribo to ransom; and after their departure there was hot dispute between the Society and the colonists as to who should pay the indemnity. During the rest of the 18th century the chief troubles of Surinam were the bush negroes and the slaves. Peace with the Aukan negroes was made in 1760, and with the Saramaccans in 1762; but in 1776 the governor Nepveu still found it necessary to surround the colony with a military cordon against the attacks of the Bonni tribe. By the spring of 1786 pacification was complete. In 1795 the Society was abrogated, and the affairs of Surinam placed under a committee of twenty-one members. The English, who had assumed the protectorate of the colony from 1799 to 1802, took actual possession in 1804, and appointed Sir Charles Green governor. In 1807 the slave trade was abolished. At the restoration of the Dutch authority in 1815 the colonists of the district of Nickerie sought to remain under English rule, or at least to receive the right of trading with English colonies. In 1825 the privileges of the Jews were annulled, and the rights of ordinary citizens bestowed on them instead. Surinam and the West Indies were placed under a common government in 1828, but the governor was to reside

[1] Seventeen publications are mentioned by Wullschlaegel in his *Kurzgefasste Neger-Englische Grammatik* (Bautzen, 1854). Focke issued a *Neger-Englisch Woordenboek* (Leyden, 1855), and Wullschlaegel a *Deutsch Neger-Englisches Wörterbuch* (Löbau, 1865).

[2] Further information on the rich tropical flora of the colony will be found in Teenstra, *Landbouw in de Kolonie Suriname*, Groningen, 1835; Van Fermin, *Hist. Nat. de la Hollande équinoxiale*, Amsterdam, 1765; Dozy and Molkenboer, "Prodromus Floræ bryologicæ Surinamensis," in *Verhandl. van de Holl. Maatsch. der Wetensch. te Haarlem;* and A. C. Focke, "De quibusdam orchideis Surinamensibus," in Mohl and Schlechtendal's *Botan. Zeitung*, 1853.

[3] Compare Mr. Cohen's Report in Parliamentary Papers [C 1861], 1877.

[4] See the Octroy or Charter in Hartsinck, or in *Verzameling van Stukken aangaande de Surinaamsche Aangeleheden*, etc., The Hague, 1845.

at Paramaribo. In 1832 several negro slaves who had set fire to the city were publicly burned alive. The administration of Surinam was separated from that of the West Indies in 1845. Baron van Raders, who assumed the governorship in that year, had the honor of greatly improving the state of the slave-laws, and of declaring the commerce of Guiana open to all nations at peace with the Netherlands. The suppression of slavery and the organization of immigration, as already indicated, are the main movements of the recent history of the colony.

Among the older works on Surinam the first rank is held by Hartsinck's masterly *Beschrijving van Guiana of de Wilde Kust in Zuid Amerika*, 2 vols., 4to, Amsterdam, 1770. A valuable *Geschiedenis der Kolonie van Suriname*, by a number of "learned Jews," was published at Amsterdam in 1791; and it has been supplemented and so far superseded by Wolbers, *Geschiedenis van Suriname*, Amsterdam, 1861. Sketches of Surinam life are given in the form of a tale in Schaik's *De Manja. Familie Tafereel uit het Surinaamsche Volksleben*, Arnheim, 1866; and a number of excellent pictorial illustrations will be found in A. Halberstadt's *Kolonisatie van Europeanen te Suriname*, Leyden, 1872, fol. The English reader is indebted to W. G. Palgrave for a brilliant study on *Dutch Guiana*, London, 1876, reprinted from the *Contemporary Review*. See also the *Jaarboekje* of the *Letterliebende Genootschap "Oefning Kweekt Kennis,"* at Paramaribo; the *Staatkundig Jaarboekje*, published by the *Vereeniging voor de Statistiek in Nederland* (Amsterdam); and the *Surinaamsche Almanak*, published by the *Maatsch. tot Nut van't Algemeen*, Leyden and Amsterdam. (H. A. W.)

III. FRENCH GUIANA is bounded on the west by the Maroni or Marowijne, which separates it from Dutch Guiana. Towards the south and east its limits are still uncertain. According to the treaty of Utrecht in 1713 it was to be bounded towards Brazil by the river of St. Vincent Pinzon, but the identification of this river has never been officially determined.[1] The Oyapock is accepted provisionally by both countries, but the French claim that the Arouari is the real St. Vincent Pinzon, and consequently that they have a right to the country for 100 miles further south along the coast. Between the Maroni and the Oyapock the coast-line is about 130 miles. The fourteen quarters of the colony are estimated to have an area of 1,308,739 hectares, *i. e.*, about 3,233,893 acres, or 5052 square miles, nearly as much as half the area of Belgium; but if the frontier be pushed back to the watershed, the whole area of the country is 30,500 square miles.

Surface.—A considerable portion of the low coast-land of French Guiana is occupied by swamps and marshes, the most deeply submerged of which are covered with a dense growth of mangroves, and receive the name of *pripris*, while the drier stretches are occupied by the pinot or wassay palm (*Euterpe oleracea*), and are designated pinotières. In a few places, as in the Sinnamary quarter, there are peat bogs in process of formation. About 40 or 50 miles inland, where the land begins to rise, the traveller reaches the outskirts of those primeval forests which stretch back vast and vague towards the mountains. Between the narrow maritime selvage, so to speak, and the commencement of the highlands are undulating plains or savannahs. Hitherto the colony has confined itself almost exclusively to the littoral and alluvial region, with its fertile mud-banks. The savannahs are still in a state of nature; and though the earlier colonists made clearings in the highlands, they soon grew disappointed with the barrenness of the cold granitic soil. The mountains behind Guiana do not exceed 3000 or 4000 feet of elevation; the principal range indeed, the Tumac Humac, was estimated by M. Crevaux, who crossed it in 1877, at no more than 1312 feet above the sea-level. But the dense tropical forests attract so much moisture from the ocean winds that the highlands are the birthplace of a large number of rivers which in the rainy season especially pour down vast volumes of water. Upwards of twenty are counted between the Maroni and the Oyapock. United as they often are in their navigable sections by cross channels, they constitute a valuable means of communication from district to district. Omitting the Maroni already described under Dutch Guiana, the first of importance as we proceed southwards is the Mana, which is navigable for large vessels 10 miles from its mouth, and for smaller vessels 27 miles further. Passing the Sinnamary and the Kourou we next come to the Cayenne, at the mouth of which lies the island on which the colonial capital is built. About a dozen lakes, of which Mepecuen, Macari, and Mapa are the largest, have been counted in the French territory.

Climate.—The rainy season begins in November or December, and lasts till the latter part of June; but there are usually three or four weeks of good weather in March. During the rest of the year there is often hardly a drop of rain for months. At Cayenne the annual rainfall amounts on an average to from 10 to 11 feet, and it is naturally heavier in the interior. It has been calculated indeed that, if all the fluvial outlets were blocked, a single winter would be sufficient to submerge the whole colony to a depth of 15 or 16 feet. During the hotter part of the year—August, September, October—the temperature usually rises to about 86° F., but it almost never exceeds 88°; in the colder season the mean is 79°, and it seldom sinks so low as 70°. Between day and night there is very little thermometric difference. The longest day is 12 hours 18 minutes, the shortest 11 hours 42 minutes. The prevailing winds are the N.N.E. and the S.E.; and the most violent are those of the N.E. During the rainy season the winds keep between N. and E., and during the dry season between S. and E. Hurricanes are unknown. Sudden rises of the sea are occasionally experienced in November and December. Within the present century there have been three earthquakes (1821, 1843, and 1877), none of which did much damage.

Population.—The population of French Guiana consists of a few pure whites, negroes from Africa, mulattoes, coolies, a decreasing number of Indians, convicts from France and its colonies (among whom are many Arabs from Algeria), and Chinese, Hindu, and Anamite immigrants. In 1877 the fixed population was stated at 17,230, and the floating population included 2300 aboriginal Indians, a military force of 1084, 338 Government officials and ecclesiastics, 4750 workmen connected with the commerce of immigration, and 1380 convicts outside of the penitentiaries; so that in round numbers the total amounted to 27,000. Of the fixed population the males were 7972, and the females 9258. The widows were 1103, while the widowers were 298. Population in 1901, 32,910.

Vegetation.—French Guiana has a rich variety of trees, and several of them are attracting increasing attention from their economic value. The *Leguminosæ* are abundantly represented, including the gayac (*Coumarouna odorata*, Aubl.), the courbaril or locust-tree of Surinam, which grows 70 or 80 feet high without branching, the angélique (*Dicorenia paraensis*), the bois violet or amarantho (*Copaifera bracteata*), the pois sabre or oily wapa (*Eperua falcata*, Aubl.), the wacapou or épi de blé (*Andira Aubletii*, Benth.), the *Robinia Panacoco*, the Saint Martin, and the *Machærium Schomburghii* or tiger wood. To the family of the *Myrtaceæ* belong the *Psidium pomiferum* or guava, the *Couratouri guianensis*, the *Lecythis grandiflora* or monkey-pot tree of British Guiana, the *Lecythis ollaria*, and other species of *Lecythis*; to the *Sapotaceæ*, the *Mimusops Balata*, the jaune d'œuf or *Lucuma Rivicoa*, and the bartaballi or *Lucuma Bonplandii*. Of the *Laurineæ* it is enough to mention the black cedar (*Nectandra Pisi*), the taoub, the bois canelle or cinnamon wood, and several species of *Acrodiclidium*. Among the palms are the cocoa-palm, the oil-palm of Africa, and the date-palm. The timber of the courbaril, the bois violet, and the balata has been found to be of very high excellence. Caoutchouc (*Hevea guianensis*) is common in the contested territory in the south; the elemi-tree (*Icica elemigera*) and the *I. Aracouchini*, which also yields a medical resin, are abundant in the colony. Large quantities of oleaginous seeds might be collected from the yayamadou (*Virola sebifera*) and the crab-wood (*Caropa guianensis*).

The manioc is the principal source of food in French Guiana; rice is becoming an important object of cultivation; and maize, yams, arrowroot, bananas, and the bread-fruit are also known. The Guiana cocoa is excellent; coffee, introduced in 1716, is extensively grown; and vanilla is one of the common wild plants of the country. The clove-tree has been acclimatized, and in the latter years of the empire it formed a good source of wealth; the cinnamon-tree was also successfully introduced in 1772, but like that of the pepper-tree and the nutmeg its cultivation is neglected.

Minerals.—Great interest attaches to the gold of Guiana, which promises, or threatens, to modify the life of the colony. Indian traditions affirmed the presence of the precious metal, and Humboldt and Buffon agreed that the geological character of the country indicated the probability of auriferous deposits; but it was not till 1819 that Felix Couy, at the instigation of a Portuguese Indian named Paoline, discovered and opened the first "placer." In 1856 the Approuague company was formed; but, though 5762 oz. were collected between 1857 and 1860, it soon after sold its rights. The Martaroni company has been

[1] See "Memoria sobre os limites do Brasil com a Guyana Franceza," by J. Caetano da Silva in *Revista trimensal de Hist. e Geogr.*, Rio de Janeiro, 1850.

more successful. 23,342 oz. of gold were obtained in 1872; 46,044 oz., equal to 4 million francs, were exported from Cayenne in 1874; and in 1875 and 1876 the yield was 4823 oz. per month. As various ferruginous minerals are abundant in some places, it is possible that iron ores may exist.

Commerce.—The total value of the imports into French Guiana in 1871 was 5,903,413 francs; and it exported to the value of 2,556,158 francs to France, 10,600 francs to the French colonies, and 148,839 francs abroad. It is with Martinique that it stands in closest commercial relations, but the imposition in 1872 of a duty on eau de vie from that island has almost put a stop to its importation. Several small steamers maintain communication between different parts of the colony.

Convict Establishments.—It was in 1851 that Guiana was recommended to the French Government by a special commission of inquiry as a suitable place for criminal penitentiaries. In February, 1852, transportation thither was offered as a favor to the convicts then under sentence, and more than 3000 of them accepted the change. As the minister of the colonies is allowed by a decree of 1853 to send to Guiana any Asiatics or Africans who are condemned to hard labor or solitary confinement, and as it has been deemed better since 1864 to take the European convicts to New Caledonia, the actual inhabitants of the penitentiary districts are mainly negroes, Arabs, and Anamites. The principal establishments are those of Cayenne, of the three Îles du Salut, of the Kourou, and of the Maroni. The little island La Mère is reserved for the aged, the infirm, and the convalescent. At Saint Laurent on the Maroni there is almost a little town of wooden houses built on brick pillars. The convicts carry on their several trades as carpenters, tanners, bakers, etc. After two years in the colony, those whose conduct has been satisfactory are allowed to contract marriage, to send home for their families, to have a piece of ground assigned to them for cultivation, and to receive the necessary implements. A tramway has been constructed for the use of the "concessions." (See *Rev. Col. et Mar.*, 1876.)

Administration.—Besides the governor and the military commandant, the administrative personnel comprises an *ordonnateur*, a director of the interior, and a procurator-general, as well as a privy council and a director of the penitentiary service. There is a court of appeal and a tribunal of first instance, and justices of peace are appointed for each canton. Cayenne is administered by a municipal council. Religious affairs are under an apostolic prefect.

History.—According even to the French writers, the history of Guiana is little better than a series of disasters. La Ravardière, sent out in 1604 by Henry IV. to reconnoitre the country, brought back a favorable report; but the death of the king put a stop to the projects of formal colonization. In 1626 a small body of traders from Rouen settled on the Sinnamary, and in 1634 a similar band took up their quarters at Cayenne. The Compagnie du Cap Nord, founded by the people of Rouen in 1643, the Compagnie de la France Équinoxiale, established in 1645, and the second Compagnie de la France Équinoxiale, or Compagnie des Douze Seigneurs, established in 1652, were so many lamentable failures, the result of incompetence, mismanagement, and misfortune. The Compagnie des Indes Occidentales, chartered in 1664 with a monopoly of Guiana commerce for forty years, proved hardly more successful; but in 1674 the colony passed under the direct control of the crown, and the able administration of Colbert began to tell favorably on its progress. The year 1763 was marked by a terrible disaster. Choiseul, the prime minister, having obtained for himself and his cousin Praslin a concession of the country between the Kourou and the Maroni, sent out about 12,000 volunteer colonists, mainly from Alsace and Lorraine. They were landed at the mouth of the Kourou, where no preparation had been made for their reception, and where even water was not to be obtained. Mismanagement had reached its grotesquest limits; there was a shop for skates (!), and the necessary tools for tillage were wanting. By 1765 no more than 918 colonists remained alive, and these were a famished fever-stricken band. A long investigation by the parliament of Paris proved only that some one had blundered. Several minor attempts at colonization in Guiana were made in the latter part of the century; but they all seemed to suffer from the same fatal prestige of failure. During the terrible times of the Revolution band after band of political prisoners were transported to Guiana. The fate of the royalists, nearly 600 in number, who were exiled on the 18th Fructidor, was especially sad. Landed on the Sinnamary without shelter or food, two-thirds of them perished miserably. In 1800 Victor Hugues was appointed governor, and he managed to put the colony in a better state; but in 1809 his career was brought to a close by the invasion of the Portuguese and British. Though French Guiana was nominally restored to the French in 1814, it was not really surrendered by the Portuguese till 1817. In 1823, at the suggestion of M. Catineau Laroche, an attempt was made to settle a colony of French agriculturists in the basin of the Mana; but they were soon driven by fevers from the town of Nouvelle Angoulême, which they had founded. Since that date the principal facts in the history of the unfortunate country are the discovery of its gold-fields and the introduction of the convict establishments.

A detailed bibliography of French Guiana will be found in Ternaux-Compans, *Notice Historique de la Guyane française*, 1843, and in Victor de Nouvion, *Extraits des auteurs et voyageurs qui ont écrit sur la Guyane*, 1844. Among the works of the present century are—Le Chevalier, *Commission de la colonisation de la Guiane française*, 1843; Bernard, *Coup d'œil sur la situat. agricole de la Guyane française*, 1843; Motézon, *Mission de Cayenne*, 1857; Vidal, "Voy. d'expl. dans le haut Maroni," in *Rev. mar. et col.*, 1862; Gouy, *Renseign. sur la navig. des côtes et des rivières de la Guyane française*, 1865 (Dépot de la Marine); Bouyer, *Notes et Souvenirs*, 1867; Sagot, "Exploitation des forêts," in *Rev. mar. et col.*, 1868, and *Agriculture de la Guyane française*, 1874; Delteil, *Voy. chez les Indiens*, 1870; Alfred de Saint Quentin, *Introduction à l'hist. de Cayenne*, 1872; Barveaux, "L'or à la Guyane française," in *Rev. mar. et col.*, 1873; Mourié, *La Guyane française*, 1874; Crevaux, "Voy. en Guyane en 1877," in *Bull. de la Soc. de Géogr.*, 1878, and in *Tour du Monde*, 1878; *Catalogue des produits des Colonies françaises* (Exposition Univ. de 1878), 1878; and Gaffaral, *Les colonies françaises*, 1880.

GUIBERT (1053–1124), of Nogent, a theological and historical writer, who flourished at the close of the 11th and the beginning of the 12th century, was born of rich and noble parents at Clermont-en-Beauvoisis on Easter Eve, 1053. Dedicated from infancy to the service of God and the Virgin, he received his early education at the Benedictine abbey of Fley (Flaviacum) or St. Germer, in the diocese of Beauvais; there he gave himself with great zeal to study, but chiefly of the secular poets, until a severe illness brought about a crisis in his spiritual life, in consequence of which he began to fix his attention almost exclusively upon the Holy Scriptures and the writings of the fathers, especially of Augustine and Gregory the Great. About this period he was largely influenced by personal intercourse with Anselm, afterwards of Canterbury, who at that time was head of the priory of Bec in the neighborhood of St. Germer's. Encouraged by his friend he now devoted his energies to Old Testament exegesis, and wrote a commentary upon the narrative of the creation; this was followed by other literary works both in verse and in prose. In 1104, when he had completed his fiftieth year, he was chosen to be head of the abbey of Notre Dame de Nogent, and there the remainder of his life was spent in a high degree of theological and ecclesiastical activity. He died in 1124.

His works, edited by D'Achery, were first published in 1651, in one volume folio, at Paris (*Venerabilis Guiberti Abbatis B. Mariæ de Novigento Opera Omnia*); they include, besides minor works, a treatise on homiletics (*Liber quo ordine sermo fieri debeat*); ten books of *Moralia* on Genesis, begun in 1084, but not completed until 1116, composed on the model of Gregory the Great's *Moralia in Jobum;* five books of *Tropologiæ* on Hosea, Amos, and the Lamentations; a treatise on the *Incarnation*, against the Jews; four books *De Pignoribus Sanctorum*, a remarkably free criticism on the abuses of saint and relic worship; eight books of the *Historia quæ dicitur Gesta Dei per Francos, sive Historia Hierosolymitana*, a history of the first crusade, which constitutes one of our best authorities on the events with which it deals; and three books *De Vita Sua, sive Monodiarum.* See Migne's *Patrologie Latine*, vols. clvi. and clxxxiv.

GUIBERT, or Wibert (c. 1030–1100), of Ravenna, better known as the antipope Clement III., was born of noble parents in the 11th century at Parma, where, on attaining the canonical age, he entered the priesthood. During the minority of Henry, Guibert was appointed by the empress Agnes to the chancellorship of the kingdom of Italy; and in this capacity he steadfastly resisted, in the interests of the crown, the innovations of Hildebrand in relation to papal elections. For his services in this he was rewarded with the archbishopric of Ravenna, to which he was consecrated in 1073; his fidelity to Henry during the struggles which followed Hildebrand's accession to the papal throne as Gregory VII. led to his being ecclesiastically suspended in 1075. By thirty bishops of the imperialist party he was elected pope at Brixen in 1080, an election which was confirmed by the synod which Henry had convened in Rome in 1084, Guibert assuming the title of Clement III. Although it was from his hands that Henry received his coronation, Clement III. met with scant recognition from the clergy and exercised few papal functions; and his name is not enrolled in any list of popes.

He died in September, 1100, and was buried at Ravenna; by the order of Paschalis II. his ashes were afterwards disinterred and scattered to the winds. See Giesebrecht's *Kaisergeschichte*, vol. iii.

GUICCIARDINI, Francesco (1483–1540), the celebrated Italian historian and statesman, was born at Florence in the year 1483, when Marsilio Ficino held him at the font of baptism. His family was illustrious and noble; and his ancestors for many generations had held the highest posts of honor in the state, as may be seen in his own genealogical *Ricordi* (*Op. Ined.*, vol. x.). After the usual education of a boy in grammar and elementary classical studies, his father, Piero, sent him to the universities of Ferrara and Padua, where he stayed until the year 1505. The death of an uncle, who had occupied the see of Cortona with great pomp, induced the young Guicciardini to hanker after an ecclesiastical career. He already saw the scarlet of a cardinal awaiting him, and to this eminence he would assuredly have risen. His father, however, checked this ambition, declaring that, though he had five sons, he would not suffer one of them to enter the church in its then state of corruption and debasement. Guicciardini, whose motives were confessedly ambitious (see *Autobiogr. Ricordi*, *Op. Ined.*, x. p. 68), turned his attention to law, and at the age of twenty-three was appointed by the signoria of Florence to read the *Institutes* in public. Shortly afterwards he engaged himself in marriage to Maria, daughter of Alamanno de' Salviati, prompted, as he frankly tells us, by the political support which an alliance with that great family would bring him (*ib.*, x. 71). He was then practising at the bar, where he won so much distinction that the signoria, in 1512, entrusted him with an embassy to the court of Ferdinand the Catholic. Thus he entered on the real work of his life as a diplomatist and statesman. His conduct upon that legation was afterwards severely criticised; for his political antagonists accused him of betraying the true interests of the commonwealth, and using his influence for the restoration of the exiled Casa Medici to power. His Spanish correspondence with the signoria (*Op. Ined.*, vol. vi.) reveals the extraordinary power of observation and analysis which was a chief quality of his mind; and in Ferdinand, hypocritical and profoundly dissimulative, he found a proper object for his scientific study. To suppose that the young statesman learned his frigid statecraft in Spain would be perhaps too simple a solution of the problem offered by his character, and scarcely fair to the Italian proficients in perfidy. It is clear from Guicciardini's autobiographical memoirs that he was ambitious, calculating, avaricious, and power-loving from his earliest years; and in Spain he had no more than an opportunity of studying on a large scale those political vices which already ruled the minor potentates of Italy. Still the school was pregnant with instructions for so apt a pupil. Guicciardini issued from this first trial of his skill with an assured reputation for diplomatic ability, as that was understood in Italy. To unravel plots and weave counterplots; to meet treachery with fraud; to parry force with sleights of hand; to credit human nature with the basest motives, while the blackest crimes were contemplated with cold enthusiasm for their cleverness, was reckoned then the height of political sagacity. Guicciardini could play the game to perfection. In 1515 Leo X. took him into service, and made him governor of Reggio and Modena. In 1521 Parma was added to his rule, and in 1523 he was appointed viceregent of Romagna by Clement VII. These high offices rendered Guicciardini the virtual master of the papal states beyond the Apennines, during a period of great bewilderment and difficulty. The copious correspondence relating to his administration has recently been published (*Op. Ined.*, vols. vii., viii.). In 1526 Clement gave him still higher rank as lieutenant-general of the papal army. While holding this commission, he had the humiliation of witnessing from a distance the sack of Rome and the imprisonment of Clement, without being able to rouse the perfidious duke of Urbino into activity. The blame of Clement's downfall did not rest with him, for it was merely his duty to attend the camp, and keep his master informed of the proceedings of the generals (see the Correspondence, *Op. Ined.*, vols iv., v.). Yet Guicciardini's conscience accused him, for he had previously counselled the pope to declare war, as he notes in a curious letter to himself written in 1527 (*Op. Ined.*, x. 104). Clement did not, however, withdraw his confidence, and in 1531 Guicciardini was advanced to the governorship of Bologna, the most important of all the papal lord-lieutenancies (Correspondence, *Op. Ined.*, vol. ix.). This post he resigned in 1534 on the election of Paul III., preferring to follow the fortunes of the Medicean princes. It may here be noticed that though Guicciardini served three popes through a period of twenty years, or perhaps because of this, he hated the papacy with a deep and frozen bitterness, attributing the woes of Italy to the ambition of the church, and declaring he had seen enough of sacerdotal abominations to make him a Lutheran (see *Op. Ined.*, vol. i. 27, 104, 96, and *Ist. d It.*, ed Ros., ii. 218). The same discord between his private opinions and his public actions may be traced in his conduct subsequent to 1534. As a political theorist, Guicciardini believed that the best form of government was a commonwealth administered upon the type of the Venetian constitution (*Op. Ined.*, i. 6; ii. 130 *sq.*); and we have ample evidence to prove that he had judged the tyranny of the Medici at its true worth (*Op. Ined.*, vol. i. 171, on the tyrant; the whole *Storia Fiorentina* and *Reggimento di Firenze*, *ib.* i. and iii., on the Medici). Yet he did not hesitate to place his powers at the disposal of the most vicious members of that house for the enslavement of Florence. In 1527 he had been declared a rebel by the signoria on account of his well-known Medicean prejudices; and in 1530, deputed by Clement to punish the citizens after their revolt, he revenged himself with a cruelty and an avarice that were long and bitterly remembered. When, therefore, he returned to inhabit Florence in 1534, he did so as the creature of the dissolute Alessandro de' Medici. Guicciardini pushed his servility so far as to defend this infamous despot at Naples in 1535, before the bar of Charles V., from the accusations brought against him by the Florentine exiles (*Op. Ined.*, vol. ix.). He won his cause; but in the eyes of all posterity he justified the reproaches of his contemporaries, who describe him as a cruel, venal, grasping seeker after power, eager to support a despotism for the sake of honors, offices, and emoluments secured for himself by a bargain with the oppressors of his country. Varchi, Pitti, Segni, and Nardi, are unanimous upon this point; but it is only the recent publication of Guicciardini's private MSS. that has made us understand the force of their invectives. To plead loyalty or honest political conviction in defence of his Medicean partisanship is now impossible, face to face with the opinions expressed in the *Ricordi Politici* and the *Storia Fiorentina*. Like Macchiavelli, but on a lower level, Guicciardini was willing to "roll stones," or to do any dirty work for masters whom, in the depth of his soul, he detested and despised. After the murder of Duke Alessandro in 1537, Guicciardini espoused the cause of Cosimo de' Medici, a boy addicted to field sports, and unused to the game of statecraft. The wily old diplomatist hoped to rule Florence as grand vizier under this inexperienced princeling. He was mistaken, however, in his schemes, for Cosimo displayed the genius of his family for politics, and coldly dismissed his would-be lord-protector. Guicciardini retired in disgrace to his villa, where he spent his last years in the composition of the *Istoria d'Italia*. He died in 1540 without male heirs.

Guicciardini was the product of a cynical and selfish age, and his life illustrated its sordid influences. Of a cold and worldly temperament, devoid of passion, blameless in his conduct as the father of a family, faithful as the servant of his papal patrons, severe in the administration of the provinces committed to his charge, and indisputably able in his conduct of affairs, he was at the same time, and in spite of these qualities, a man whose moral nature inspires a sentiment of liveliest repugnance. It is not merely that he was ambitious, cruel, revengeful, and avaricious, for these vices have existed in men far less antipathetic than Guicciardini. Over and above those faults, which made him odious to his fellow-citizens, we trace in him a meanness that our century is less willing to condone. His phlegmatic and persistent egotism, his sacrifice of truth and honor to self-interest, his acquiescence in the worst conditions of the world, if only he could use them for his own advantage, combined with the glaring discord between his opinions and his practice, form a character which would be contemptible in our eyes were it not so sinister. The social and political decrepitude of Italy, where patriotism was unknown, and only selfishness survived of all the motives that rouse men to action, found its representative and exponent in Guicciardini. When we turn from the man to the author, the decadence of the age and race that could develop a political philosophy so arid in

its cynical despair of any good in human nature forces itself vividly upon our notice. Guicciardini seems to glory in his disillusionment, and uses his vast intellectual ability for the analysis of the corruption he had helped to make incurable. If one single treatise of that century should be chosen to represent the spirit of the Italian people in the last phase of the Renaissance, the historian might hesitate between the *Principe* of Macchiavelli and the *Ricordi Politici* of Guicciardini. The latter is perhaps preferable to the former on the score of comprehensiveness. It is, moreover, more exactly adequate to the actual situation, for the *Principe* has a divine spark of patriotism yet lingering in the cinders of its frigid science, an idealistic enthusiasm surviving in its moral aberrations; whereas a great Italian critic of this decade has justly described the *Ricordi* as "Italian corruption codified and elevated to a rule of life." Guicciardini is, however, better known as the author of the *Storia d'Italia*, that vast and detailed picture of his country's sufferings between the years 1494 and 1532. Judging him by this masterpiece of scientific history, he deserves less commendation as a writer than as a thinker and an analyst. The style is wearisome and prolix, attaining to precision at the expense of circumlocution, and setting forth the smallest particulars with the same distinctness as the main features of the narrative. The whole tangled skein of Italian politics, in that involved and stormy period, is unravelled with a patience and an insight that are above praise. It is the crowning merit of the author that he never ceases to be an impartial spectator,—a cold and curious critic. We might compare him to an anatomist, with knife and scalpel dissecting the dead body of Italy, and pointing out the symptoms of her manifold diseases with the indifferent analysis of one who has no moral sensibility. This want of feeling, while it renders Guicciardini a model for the scientific student, has impaired the interest of his history. Though he lived through that agony of the Italian people, he does not seem to be aware that he is writing a great historical tragedy. He takes as much pains in laying bare the trifling causes of a petty war with Pisa as in probing the deep-seated ulcer of the papacy. Nor is he capable of painting the events in which he took a part, in their totality as a drama. Whatever he touches, lies already dead on the dissecting table, and his skill is that of the analytical pathologist. Consequently, he fails to understand the essential magnitude of the task, or to appreciate the vital vigor of the forces contending in Europe for mastery. This is very noticeable in what he writes about the Reformation. Notwithstanding these defects, inevitable in a writer of Guicciardini's temperament, the *Storia d'Italia* was undoubtedly the greatest historical work that had appeared since the beginning of the modern era. It remains the most solid monument of the Italian reason in the 16th century, the final triumph of that Florentine school of philosophical historians which numbered Macchiavelli and Vettori, Segni, Pitti, Nardi, Nerli, Varchi, and Giannotti. Up to the year 1857 the fame of Guicciardini as a writer, and the estimation of him as a man, depended almost entirely upon the *History of Italy*, and on a few ill-edited extracts from his aphorisms. At that date his representatives, the Counts Piero and Luigi Guicciardini, opened their family archives, and committed to Signor Giuseppe Canestrini the publication of his hitherto inedited MSS. in ten important volumes. The vast mass of documents and finished literary work thus given to the world has thrown a flood of light upon Guicciardini, whether we consider him as author or as citizen. It has raised his reputation as a political philosopher into the first rank, where he now disputes the place of intellectual supremacy with his friend Macchiavelli; but it has colored our moral judgment of his character and conduct with darker dyes. From the stores of valuable materials contained in those ten volumes, it will be enough here to cite (1) the *Ricordi Politici*, already noticed, consisting of about 400 aphorisms on political and social topics; (2) the observations on Macchiavelli's *Discorsi*, which bring into remarkable relief the views of Italy's two great theorists on statecraft in the 16th century, and show that Guicciardini regarded Macchiavelli somewhat as an amiable visionary or political enthusiast; (3) the *Storia Fiorentina*, an early work of the author, distinguished by its animation of style, brilliancy of portraiture, and liberality of judgment; and (4) the *Dialogo del Reggimento di Firenze*, also in all probability an early work, in which the various forms of government suited to an Italian commonwealth are discussed with infinite subtlety, contrasted, and illustrated from the vicissitudes of Florence up to the year 1494. To these may be added a series of short essays, entitled *Discorsi Politici*, composed during Guicciardini's Spanish legation. It is only after a careful perusal of these minor works that the student of history may claim to have comprehended Guicciardini, and may feel that he brings with him to the consideration of the *Storia d'Italia* the requisite knowledge of the author's private thoughts and jealously guarded opinions. Indeed, it may be confidently affirmed that those who desire to gain an insight into the true principles and feelings of the men who made and wrote history in the 16th century will find it here far more than in the work designed for publication by the writer. Taken in combination with Macchiavelli's treatises, the *Opere Inedite* furnish a comprehensive body of Italian political philosophy anterior to the date of Fra Paolo Sarpi.

The student may be referred to Rosini's edition of the *Storia d'Italia*, Pisa, 1819, 10 vols., and to the *Opere Inedite*, in 10 vols., published at Florence, 1857. These two books place him in possession of all that is extant of Guicciardini. (J. A. S.)

GUIDI, Carlo Alessandro (1650–1712), Italian lyric poet, was born at Pavia in 1650. As chief founder of the well-known Roman academy called "L'Arcadia," he had a considerable share in the reform of Italian poetry, corrupted at that time by the extravagance and bad taste of the poets Marini and Achillini and their school. The poet Guidi and the critic and jurisconsult Gravina checked this evil by their influence and example. The genius of Guidi was lyric in the highest degree; his songs are written with singular force, and charm the reader, in spite of touches of bombast. His most celebrated song is that entitled *Alla Fortuna* (To Fortune), which certainly is one of the most beautiful pieces of poetry of the 17th century. Guidi was squint-eyed, humpbacked, and of a delicate constitution, but possessed undoubted literary ability. His poems were printed at Parma in 1671, and at Rome in 1704. In 1681 he published at Parma his lyric tragedy *Amalasunta in Italy*, and two pastoral dramas *Daphne* and *Endymion*. The last had the honor of being mentioned as a model by the critic Gravina, in his treatise on poetry. Less fortunate was Guidi's poetical version of the six homilies of Pope Clement XI., first as having been severely criticised by the satirist Settano, and next as having proved to be the indirect cause of the author's death. A splendid edition of this version had been printed in 1712, and, the pope being then in San Gandolfo, Guidi went there to present him with a copy. On the way he found out a serious typographical error, which he took so much to heart that he was seized with an apoplectic fit at Frascati and died on the spot. Guidi was honored with the special protection of Ranuccio II., duke of Parma, and of Queen Christina of Sweden.

GUIDICCIONI, Giovanni, one of the best Italian poets of the first half of the 16th century, was born at Lucca in 1480, and died at Macerata in 1541. He occupied a high position, being bishop of Fossombrone and president of Romagna. The latter office nearly cost him his life; a murderer attempted to kill him, and had already touched his breast with his dagger when, conquered by the resolute calmness of the prelate, he threw away the weapon and fell at his feet, asking forgiveness. The *Rime* and *Letters* of Guidiccioni are models of elegant and natural Italian style. The best editions are those of Genoa (1749), Bergamo (1753), and that recently published at Florence.

GUIDO of Arezzo, an Italian monk of the 11th century, has by many been called the father of modern music, and a portrait of him in the refectory of the monastery of Avellana bears the inscription "Beatus Guido, inventor musicæ." Although these statements are manifestly exaggerated, it is none the less true that Guido's reforms mark an enormous progress in the notation as well as in the teaching of music. Of his life little is known, and that little is chiefly derived from the dedicatory letters prefixed to two of his treatises and addressed respectively to Bishop Theodald (not Theobald, as Burney writes the name) of Arezzo, and Michael, a monk of Pomposa and Guido's pupil and friend. Occasional references to the celebrated musician in the works of his contemporaries are, however, by no means rare, and from these it may be conjectured with all but absolute certainty that Guido was born in the last decade of the 10th century. The place of his birth is, beyond a doubt, Arezzo; for on the title-page of all his works he is styled *Guido Aretinus*, or simply *Aretinus*. At

his first appearance in history Guido was a monk in the Benedictine monastery of Pomposa, and it was there that he invented his educational method, by means of which, according to his own statement, a pupil might learn within five months what formerly it would have taken him ten years to acquire. Envy and jealousy, however, were his only reward, and by these he was compelled to leave his monastery—"inde est, quod me vides prolixis finibus exulatum," as he says himself in the second of the letters above referred to. According to one account, he travelled as far as Bremen, called there by Archbishop Hermann in order to reform the musical service. But this statement has been doubted, for chronological and other reasons. Certain it is that not long after his flight from Pomposa Guido was living at Arezzo, and it was here that, about 1030, he received an invitation to Rome from Pope John XIX. He obeyed the summons, and the pope himself became his first and apparently one of his most proficient pupils. But in spite of his success Guido could not be induced to remain in Rome, the insalubrious air of which seems to have affected his health. In Rome he met again his former superior, the abbot of Pomposa, who seems to have repented of his conduct towards Guido, and to have induced him to return to Pomposa; and here all authentic records of Guido's life cease. We only know that he died, on May 17, 1050, as prior of Avellana, a monastery of the Camaldulians; such at least is the statement of the chroniclers of that order. It ought, however, to be added that the Camaldulians claim the celebrated musician as wholly their own, and altogether deny his connection with the Benedictines. It is quite in accordance with the semi-mythical character of Guido's life that a great many inventions belonging to earlier as well as to later times have been attributed to him, in the same way as Charlemagne, Arthur, and Roland have been made responsible for the deeds and exploits of other kings and heroes. His eulogists declare that before him church music was in a state of utter barbarism, wholly ignoring the achievements of Gregory the Great, Hucbald, and others. The notation of music by means of the *neumæ* also, although very imperfect for practical purposes, at any rate served to give permanence to the composer's thoughts. There is, however, no doubt that in the latter respect Guido's method shows an enormous progress. It was he who invented, or at least for the first time systematically used, the lines of the staff, and the intervals or *spatia* between them, and thus fixed the principle of modern notation; and the value of this innovation for educational and general artistic purposes cannot be overrated. There is also little doubt that the names of the first six notes of the scale, *ut, re, mi, fa, sol, la,* still in use among Romance nations, were introduced by Guido, although he seems to have used them in a relative rather than in an absolute sense. It is well known that these words are the first syllables of six lines of a hymn addressed to St. John the Baptist, which may be given here:—

Ut queant laxis *re*sonare fibris
*Mi*ra gestorum *fa*muli tuorum,
*Sol*ve polluti *la*bii reatum,
Sancte Joannes.

In addition to this Guido is generally credited with the introduction of the F clef. But perhaps more important than all this is the thoroughly practical tone which Guido assumes in his theoretical writings, and which differs greatly from the clumsy scholasticism of his contemporaries and predecessors.

The most important of Guido's treatises, and those which are generally acknowledged to be authentic, are *Micrologus Guidonis de disciplina artis musicæ,* dedicated to Bishop Theodald of Arezzo, and comprising a complete theory of music, in 20 chapters; *Musicæ Guidonis regulæ rhythmicæ in antiphonarii sui prologum prolatæ,* written in trochaic decasyllabics of anything but classical structure; *Aliæ Guidonis regulæ de ignoto cantu, identidem in antiphonarii sui prologum prolatæ;* and the *Epistola Guidonis Michaeli monacho de ignoto cantu,* already referred to. These are published in the second volume of Gerbert's *Scriptores ecclesiastici de musica sacra.* A very important manuscript unknown to Gerbert (the *Codex Bibliothecæ Uticensis,* in the Paris library) contains, besides minor treatises, an antiphonarium and gradual undoubtedly belonging to Guido. A comprehensive but very uncritical life of Guido has been written by Luigi Angeloni (*Sopra la vita, etc., di Guido d'Arezzo*). Of infinitely greater importance are the studies on the subject by Herr Kiesewetter and by M. Bottée de Toulmon. Burney's *General History of Music,* and Fétis's *Biographie des Musiciens* should also be consulted. A comprehensive and admirable account of Guido's life and work by Dr. W. Langhans may be found in the fourth volume of Mendel's *Musikalisches Conversations-Lexikon.*

GUIDO RENI. See Reni.

GUIDO OF SIENA. The name of this painter is of considerable interest in the history of art, on the ground that, if certain assumptions regarding him could be accepted as true, he would be entitled to share with Cimabue, or rather indeed to supersede him in, the honor of having given the first onward impulse to the art of painting. The case stands thus. In the church of S. Domenico in Siena is a large painting of the Virgin and Child enthroned, with six angels above, and in the Benedictine convent of the same city is a triangular pinnacle, once a portion of the same composition, representing the Saviour in benediction, with two angels; the entire work was originally a triptych, but is not so now. The principal section of this picture has a rhymed Latin inscription, giving the painter's name as Gu . . . o de Senis, with the date 1221: the genuineness of the inscription is not, however, free from doubt. In the general treatment of the picture there is nothing to distinguish it particularly from other works of the same early period; but the heads of the Virgin and Child are indisputably very superior, in natural character and graceful dignity, to anything to be found anterior to Cimabue. The question therefore arises, Are these heads really the work of a man who painted in 1221? The best informed connoisseurship of recent years (see especially the discussion of the matter in Messrs. Crowe and Cavalcaselle's work, vol. i.) pronounces in the negative, concluding that the heads are repainted, and are, as they now stand, due to some artist of the 14th century, perhaps Ugolino da Siena; thus the claims of Cimabue would remain undisturbed and in their pristine vigor. Beyond this, little is known of Guido da Siena. There is in the Academy of Siena a picture assigned to him, a half-figure of the Virgin and Child, with two angels, dating probably between 1250 and 1300; also in the church of S. Bernardino in the same city a Madonna dated 1262. Milanesi thinks that the work in S. Domenico is due to Guido Graziani, of whom no other record remains earlier than 1278, when he is mentioned as the painter of a banner. Guido da Siena appears always to have painted on panel, not in fresco on the wall. He has been termed, very dubiously, a pupil of Pietrolino, and the master of Diotisalvi, Mino da Turrita, and Berlinghieri da Lucca.

GUIENNE, an old French province, whose name until the 10th century was Aquitania, and whose history until it came into the possession of England in 1152 is given under the heading Aquitania. It was bounded by the Pyrences, Languedoc, Auvergne, Angoumois, Saintonge, and the sea of Gascony; and out of it are now formed the departments of Gironde, Dordogne, Lot, Aveyron, Lot-et-Garonne, Tarn, Landes, Gers, Upper Pyrenees, Ariége, and Lower Pyrenees. The chief town was Bordeaux. Soon after it was joined to the English crown the nobles twice revolted, but were each time subdued, and in 1169 Henry II. of England bequeathed it to his son Richard (Cœur de Lion), who after quelling all symptoms of revolt added in 1186 and 1188 Toulouse and Rochelle to his French possessions. In 1196 he bequeathed it to his nephew Otto of Brunswick, but he resumed its possession in 1198, when Otto was chosen king of Germany. After the death of Richard in 1199, his mother Eleanor retained possession of it during her lifetime. It was reconquered by the French in the reign of Edward I. of England, but at the peace of 1303 it was again ceded to the English, with whom it remained till 1451, when it was conquered and finally united to France by Charles VII. In 1469 Louis IX. gave it in exchange for Champagne and Brie to his brother the duke of Berri, after whose death in 1472 it was again united to the French crown.

GUIGNES, Joseph de (1721–1800), a French Orientalist, born at Pontoise October 19, 1721, became in his fifteenth year a student of Oriental languages, and especially of Chinese, at the Collége Royal under the celebrated Fourmont, whom in 1745 he succeeded at the Royal Library as secretary interpreter of the Eastern languages. A *Mémoire Historique sur l'Origine des Huns et des Turcs,* published by De Guignes in 1748, having brought his name with some prominence before the learned world, he was admitted a member of the Royal Society of London in 1752 and an associate of the French Academy of Inscriptions in 1754. Two years later he gave to the world the first two volumes

of his learned and laborious *Histoire Générale des Huns, des Mongoles, des Turcs, et des autres Tartares occidentaux;* and in 1757 he was appointed to succeed Jault in the chair of Syriac at the Collége Royal. The completion of the *Histoire* by the publication of the three remaining volumes in 1758 was followed in 1759 by the publication of a *Mémoire* in which he propounded and endeavored to prove the untenable and absurd theory that the Chinese nation had originated in Egyptian colonization, an opinion to which, in spite of every argument, he to the last obstinately clung. To its support, as also to the further elucidation of the chronology and arrangement of his *Histoire*, which had been, not without some justice, unfavorably criticised, he devoted several learned papers which are to be found in the *Mémoires* of the Academy of Inscriptions; and among his other literary labors, an improved edition of an old translation of the *Shooking* is worthy of special mention. The Revolution, while permitting De Guignes to retain some insignificant pensions which had been conferred upon him, deprived him of various posts, such as those of keeper of the antiquities in the Louvre and editor of the *Journals des Savans*, on which he was chiefly dependent for his income; and his later years are said to have brought to him considerable personal hardship, from which his sole refuge was in redoubled application to study. He died at Paris, March 19, 1800. The *Histoire* had been translated into German by Dähnert (1768–71). De Guignes left a son, Christian Louis Joseph (1759–1845), who, after learning Chinese from his father, went as consul to Canton, where he spent seventeen years. On his return to France he was charged by the Government with the work of preparing a Chinese-French-Latin dictionary. Though bearing his name alone on the title page (1813), it was in reality only a new edition of the work of Glemona. He was also the author of a large work of travels (*Voyages à Pékin, Manille, et l'Île de France*, 1808).

GUILD. The spirit of association has in all ages induced men to join together for the pleasures of mutual enjoyment or for the attainment of some common purpose for which the support of numbers was necessary. The idea has taken shape in various ways, influenced by the temperament of race, the policy of Governments, the social condition of classes, or the need for a special object. Independently of the organization of peoples, of their constitution into towns, provinces, and states as units in a system, whether of self-government or of imposed government,—independently too of those great associations or brotherhoods, the church, the orders of knighthood, the greater and lesser monastic orders, and secret societies,—there is a third kind of association upon a basis distinct from these. The public welfare of a community within certain territorial limits is the great object of Governments, local or imperial; the pursuit of some great moral, religious, or equitable thought, touching the hearts of men in general without regard to nation, was the animating principle of the chivalric and religious orders; but when men began to form themselves into *guilds*, the benefit of each one in his individual and social capacity was concerned, naturally confined within the bounds of neighborhood. A guild was a voluntary association of those living near together who joined for a common purpose, paying contributions, worshipping together, feasting together periodically, helping one another in sickness and poverty, and frequently united for the pursuit of a special object.

The true history of these institutions has been till recently unnoticed, their value and importance, especially in connection with the life of towns and villages, having been but imperfectly investigated or understood. Guilds have, however, been numerous, and their influence most important, in Europe from an early period; they attained their highest prosperity and development in the Teutonic countries, and especially in England during the Middle Ages, and they have been widely spread among the Romance nations.

The meaning of the word *guild* or *gild* is closely connected with the origin of the institution. *Gild* or *geld* was Old English for a set payment or contribution, from *zeldan* or *zyldan*, to pay (whence also the present *yield*); the primary meaning was payment, and the company of those who paid became known by this chief title to membership. There are also *gilde*, Danish and Low German, in the sense of a contributory company of this kind; *gjalda* and *gildi*, Icelandic, a payment, and *gildi*, also a banquet. The word therefore, thus derived, is better spelt (as most authorities have it) without the *u*; a color is, however, given for the ordinary modern form *guild*, by deriving it (as Wedgwood, *English Etymology*) from the Welsh or Breton *gouil*, a feast or holiday, *gwylad*, keeping a festival.

The essential principle of the guild is the banding together for mutual help, mutual enjoyment, and mutual encouragement in good endeavor. The spirit which directed itself to the inner business and life of each society and its members is the true mark, in some degree, of all bodies, ancient or modern, that can claim the character of guilds. The peace guild of the North in the 10th century had this character in common with the great trading guild of the 13th and 14th centuries, or the little social or religious guild of an English country village of a century later.

Some German scholars find the origin of the first guilds in the banquets and sacrificial assemblies of the heathen German tribes. Wilda, Dr. L. Brentano, and others, connecting these with what is known of the importance of family relations among the Teutonic nations, find in the family union the germ from which the guild was developed, and show that when Christianity was brought from the south of Europe "the spirit of association received a mighty impulse, and the gilds spread themselves rapidly under the influence of Christian doctrine" (Brentano). It is maintained by others that the guilds have sprung from the *collegia*, in those countries where the Romans bore sway.

The Romans exercised the right of association from early times; it is attributed to Numa that he encouraged the formation of craft guilds, of which Plutarch enumerates nine; there also existed early religious societies among them. Exercised voluntarily under the republic, this right became crippled under the empire, and the *collegia* were obliged to seek authorization from the state for the narrower objects to which the imperial decrees attempted to limit them. These societies were numerous not only at Rome, but throughout the empire, especially in the East, in Italy, and in Gaul; a large number were trade corporations, devoted to the interest of their crafts; others were united for good-fellowship, religion, and many especially to provide for burial. In the provinces, besides merchants and others, the highest persons were glad at times to belong to them; those in Rome under the empire appear to have consisted principally of workmen, freedmen, slaves, and persons of the humbler classes. All appear to have had the same general features; they chose their own masters and officers, made rules for self-government, paid contributions to a common fund, met and feasted together at stated periods, —the freedom of social intercourse being particularly appreciated among the poorer companies. They formed rules for good behavior at table, and admitted women as members; they "affirmed their existence by a common worship," choosing a patron god. From these and other resemblances Mr. H. C. Coote contends that there is an identity between the Roman *collegia* and the guilds of Saxon growth; and M. Raynouard was an advocate of a similar descent in France and Italy. But though analogous in many respects, as far as is known they lacked the essential element of the guild, that of mutual help in sickness and poverty; the soldiers' colleges, formed in spite of the law which forbade them, approach the nearest to this character, in providing their members with travelling expenses and retiring pensions. The evidence against the connection between the *collegium* and the guild is regarded by the ablest German writers who have investigated the subject as conclusive, but this interesting historical question has not yet been fully worked out.[1]

The Greeks also, in the 2d and 3d centuries B. C., had their associations of the same kind, called *Eranoi* or *Thiasoi*, which were numerous at Rhodes, in the islands of the Archipelago, at the Piræus, and in other important places. These societies partook more nearly of the character of the mediæval guilds than did the Roman; the members paid contributions to a general fund, aided one another in necessity, provided for funerals, met in assembly to deliberate on their affairs, and celebrated feasts and religious sacrifices in common. Strict rules against disorderly conduct were to be enforced by fine; he who did not pay his yearly quota to the society was excluded, unless he could show good cause of poverty or sickness. Women could be members, and were admitted to the meetings. Some of these so-

[1] For a valuable sketch of the *Collegia*, including trade-guilds and burial-guilds, see "Les Sociétés ouvrières à Rome," by Gaston Boissier, *Revue des Deux Mondes*, December, 1871; also "The Friendly Societies of Antiquity," by H. Tompkins, *Oddfellows' Magazine*, April, 1868, and the article CLUB.

cieties concerned themselves with religion, others with politics or commerce; in the cause of liberal as opposed to official religion, they appear to have done good service.

It is perhaps of little use attempting to ascribe to any one country or race the special initiative of these institutions, any more than it would be to say that the custom of men to congregate in towns originated with this or that nation. Human nature is the same everywhere, and two motives induce men to join together:—weakness, seeking the power of numbers for resisting oppression, or for mutual assistance; and the affinity which those pursuing the same occupation and possessing the same interests have for each other. These motives are sufficient to account for the existence of the *Eranoi* in Greece, contemporary with the *Collegia* of the Romans; they are sufficient to explain why, although the *collegia opificum*, or artisans' guilds, are found as late as the code of Justinian, and that 50 or 60 years later, in the 6th century, we have record of a soap-makers' craft in Naples (Letter of Pope Gregory the Great, lib. x. epist. 26; Migne's *Pat. Curs.*, vol. lxxvii.), the guilds in the towns of Italy should begin a new life in the 10th century (Hegel); they can explain why in England we find from the 7th to the 10th century other guilds actively in existence, while in Norway they were instituted in the 11th century. These societies "may thus have one history in China, another in India, another in Greece or Rome, another in the Europe of the Middle Ages; the like needs will require the like kinds of help, and develop institutions which, amid whatever diversities of outward garb, will substantially fulfil the same ends" (J. M. Ludlow).

In the Middle Ages guilds are recognized as belonging to three or four classes. In the north of Europe the *frith* or *peace-guild* was an important form, widely spread in early times. These were associations for defence, based upon mutual obligations, "sworn communities for the protection of right and the preservation of liberty;" we see traces of them in England from the laws of Ina (7th century) down to the "Dooms" of London in Athelstan's time (10th century). These statutes of the old London peace-guild are thus shortly described by Prof. Stubbs:—

> "A monthly meeting is directed, at which there is to be bytt-fylling and a refection, the remains of which are to be bestowed in alms: on the death of a member each brother gives a loaf, and sings or pays for the singing of fifty psalms. . . . Each member pays fourpence for common purposes, towards a sort of insurance fund from which the guild makes good the losses of members, and a contribution of a shilling towards the pursuit of the thief. The members are arranged in bodies of ten, one of whom is the head-man; these again are classed in tens under a common leader, who with the other head-men acts as treasurer and adviser of the hundred members."

The early English recognized the responsibility of the guild for the actions of its members and their mutual liability,—the fundamental principle of English institutions for keeping the peace; besides this, the rules still exist of Saxon guilds at Abbotsbury, Woodbury, Cambridge, and Exeter, and show by the many points in common with the social guilds of later English growth whence these derived their descent. Abroad, the frith guilds in the 11th and 12th centuries extended over the continent; one of the most remarkable was founded at Roeskild, under king Canute, for the suppression of the piracy of the vikings. Others, as in Schleswig, Artois, Flensburg, etc., joined for hindering violence and maintaining peace, by all means that law and custom allowed, even against kings. These guilds became of such importance that in many places their law grew to be that of the *commune* or town (see BOROUGH). In France the great development of town governments at this period was frequently but the acknowledgment of an already existing defensive guild, or of the important merchant or craft guilds. At Montpellier and Paris, in the beginning of the 13th century, the trade guilds took part in the watch and ward of the city, and thus were a recognized part of the *commune*. The same was the case in London in early times.[1] Even as late as the 15th century a guild was founded at Ghent, composed of the culverineers, arquebusiers, and gunners, in order to teach the burgesses the use of fircarms, so as to be able to defend the town or suppress troubles. It became the chief guild of the city, had public festivities, admitted women as "consœurs," and possessed many of the features of both peace and social guilds.

In the Frankish empire guilds were numerous for defence, for conviviality, and for religious and social duties, among the serfs and the clergy as well as others; but under Charlemagne and his successors they suffered great oppression, and were persecuted by both ecclesiastical and secular authorities. In later times the clergy formed special societies called *Guilds of Kalenders*, so named from their meeting day having originally been on the kalends of each month (Brentano); these were to be found in many towns on the Continent, sometimes we read of the major and minor guilds for the higher and lower clergy. The only company that is known to have partaken of this character in England was the ancient Guild of the Kalenders at Bristol, which kept the records of that town and other places, and in its later years supported a school for Jews.

A class of guilds widely spread in the Middle Ages, especially in England, were those which have been distinguished by the name of *Social* (Toulmin Smith) or *Religious* (Brentano). These were the small and numerous societies that sprung up all over the country in every village, in small or large towns, at different times as the need arose, or for good neighborhood's sake. Their objects included "not only devotions and orisons, but also every exercise of Christian charity, and therefore, above all things, mutual assistance of the gild-brothers in every exigency, especially in old age, in sickness, in cases of impoverishment,—if not brought on by their own folly,—and of wrongful imprisonment, in losses by fire, water, or shipwreck, aid by loans, provision of work, and lastly, the burial of the dead. It included further the assistance of the poor and sick, and the visitation and comfort of prisoners not belonging to the gild" (Brentano). These societies were composed of men and women of all ranks, and when, as in some instances, they grew into wealth and popularity, kings and princes did not disdain to become guild-brethren. Henry IV. and Henry VI. were members of the guild of the Trinity at Coventry; Henry VIII. and his queen were members of the guild of St. Barbara, of St. Katherine's church next the Tower, London. Another prince belonged to the famous guild of St. George at Norwich. One guild, however, who said they were "of the rank of common and middling folks," would not admit even a mayor or a bailiff.

Each member took an oath, and paid an admission fee and yearly contribution; they held regular business meetings or "morn-speech," and had an annual "guild-day." Every guild had its livery, which the members were expected to wear at funerals, feasts, etc.; and they had strict rules for good life and behavior. The little parochial guilds met in a room or in members' houses; if the guild was rich enough it had a hall or "guild-house;" legacies and gifts were made to them, and they lent out of their stock to poor members, or devoted it to some public or charitable object. Schools and churches were founded or helped by these private guilds, as some of the colleges at Cambridge, schools at Coventry, Worcester, Brayles, Sleaford, Ludlow, Bristol, and elsewhere; forty guilds of Bodmin (of which only five were craft guilds) joined in the repair of the church there. Bridges and town-walls were repaired, both in England and in France—in which latter country M. Giry finds some relics of these social guilds. The performing of miracle and other plays, setting out of pageants, and providing of minstrels were undertaken by many of the social as well as by the craft guilds, and in many towns formed an important adjunct to the municipal proceedings, as at Coventry, York, Durham, Norwich, etc.; the Lord Mayor's show of London owes its origin to this custom.[2]

These local social guilds were very numerous in England and in the Teutonic countries; it is believed that they were so in France, but little is known of them elsewhere. There were 50 such guilds in the county of Cambridge, 909 in Norfolk, 42 in Bodmin, 80 in Cologne, 70 at Lübeck, etc.

At the time of the Reformation these guilds were abolished in Protestant countries, under pretence of their being superstitious foundations; in Denmark and North Germany their property was devoted to public service, but in Eng-

[1] The custom of "setting out the watch," or the "marching watch," in London, Bristol, Worcester, etc., on midsummer eve, originated in the part taken in the defence of the city by the trade guilds or companies of those places; it was a kind of "military muster" (Herbert).

[2] Probably the numerous societies in France and Flanders of the 12th and 13th centuries for keeping the poetic and musical foundation of *Le Feste de Pui* belonged to the class of social guilds. One of them was set up in London (Riley's *Liber Custumarum*)

land it was handed over to the king and his courtiers, their guild-halls became poor-houses, their pageants were laid aside. A very few of these societies escaped; St. George's guild at Norwich continued to live on many years.

Wickliffe, in the 14th century, had complained of the abuses among the guilds, including those of trades. In 1389 returns were made into Chancery of the social and other guilds in England; these, though imperfect, give a valuable body of details, and draw the distinction between the two great classes of social and trade guilds. The trade guilds have in all countries attracted more attention than the rest, on account of their wealth and importance; they are of two orders, *guilds-merchant* and *craft-guilds*. The guild-merchant arose in this way; the same men who in the growth of towns became citizens by reason of possessing town-land, frequently were also traders; the uncertain state of society in early times naturally caused them to unite for protection of their trade interests in a *gilda mercatoria* which made internal laws akin to those of other guilds; the success of these private interests enlarged their importance; and when the towns and boroughs obtained confirmation of their municipal life by charter, they took care to have it included that the men of the place should also have their guild-merchant.[1] Thus these guilds obtained the recognition of the state; in their origin they had been as other guilds, partaking especially of the character of peace-guilds, but now "the citizens and the guild became identical, and what was guild-law" often became the law of the town. In great cities, such as London and Florence, we do not hear of merchant guilds (Norton); there the separate occupations or crafts early asserted their associating power and independence, and the craft-guilds gradually took a place in the organization of the town government. Many craft-guilds, the heads of which were concerned in the government of the commune, are found in Italy between the 9th and the 12th centuries (Perrens, *Hist. de Florence*). But in England and the north of Europe the guilds-merchant during this period, having grown rich and tyrannical, excluded the landless men of the handicrafts; these then uniting among themselves, there arose everywhere by the side of the guilds-merchant the craft-guilds, which gained the upper hand on the Continent in the struggle for liberty in the 13th and 14th centuries. In England these companies usually existed side by side with the old town or merchant guild; until at length their increasing importance caused the decay of the old guilds, and the adoption of these crafts as part of the constitution of the towns (13th to 15th century). The separation of the richer and perhaps the older from the poorer of the companies occurred, and thus arose the paramount influence of a few,—as the twelve great Companies of London, the *Arti Majori* of Florence, and others.

The constitution of the trade-guilds was formed on the model of other guilds; they appointed a master or alderman and other officers, made ordinances, including provisions for religious observance, mutual help, and burial; the town ordinances yet remaining of many places, as of Berwick, Southampton, and Worcester, show traces of the trade laws of the old guilds-merchant. As their principal objects, "the craft-gildmen provided for the maintenance of the customs of their craft, framed further ordinances for its regulation (including care against fraudulent workmanship), saw these ordinances properly executed, and punished the gild-brothers who infringed them." "Though the craft-gilds, as voluntary associations, did not need confirmation by the authorities at their birth, yet this confirmation became afterwards of the greatest importance, when these gilds wanted to be recognized as special and independent associations, which were thenceforth to regulate the trade instead of the authorities of the town" (Brentano). Hence obtained the practice of procuring a charter in confirmation and recognition of their laws, in return for which certain taxes were paid to the king or other authority. It is therefore erroneous to state, as is sometimes done, that these companies owe their origin to royal charter, or that they required a license.

Few important towns in Great Britain have been without a more or less number of craft-guilds. London, York, Exeter, Norwich, Bristol, Coventry, etc., teemed with their life and pageantry. But the Reformation shook these as it destroyed others; the exactions they suffered, and the altered conditions of social economy and labor have contributed to their decay; "all that remains of the ancient gilds in the livery companies of to-day is the common eating and drinking." In the centres of industry of Italy, France, Germany, even in Constantinople, they once formed the strength of commerce, but, abused or decayed, in France they were abolished on 4th August, 1789; in Germany their last remnants died in 1869.[2] In Constantinople numerous trade-guilds were flourishing up till the war of 1877–78. In Russia there are no true spontaneous guilds; the trade companies were imposed by the imperial orders of Catherine and Peter the Great.

[1] There are numerous examples of this among the borough records of England and Scotland.

See L. Brentano, *On the History and Development of Gilds*, 1870; *English Gilds, Original Ordinances*, etc., by Toulmin Smith, 1870; Wilda, *Das Gildenwesen im Mittelalter*, 1831; F. T. Perrens, *Histoire de Florence*, 1877; G. Schmoller, *Geschichte der Turcher- und Weberzunft in Strassburg*, 1879; G. Schanz, *Zur Geschichte der Deutschen Gesellen-Verbände im Mittelalter*, 1877; G. Fagniez, *L'Industrie à Paris au 13ème et au 14ème siècle*, 1877; Herbert's *Twelve great Livery Companies of London*, 1836; G. Norton's *Commentaries on the History of London*, 1869; works by the German writers Carl Hegel, Arnold, Maurer, and Gierke; and the article Club. (L. T. S.)

GUILDFORD, a municipal and parliamentary borough and market-town of England, capital of the county of Surrey, is beautifully situated on a gentle acclivity of the northern chalk downs and on the river Wye, crossed there by a bridge of five arches, 30 miles S. S. W. of London. It consists chiefly of one long, wide, and well-built street, and contains a number of old picturesque gabled houses, with quaint lattices and curious doorways. The principal buildings are the ruins of an old castle, erected soon after the Norman conquest, and for a long time used as the county jail; the town-hall, erected in 1683, containing a number of interesting pictures; the corn market-house, erected in 1818; the county hall and assize court in the domestic Gothic style, erected in 1862; the Abbots Hospital, founded by Archbishop Abbot for decayed tradesmen and decayed tradesmen's widows; the county hospital, opened in 1866, erected as a memorial to the Prince Consort; the Royal Free Grammar School, founded in 1509; the Institute, formed in 1844, with museum, library, and reading and lecture rooms; the church of St. Mary, in the Anglo-Norman style, of very early origin, and restored in 1863; the church of St. Nicholas, in the Gothic style, erected on the site of an ancient structure of Saxon origin; and Holy Trinity church, a red brick structure erected 1749–63, with a square embattled tower. Guildford has corn mills, iron foundries, and breweries. There is considerable trade in corn, and fairs are held for cattle, sheep, horses, and pigs. Guildford first returned members to Parliament in the reign of Edward I. Formerly it had two members, but since the Reform Act of 1867 it returns only one. The population of the municipal and parliamentary borough in 1861, when the municipal and parliamentary limits were coextensive, was 8020; in 1871 the population of the municipal borough (area 6543 acres) was 15,937, and that of the parliamentary borough (644 acres) 18,500.

It is probable that Guildford is of Roman origin, but it is first mentioned in the will of King Alfred, who bequeathed it to his nephew Ethelwald. Near it took place, in 1039, the murder of Alfrod, youngest son of King Ethelred, and his Roman retinue, by the men of Earl Godwine. It was an occasional residence of the English kings, and a portion of it remained attached to the royal demesnes until 1630, when the whole of the crown lands at Guildford were vested in Murray, earl of Annandale. After various changes they passed in 1736 to the Onslow family, with whom they still remain.

GUILLEMOT (French, *Guillemot*[3]), the name accepted by nearly all modern authors for a Sea-bird, the *Colymbus troile* of Linnæus and the *Uria troile* of Latham, which nowadays it seems seldom if ever to bear among those who, from their vocation, are most conversant with it, though, according to Willughby and Ray his translator, it was in their time so called "by those of Northumberland and Durham." Around the coasts of Britain it is variously known as the Frowl, Kiddaw or Skiddaw, Langy (*cf.* Icelandic,

[2] There is, however, a lively movement for the revival of craft-guilds in Germany at the present time (1879).

[3] The word, however, seems to be cognate with or derived from the Welsh and Manx *Guillem*, or *Gwilym* as Pennant spells it. The association may have no real meaning, but one cannot help comparing the resemblance between the French *Guillemot* and *Guillaume* with that between the English Willock (another name for the bird, as will be seen by the text) and William.

Lanyia), Lavy, Marrock, Murre, Scout (*cf.* Coot, vol. vi. p. 303), Scuttock, Strany, Tinker or Tinkershire, and Willock. The number of local names testifies to the abundance of this bird, at least of old time, in different places, but it should be observed that in certain districts some of them are the common property of this species and the Razor-bill. In former days the Guillemot yearly frequented the cliffs on many parts of the British coasts in countless multitudes, and this is still the case in the northern parts of the United Kingdom; but more to the southward nearly all its smaller settlements have been rendered utterly desolate by the wanton and cruel destruction of their tenants during the breeding season, and even the inhabitants of those which were more crowded had become so thinned that, but for the intervention of the Sea Birds Preservation Act (32 and 33 Vict. cap. 17), which provided under penalty for the safety of this and certain other species at the time of year when they were most exposed to danger, they would unquestionably by this time have been exterminated so far as England is concerned. The slaughter, which, before the passing of that Act, took place annually on the cliffs of the Isle of Wight, near Flamborough Head, and at such other stations frequented by this species and its allies the Razor-bill and Puffin, and the Kittiwake-Gull, as could be easily reached by excursionists from London and the large manufacturing towns, was in the highest degree brutal. No use whatever could be made of the bodies of the victims, which indeed those who indulged in their massacre were rarely at the trouble to pick out of the water; the birds shot were all engaged in breeding; and most of them had young, which of course starved to death through the destruction of their parents, intercepted in the performance of the most sacred duty of nature, and butchered to gratify the murderous lust of those who sheltered themselves under the name of "sportsmen."

Part of the Guillemot's history is still little understood. We know that it arrives at its wonted breeding stations on its accustomed day in spring, that it remains there till, towards the end of summer, its young are hatched and able, as they soon are, to encounter the perils of a seafaring life, when away go all, parents and progeny. After that time it commonly happens that a few examples are occasionally met with in bays and shallow waters. Tempestuous weather will drive ashore a large number in a state of utter destitution—many of them indeed are not unfrequently washed up dead—but what becomes of the bulk of the birds, not merely the comparatively few thousands that are natives of Britain, but the tens and hundreds of thousands, not to say millions, that are in summer denizens of more northern latitudes, no one can yet say. This mystery is not peculiar to the Guillemot, but is shared by all the *Alcidæ* that inhabit the Atlantic Ocean. Examples stray every season across the Bay of Biscay, are found off the coasts of Spain and Portugal, enter the Mediterranean and reach Italian waters, or, keeping further south, may even touch the Madeiras, Canaries, or Azores; but these bear no proportion whatever to the mighty hosts of whom they are literally the "scouts," and whose position and movements they no more reveal than do the vedettes of a well-appointed army. The common Guillemot of both sides of the Atlantic is replaced further northward by a species with a stouter bill, the *U. arra* or *U. bruennichi* of ornithologists, and on the west coast of North America by the *U. californica*. The habits of all these are essentially the same, and the structural resemblance between all of them and the Auks is so great that of late several systematists have relegated them to the genus *Alca*, confining the genus *Uria* to the Guillemots of another group, of which the type is the *U. grylla*, the Black Guillemot of British authors, the Dovekey or Greenland Dove of sailors, the Tysty of Shetlanders. This bird assumes in summer an entirely black plumage with the exception of a white patch on each wing, while in winter it is beautifully marbled with white and black. Allied to it as species or geographical races are the *U. mandti*, *U. columba*, and *U. carbo*. All these differ from the larger Guillemots by laying two or three eggs, which are generally placed in some secure niche, while the members of the other group lay but a single egg, which is invariably exposed on a bare ledge. (A. N.)

GUILLOTINE, the instrument for inflicting capital punishment by decapitation, introduced into France at the period of the Revolution. It consists of two upright posts surmounted by a cross beam, and grooved so as to guide an oblique-edged knife, the back of which is heavily weighted to make it fall swiftly and with force when the cord by which it is held aloft is let go. Some ascribe the invention of the machine to the Persians; and previous to the period when it obtained notoriety under its present name it had been in use in Scotland, England, and various parts of the Continent. There is still preserved in the Antiquarian Museum of Edinburgh the rude guillotine called the "maiden" by which the regent Morton was decapitated in 1581. The last persons decapitated by the Scotch "maiden" were the marquis of Argyll in 1661, and his son the earl of Argyll in 1685. It would appear that no similar machine was ever in general use in England; but until 1650 there existed in the forest of Hardwick, which was coextensive with the parish of Halifax, West Riding, Yorkshire, a mode of trial and execution called the gibbet law, by which a felon convicted of theft within the liberty was sentenced to be decapitated by a machine called the Halifax gibbet. A print of it is contained in a small book called *Halifax and its Gibbet Law* (1708), and in Gibson's edition of Camden's *Britannia* (1722). In Germany the machine was in general use during the Middle Ages, under the name of the *Diele*, the *Hobel*, or the *Dolabra*. Two old German engravings, the one by George Penez, who died in 1550, and the other by Heinrich Aldegrever, with the date 1553, represent the death of a son of Titus Manlius by a similar instrument, and its employment for the execution of a Spartan is the subject of the engraving of the eighteenth symbol in the volume entitled *Symbolicæ Quæstiones de Universo Genere*, by Achilles Bocchi (1555). From the 13th century it was used in Italy under the name of *Mannaia*, for the execution of criminals of noble birth. The *Chronique de Jean d'Anton*, first published in 1835, gives minute details of an execution in which it was employed at Genoa in 1507; and it is elaborately described by Père Labat[1] in his *Voyage en Espagne et en Italie en 1730*. It is mentioned by Puységur in his *Mémoires* as in use in the south of France, and he describes the execution by it of Marshal Montmorency at Toulouse in 1632. For about a century it had, however, fallen into general disuse on the Continent; and Dr. Guillotine, who first suggested its use in modern times, is said to have obtained his information regarding it from the description of an execution that took place at Milan in 1702, contained in an anonymous work entitled *Voyage Historique et Politique de Suisse, d'Italie, et d'Allemagne*.

Guillotine, who was born at Saintes, May 28, 1738, and elected to the Constituent Assembly in 1789 brought forward on the 1st December of that year two propositions regarding capital punishment, the second of which was that, "in all cases of capital punishment it shall be of the same kind—that is, decapitation—and it shall be executed by means of a machine." The reasons urged in support of this proposition were that in cases of capital punishment the privilege of execution by decapitation should no longer be confined to the nobles, and that it was desirable to render the process of execution as swift and painless as possible. The debate was brought to a sudden termination in peals of laughter caused by an indiscreet reference of Dr. Guillotine to his machine, but his ideas seem gradually to have leavened the minds of the assembly, and after various debates decapitation was adopted as the method of execution in the penal code which became law on the 6th October, 1791. At first it was intended that decapitation should be by the sword, but on account of a memorandum by M. Sanson, the executioner, pointing out the expense and certain other inconveniences attending that method, the assembly referred the question to a committee, at whose request Dr. Antoine Louis, secretary to the academy of surgeons, prepared a memorandum on the subject. Without mentioning the name of Guillotine, it recommended the adoption of an instrument similar to that which was formerly suggested by him. The assembly decided in favor of the report, and the contract was offered to the person who usually provided the instruments of justice; but, as his terms were considered exorbitant, an agreement was ultimately come to with a German of the name of Schmidt, who, under the direction of M. Louis, furnished a machine for each of the French departments. After satisfactory experiments had been made with the machine on several dead bodies in the hospital of Bicêtre, it was erected on the Place de Grève for the execution of the highwayman Pelletier on the 25th April, 1792. While

[1] [Jean Baptiste (1663–1738), a Dominican missionary to the French Antilles (1693–1705), founder of Basse Terre, Guadeloupe, wrote voluminous books of travel in Paris.—Am. Ed.]

the experiments regarding the machine were being carried on, it received the name *Louisette* or *La Petite Louison*, but the mind of the nation seems soon to have reverted to Guillotine, who first suggested its use; and in the *Journal des Révolutions de Paris* for 28th April, 1792, it is mentioned as *la guillotine*, a name which it thenceforth bore both popularly and officially. In 1795 the question was much debated as to whether or not death by the guillotine was instantaneous, and in support of the negative side the case of Charlotte Corday was adduced whose countenance, it is said, blushed as if with indignation when the executioner, holding up the head to the public gaze, struck it with his fist. The connection of the instrument with the horrors of the Revolution has hindered its introduction into other countries, but in 1853 it was adopted under the name of *Fallschwert* or *Fallbeil* by the kingdom of Saxony, and it has been subsequently introduced into several other German states. It has often been stated that Dr. Guillotine perished by the instrument which bears his name, but it is beyond question that he survived the Revolution, and died a natural death in 1814.

See Sédillot, *Réflexions historiques et physiologiques sur le supplice de la guillotine*, 1795; Sue, *Opinion sur le supplice de la guillotine*, 1796; Réveillé-Parise, *Étude biographique sur guillotin*, Paris, 1851; *Notice historique et physiologique sur le supplice de la guillotine*, Paris, 1830; Louis Dubois, *Recherches historiques et physiologiques sur la guillotine et détails sur Sanson*, Paris, 1843; and a paper by J. W. Croker in the *Quarterly Review* for December, 1843, reprinted separately in 1850 under the title *The Guillotine, a historical Essay*.

GUIMARÃES, a fortified city of Portugal, province of Minho, government district of Braga, is beautifully situated on the Ave, 12 miles south-east of Braga. It stands on an acclivity, and with its Moorish towers has a very picturesque appearance. An old castle which was the birthplace of Alphonso, the first king of Portugal, is still in a state of good preservation. Among the four churches may be mentioned the *Colegiata*, founded in 1385, and although modernized still retaining intact its beautiful choir. The principal manufactures are knives and other steel wares, leather, paper, and table linen. In the neighborhood there are sulphurous springs, with a temperature of 164° Fahr., frequented since the origin of the city in the 4th century. Guimarães was made the chief town of the countship of Portugal in the 11th century by Henry of Burgundy, and retained that honor till 1511, when it was conferred by King Emanuel on Lisbon. The population is about 9,000.

GUINEA, the general name applied by Europeans to part of the western coast region of intertropical Africa. Like many other geographical designations the use of which is controlled neither by natural nor political boundaries, it has been very differently employed by different writers and at different periods. In the widest acceptation of the term, the Guinea coast may be said to extend from 11° N. lat. to 16° S. lat., or in other words, from the neighborhood of Cape Verga to Cape Negro. Southern or Lower Guinea comprises the coasts of Loango, Congo, Angola, and Benguela; and Northern or Upper Guinea comprises part of Senegambia, the Sierra Leone district, the Grain Coast, the Ivory Coast, the Gold Coast, the Slave Coast, the Niger Delta, and the Calabar district. The Cameroon mountains may be accepted as the limit of the two divisions, though some writers prefer the river Gambia or the equator. In a narrower and perhaps more common use of the name, Guinea is the coast only from Cape Palmas to the Gaboon. Originally, on the other hand, Guinea was supposed to commence as far north as Cape Nun opposite the Canary Islands; and Azurara is said to be the first authority who brings the boundary south to the Senegal. The name is derived from Ginnie, Genna, or Jinnie, a town and kingdom in the Niger district; and, though it appears on a map as early as 1351, it did not come into general use till the close of the 15th century. Few questions in historical geography have been more keenly discussed than that of the first discovery of Guinea by the navigators of modern Europe. It appears from the testimony of Jacopo Doria that two Genoese, Ugolino and Guido de Vivaldi, were sailing south along the African coast in 1291, but there is almost no further record of their voyage. The French claim that in the latter part of the 14th century the people of Dieppe sent out several expeditions to Guinea; and Jean de Bethencourt, who settled in the Canaries about 1402, made explorations towards the south At length, in the latter half of the 15th century, the consecutive efforts of the navigators employed by Prince Henry of Portugal, Cadamosto, Usodimare, and Diogo Gomes, made the whole region familiar to Europeans.

See Azurara, *Chronica de descobrimento e conquista de Guiné*, published, with an introduction, by Barros de Santarem, Paris, 1841; Villault de Bellefond, *Relations des Costes d'Afrique appellées Guinée*, Paris, 1679; Desmarquets, *Mém. Chron. pour servir à l'hist. de Dieppe*, 1875; Major, *Life of Prince Henry the Navigator*, London, 1868; and the elaborate review of Major's work by M. Codine in the *Bulletin de la Soc. de Géogr.*, 1873.

GUINEA FOWL, a well-known domestic gallinaceous bird, so called from the country whence in modern times it was brought to Europe, the *Meleagris* and *Avis* or *Gallina Numidica* of ancient authors.[1] Little is positively known of the wild stock to which we owe our tame birds, nor can the period of its reintroduction (for there is apparently no evidence of its domestication being continuous from the time of the Romans) be assigned more than roughly to that of the African discoveries of the Portuguese. It does not seem to have been commonly known till the middle of the 16th century, when Caius sent a description and figure, with the name of *Gallus Mauritanus*, to Gesner, who published both in his *Paralipomena* in 1555, and in the same year Belon also gave a notice and woodcut under the name of *Poulle de la Guinée;* but while the former authors properly referred their bird to the ancient *Meleagris*, the latter confounded the *Meleagris* and the Turkey.

The ordinary Guinea Fowl of our poultry-yards is the *Numida meleagris* of ornithologists, and is too common a bird to need description. The chief or only changes which domestication seems to have induced in its appearance are a tendency to albinism generally shown in the plumage of its lower parts, and frequently, though not always, the conversion of the color of its legs and feet from dark grayish-brown to bright orange. That the home of this species is West Africa from the Gambia[2] to the Gaboon is certain, but its range in the interior is quite unknown. It appears to have been imported early into the Cape Verd Islands, where, as also in some of the Greater Antilles and in Ascension, it has run wild. Representing the species in South Africa we have the *N. coronata*, which is very numerous from the Cape Colony to Ovampoland, and the *N. cornuta* of Drs. Finsch and Hartlaub, which replaces it in the west as far as the Zambesi. Madagascar also has its peculiar species, distinguishable by its red crown, the *N. mitrata* of Pallas, a name which has often been misapplied to the last. This bird has been introduced to Rodriguez, where it is now found wild. Abyssinia is inhabited by another species, the *N. ptilorhyncha*,[3] which differs from all the foregoing by the absence of any red coloring about the head. Very different from all of them, and the finest species known, is the *N. vulturina* of Zanzibar, conspicuous by the bright blue in its plumage, the hackles that adorn the lower part of its neck, and its long tail. By some writers it is thought to form a separate genus, *Acryllium*. All these Guinea Fowls are characterized by having the crown bare of feathers and elevated into a bony "helmet," but there is another group (to which the name *Guttera* has been given) in which a thick tuft of feathers ornaments the top of the head. This contains four or five species, all inhabiting some part or other of Africa, the best known being the *N. cristata* from Sierra Leone and other places on the western coast. This bird, apparently mentioned by Marcgrave more than 200 years ago, but first described by Pallas, is remarkable for the structure—unique, if not possessed by its representative forms—of its *furcula*, where the head, instead of being the thin plate found in all other *Gallinæ*, is a hollow cup opening upwards, into which the trachea dips, and then emerges on its way to the lungs. Allied to the genus *Numida*, but readily distinguished therefrom among other characters by

[1] Columella (*De Re Rustica*, viii., cap. 2) distinguishes the *Meleagris* from the *Gallina Africana* or *Numidica*, the latter having, he says, a red wattle (*palea*, a reading obviously preferable to *galea*), while it was blue in the former. This would look as if the *Meleagris* had sprung from what is now called *Numida ptilorhyncha*, while the *Gallina Africana* originated in the *N. meleagris*,—species which, as will be seen by the text, have a different range, and if so the fact would point to two distinct introductions—one by Greeks, the other by Latins.

[2] Specimens from the Gambia are said to be smaller, and have been described as distinct under the name of *N. rendalli*.

[3] Mr. Darwin (*Anim. and Pl. under Domestication*, i. p. 294) gives this as the original stock of our modern domestic birds, but herein the writer ventures to think he has been misled. As before observed, it may possibly have been the true μελεαγρὶς of the Greeks.

the possession of spurs, are two very rare forms, *Agelastes* and *Phasidus*, both from Western Africa. Of their habits nothing is known. All these birds are beautifully figured in Mr. Elliot's *Monograph of the Phasianidæ*, from drawings by Mr. Wolf. (A. N.)

GUINEA-PIG. See Cavy.

GUINGAMP, a town of France, capital of an arrondissement in the department of Côtes-du-Nord, is situated in a large and rich valley on the right bank of the Trieux, 20 miles W. N. W. of St. Brieuc. It was formerly surrounded by walls, portions of which still exist. It has a library, a museum, a prison, and a hospital dating from the 17th century, enlarged in 1830, and having within its grounds an old oak of immense size. There are also several old buildings of interest, including the beautiful church of *Notre Dame du Bon-Secours*, portions of which date from the 13th, 14th, 15th, and 16th centuries respectively, and which has been lately restored; four pillars of the tower of the chapel of Saint Leonard, dating from the 11th century; and the Ursuline convent, dating from the 17th century, now used as a cavalry depot. The beautiful fountain in the Place de Plomb, constructed by Italian artists in the 15th century, was replaced in 1743 by the present structure. The town has manufactures of ginghams (to which it gives the name), linen fabrics, thread, leather, and hats; and there is some trade in wine, brandy, cattle, and agricultural produce. Guingamp originally belonged to the dukes of Penthièvre, and was inherited from them by King Louis Philippe. The population in 1901 was 7,113.

GUIPUZCOA, the smallest and most densely peopled of the three Basque provinces of Spain, is bounded on the N. by the Bay of Biscay, on the W. by the province of Biscay, on the S. and S. E. by Alava and Navarre, and on the N. E. by the Bidasoa, which separates it from France. Its area is nearly 728 square miles, and in 1870 its estimated population was 180,743. Situated on the northern slope of the great Cantabrian chain, the province has a great variety of surface in mountain, hill, and valley; and the scenery accordingly is highly picturesque and romantic. The coast is much indented, and has numerous harbors, but none of very great importance; the chief are those of San Sebastian, Los Pasajes, Guetaria, Deva, and Fuenterrabia. The rivers (Deva, Urola, Oria, Urumea, Bidasoa) are all short, rapid, and unnavigable. The mountains are for the most part covered with forests of oak, chestnut, or pine; holly and arbutus are also common, with furze and heath in the poorer parts. The soil in the lower valleys is generally of hard clay and unfertile; it is cultivated with great care, but the grain raised falls considerably short of what is required for home consumption. The climate, though moist, is mild, pleasant, and healthy; fruit is produced in considerable quantities, especially apples for manufacture into "zaragua" or cider. The chief wealth of the province arises from its mineral stores (iron, argentiferous lead, copper) and from its excellent fisheries, which supply the neighboring provinces (cod, tunny, sardines, oysters). The iron, which is of excellent quality, is smelted with wood. There are also considerable manufactures of woollen and cotton fabrics, paper, and lucifer matches. The people are remarkable for their fine physique, and bold manly spirit, united with honesty, industry, energy, and enterprise. The capital of the province is San Sebastian, with a population of 17,902 in 1876. All the other towns are small, Tolosa alone having a population at all exceeding 5000; Fuenterrabia no longer retains its former importance; Mondragon is entirely dependent on the rich iron mines in its vicinity, and Salinas, on the Deva, on its salt works. A small island in the Bidasoa, called La Isla de los Faisanes, or l'Isle de la Conférence, is celebrated as the place where the marriage of the duke of Guienne was arranged between Louis XI. and Henry IV. in 1463, where Francis I. the prisoner of Charles V. was exchanged for his two sons in 1526, and where in 1659 "the peace of the Pyrenees" was concluded between D. Luis de Haro and Cardinal Mazarin.

The early history of Guipuzcoa, as of the other Basque provinces, is still the subject of much learned research. Never wholly subdued by the Romans, the Celtiberi in their mountain fastnesses continued to preserve their independence after the fall of the Western Empire until the times of the West-Gothic kings Leovigild (580) and Wamba (672–681). Nominally subject to Charlemagne at a later period, they were prompt to avail themselves of the first opportunity to assert their full independence; their alliance with the Moors, and its results at Roncesvalles are prominent facts in mediæval history. About the 11th century the inhabitants of the Basque districts emerge as organized into a somewhat free confederation of detached republics, owning allegiance to a señor or lord, but under definite constitutional guarantees (fueros). In 1202 Guipuzcoa accepted as its lord Alphonso VIII. of Castile, and for many centuries it ranked as a distinct "señorio" attached to the Spanish crown. The last of its distinctive fueros was abolished in July, 1876.

GUISBOROUGH, or Gisborough, a market-town of England, North Riding of Yorkshire, is situated in a narrow but fertile valley at the foot of the Cleveland Hills, 4 miles from the mouth of the Tees and 10 miles E. S. E. of Middlesborough. It consists chiefly of one wide and handsome street, having many good houses. The principal buildings are the parish church, which, though partly rebuilt in 1791 and thoroughly renovated in 1875, has some remains of an ancient structure; the free-grammar school, founded in 1561; the town-hall, recently much improved and enlarged; the mechanics' institute, the hospital for old men and women, and the hospital for accidents erected lately by Admiral Chaloner. The ruins of the Austin priory, founded in 1129, are beautifully situated near the eastern extremity of the town. The accumulation of rubbish has been recently removed from its foundations and floors, and a large number of interesting relics discovered. Among the historic personages who were buried within its walls was Robert the Bruce, lord of Annandale, the competitor for the throne of Scotland with John Baliol, and the grandfather of King Robert Bruce. The town within late years has been rapidly increasing, on account of the iron mines in its neighborhood; and it has also tanneries and breweries. Alum works were established in the reign of Queen Elizabeth by Sir Thomas Chaloner, who introduced the manufacture of alum into England from Italy; but they have been long discontinued. About a mile south-east of the town there is a sulphurous spring discovered in 1822, efficacious in cutaneous, rheumatic, and bilious complaints. The population of the town in 1871 was 5,262, and in 1901, 5,645.

GUISCARD. See Robert Guiscard.

GUISE, a fortified town of France, department of the Aisne, arrondissement of Vervins, is situated on the left bank of the Oise, 13 miles N. W. of Vervins. It was formerly the chief town of the Thiérache, a district in the extreme north of France, bordering on Hainault. It has an old castle dating from the 16th century, and a palatial *familistère* with accommodations for 400 families. The principal industries are woollen and cotton weaving, iron and copper founding, tanning, and the manufacture of chicory and sugar. The population in 1901 was 7,140.

GUISE, House of. The House of Guise, which in the 16th century suddenly rose to an eminence unrivalled in Europe, takes title from the place noticed above. The countship of Guise, a fief under the French crown, was carried in 1333 by its holder, Marie of Blois, as her dower to Rodolf, duke of Lorraine. In 1508 René II., the conqueror of Charles the Bold, divided his territories between his sons Antony, who became duke of Lorraine, and received the Germanic part, and Claude, who had the French fief, including Guise.

Claude of Lorraine thus became founder of a great and well-marked family, which occupied the place that had in the fifteenth century been held by the princes of the lilies. Generation after generation we have a duke and a cardinal side by side: they illustrate with singular fidelity the movements of the period from its Catholic side; the first duke and cardinal belonged to the Renaissance; the second pair threw themselves into the Catholic reaction, and led the resistance to the Reformation in France; the third pair showed the decay of the religious movement, and its transit into political activities, being among the most ambitious statesmen of the later years of the century; while the fourth and last pair feel the breath of Richelieu's absolutism. The family has throughout characteristic qualities,—bravery, ambition, a certain nobleness of sentiment, an imposing presence, and winning manners; they stand between nobility and royalty,—always greater than the one, sometimes even overtopping the other. They seem never to forget that in their veins runs the blood of those who wore or claimed the crowns of Jerusalem and Naples, of Sicily and Hungary. Claude of Lorraine, born in 1496, succeeded in 1508 to a group of lordships, which by their

names testify to the high fortunes of the house: besides Guise itself, he had Elbeuf, Aumale, Maycnne, Joinville, Harcourt, Longiumeau, Boves, Sablé, Lambesc, and others. In addition to these, the family gathered to itself relations with Eu, Sully, Ventadour, Aiguillon, Mercœur, Joyeuse, and Nevers; a cardinal's hat, together with a group of splendid church dignities, also went with the house of Guise; the archbishopric of Rheims, the bishopric of Metz, and several other bishoprics were family benefices, which enabled younger members to take an important share in the fortunes of the family. The shield of Claude expresses the pride of the race; we find there not only the Lorraine spread-eagle, the German bird, but also the quarterings of eight sovereign houses, those of the kings of Hungary, Naples, Jerusalem, and Aragon, and of the sovereign lords of Anjou, Guelderland, Flanders, and Bar. This young prince, who claimed so much, and did so much, who both exercised his rights as a foreign prince and took precedence of the proudest in France, attached himself closely to Francis I. He was the most brilliant among the "young men" who displaced the older wisdom of the court of Louis XII. In 1513 he married Antoinette of Bourbon, the duke of Vendôme's daughter and great aunt of Henry IV.; in 1515 he accompanied Francis to Italy, and showed the mettle of his race at Marignano, where his brother Ferry was killed. From that time he sagaciously avoided the Italian expeditions, and stayed in France, winning popularity as protector of the realm. Thus in 1521 he was on the Spanish frontier, and helped to take Fuenterrabia; in 1522 he opposed the English in the north, covering Paris; next, he defended Champagne from the Germans, clearing that rich district with equal glory and gain. In 1525 he avoided the expedition which ended in the disaster of Pavia, wherein another of his brothers, Francis, was slain; and during the captivity of Francis I. at Madrid, he became virtual head of the regency under the queen, Louise of Savoy. In these dark days he crushed the rising of the peasants of Lorraine and Swabia, which threatened all the east of France. After the king's return, Claude was made (in 1527) duke of Guise, and peer, and governor of Champagne; fresh territory and wealth were added to these honors. He had now reached his highest point; henceforth it is clear that Francis I. regarded him with more jealousy than favor: his ambitious views as to the crown of the "good king René," and hopes of a revived Angevin dynasty, offended the French king, though they were only dreams of the past; for the new spirit of monarchy and national life in the 16th century made any creation of lesser kingdoms on the borderlands of France and Germany impossible. Claude was a man of harsh and narrow character; cautious and persistent, he saw his way, and walked carefully along it all his days. In an age in which wealth was becoming the most effective of all means of power, he gathered riches in all ways, fair or foul; and though willing to spend for his own advancement, he won and deserved the character of a grasping and greedy prince. His brother John, first cardinal of Lorraine, seconded him in every way; he was as greedy as the duke, though much more open-handed. Accepting the new ideas of the time, he became a splendid Renaissance prelate, the friend of Erasmus and Rabelais, and even of Marot, while, at the same time, he only too faithfully reflected the worst vices of the movement. His church preferment was enormous; he shamelessly took all he could get. He and his brother have the distinction of giving a bad name to a whole country; for, thanks to their rapacity, the Lorrainers got that reputation for avarice and greediness which has unjustly clung to them even to our days. After 1527 the cleverness of the cardinal rather than the prudence of the duke advanced the family. Claude had twelve children, a splendid group of princely youths, who inherited the handsome features and figure of their father, with even greater abilities and a more effective ambition. Francis, the eldest of those who grew up, was born in 1519, and became the second duke; Charles, born in 1524, was the second cardinal of Lorraine, a man as intelligent and depraved as his uncle, and more vigorous and ambitious; Claude, the next, was created duke of Aumale; Louis, archbishop of Sens and cardinal of Guise; René, marquis of Elbeuf. The daughters made brilliant matches; above all, the eldest, Marie, widow of the duke of Longueville, was married in 1538 to James V. of Scotland and had a stormy career as regent to her daughter, Mary Stuart, queen of Scots.

In his later days Claude of Guise withdrew somewhat from public life; he stood aloof from the intrigues of the reign, while the cardinal attached himself to the "black court," the court of Diana of Poitiers, and promoted the interests of his nephews without stint. From this time all leanings towards either Renaissance or reform were at an end: henceforth the Guises became the heads of the opposition to the Huguenots, the strength and support of the new Jesuit movement, and, later, the leaders of the League. Claude of Guise died in 1550, leaving his dignities to his son Francis, "le grand Guise," who had already won great credit for bravery, and had shown that dashing contempt for all rules of military prudence which gives a captain undying popularity. The ghastly wound in the face, which his rashness won for him in 1545 at the hands of the English near Boulogne, got him the name of the first "Balafré;" it was the outward symbol of his devotion to his country, and greatly raised his repute among the people. He had too the essential qualities of popularity, a majestic presence, and friendly manners in camp; he was chivalrous, liberal, humane, discerning. In 1552, as lieutenant-general in the three bishoprics, he withstood at the siege of Metz the last efforts of Charles V., and saved France from a terrible invasion. Thanks to the jealousy of the Montmorencies, he was sent in 1557 to conquer Naples, and would have added another to the long roll of reputations ruined by Italy, had he not been suddenly recalled to protect his country after the disaster of St. Quentin. With happy boldness, instead of watching the victorious allies, he suddenly attacked and took Calais, ending the English occupation of French soil, and raising his own renown to the highest point. Then, with his brother Charles, second cardinal of Lorraine, he wielded unlimited power throughout the reign of Francis II. Under Charles IX. his influence abated, and he withdrew into Alsace. On his return thence in 1562, he was, however unwillingly, for he was not inhumane, the cause of the massacre of Vassy, which began the civil wars. In the first war he won the battle of Dreux (1562), and thence passing southward besieged the Huguenots in Orleans. There, early in 1563, he was assassinated. If he was the noblest of the Guises, his brother the cardinal was the ablest. In his earlier days the cardinal had shown some sympathy with the Reformers; in later life he vigorously repressed them, and took a leading part in the council of Trent, where he is said to have sketched the first lines of the famous League. Like all early friends of the Jesuits, he did his best for education, and patronized men of letters, while he coerced independence of thought and aimed at introducing the Inquisition. He died in 1574. His younger brother Charles, cardinal of Guise, "le cardinal des bouteilles," was a grand pluralist, an easy-going personage, whose quiet life was in striking contrast to the feverish energy of his brothers. René, marquis of Elbeuf, another brother, is the stem of the great houses of Elbeuf, Harcourt, and Lislebonne.

Henry of Guise, eldest son of Duke Francis, born in 1550, was with his father at Orleans, and saw his death. The boy therefore began his public life with an inextinguishable hatred against Huguenots, eager to distinguish himself in civil war. With his brother Louis, second cardinal of Guise, he entered into all the intrigues of the succession question, and bitterly opposed Henry of Navarre. He was at Jarnac, and in the victory of Dormans (1575) over the German invaders, he too won the title of "le Balafré." He soon became the idol of Paris: manly, handsome, and decided, he won all hearts, and was at once a popular hero. Fortune too favored him by bringing him into contrast with the wretched Henry III., and with his portly cautious brother the duke of Maycnne. In 1576 he was recognized as head of the League, supported by Philip II. and the papacy. Ambitious of the crown of France, he worked subtly for it behind the screen of old Cardinal Bourbon's name. In the war of the three Henries (Henry III., Henry of Navarre, Henry of Guise) he again drove the Germans out of France; and, when invited to the capital by the "Sixteen," ruled there unopposed, the "King of Paris." Henry III., whom he had compelled to sign the Edict of Union, found his supremacy intolerable; and just before Christmas (1588), the duke and the cardinal his brother were assassinated by the royal orders.

His eldest son Charles, born in 1571, was arrested at the time of the double murder, but escaped in 1591, and was welcomed with enthusiasm by the Paris mob, which hoped

he would wed the infanta of Spain, and with the help of Philip II. secure for himself the throne of France. But the opposition of his uncle Mayenne proved fatal to the scheme. At the end of the struggle, both he and Mayenne submitted to Henry IV., helped him to reduce the nobles in Languedoc, and received the government of Provence. In Richelieu's days he sided with the queen mother, and was compelled to withdraw in 1631 to Italy, where he died in 1640. By his side also was a cardinal brother, the third of Guise, who ended by abandoning the ecclesiastical state, and marrying one of the mistresses of Henry IV.

Henry, fourth son of Charles, born in 1614, had already succeeded to that family benefice, the archbishopric of Rheims, when the death of his elder brother made him head of the family, and in 1640 fifth duke. He too went against the absolutism of the age, and joined the count of Soissons. Condemned to lose his head he fled to Brussels, and took command of the Austrian troops against France,—noble traitors to their country being then not uncommon. In 1643, however, after Richelieu's death, he returned to France; but being chosen their chief by the Neapolitans, at the time of Masaniello's revolt, and dazzled by this opening for his ambition, he betook himself to Naples. There his failure was complete; he was defeated and carried prisoner to Madrid. Delivered thence by the intercession of the Great Condé, he again attempted Naples, and failed again. After this he spent the rest of his romantic ill-ordered life at the French court, and died in 1664 leaving no issue; his sisters never married, and of all his brothers, one only, Louis, duke of Joyeuse, left a son, born in 1650, who became sixth duke of Guise. He died of small-pox in 1671, leaving an infant son, Francis Joseph, seventh duke, a sickly babe, with whom, four years later, the direct line of the house of Guise expired. The other branches had early died out, saving the family of the seventh son of Claude first duke, René, marquis of Elbeuf; the marquis of Lambesc, who died in 1826, was the last descendant of this branch, and with him the family finally became extinct.

The authorities for the house of Guise are René de Bouillé, *Histoire des Ducs de Guise*, 4 vols., 1853, the most complete account of the family; Valincour, *Vie de François de Lorraine, Duc de Guise*, 1664; Guillemin, *Histoire du Cardinal de Lorraine*; the *Biographie Universelle*, art. "Guise;" and Forneron's *Ducs de Guise et leur époque*, 2 vols.

Genealogical Table of the House of Guise.

René II. (who united the two branches of the house of Lorraine), duke of Lorraine, and Philippa of Guelders, had (besides two older boys who died in childhood, and four unmarried daughters)—

- Antoine, duke of Lorraine.
- Claude, 1st duke of Guise = Antoinette of Bourbon, † 1550.
  - Francis, 2d duke of Guise = Anne of Este, † 1563.
    - Henry, 3d duke = Catherine of Cleves (and had 14 children), † 1588.
      - Charles, 4th duke of Guise, † 1640.
        - Henry, archb. of Rheims, and 5th duke, † 1664.
        - Louis, duke of Joyeuse, † 1654.
          - Louis-Joseph, 6th duke of Guise, † 1671.
            - Francis-Joseph, 7th (and last) duke of Guise, † 1675.
        - Louis, 3d cardinal of Guise = Charlotte des Essarts.
        - And twelve more.
      - Charles, duke of Mayenne, † 1611.
        - Henry, duke of Mayenne, † 1621.
      - Louis, 2d cardinal of Guise † 1588.
      - And five others.
    - Charles, 2d card. of Lorraine.
    - Claude, marquis of Mayenne, and duke of Aumale.
    - Louis, 1st cardinal of Guise.
  - John, 1st cardinal of Lorraine.
  - Ferry, killed at Marignane.
  - René, marquis of Elbeuf.
    - Charles, duke of Elbeuf.
  - Louis, killed at Naples.
  - Marie = James V. of Scotland.
    - Mary Stuart, Q. of Scots.
  - Francis, killed at Pavia.
  - And six others.

(G. W. K.)

GUITAR, a stringed instrument of Eastern origin. The name no doubt is derived from the Greek κιθάρα, but the instrument itself we owe to the Arabs, who introduced it into Spain. In the 16th century it became known in Italy and France, and about 1790 a German instrument-maker of the name of Cetto greatly increased its power by adding a sixth string to the five formerly in use. The genuine Spanish guitar was introduced into England after the Peninsular War by Ferdinand Sor, a Spaniard who was both a composer for and a player on the instrument. About the same time the guitar was very much in fashion on the Continent, and even Paganini cultivated it. But this circumstance was due to the romantic associations rather than to the intrinsic merits of the instrument, and accordingly it soon relapsed into comparative oblivion. It is, however, occasionally employed in the orchestra and for the accompaniment of simple vocal pieces, and for these purposes it has no doubt its merits. The guitar is a flat backed instrument, the sides of which turn inwards. The sound-board, pierced by a round sound-hole, is generally made of pine, maple or cherry-wood being used for the sides and the back. The modern guitar, as already stated, has six strings, while the original *El Aud* of the Arabs had only four, subsequently increased to five. They are tuned to the notes E, A, D, G, B natural, and E. In the more remote keys transposition by means of a *capo tasto*, or *nut*, is effected. In this manner a basis of flat instead of natural keys may be substituted without any change of fingering. In the East, especially in Arabia, India, China, and Japan, many varieties of the guitar and its congeners are in use, the number of strings varying from two to five. For the technique of the guitar Madame Sidney Pratten's treatise, *Learning the Guitar simplified*, may be consulted.

GUIZOT, François Pierre Guillaume (1787–1874), historian, orator, and statesman, was born at Nîmes on the 4th October, 1787, of an honorable Protestant family belonging to the *bourgeoisie* of that city. It is characteristic of the cruel disabilities which still weighed upon the Protestants of France before the Revolution, that his parents, at the time of their union, could not be publicly or legally married by their own pastors, and that the ceremony was clandestine. The liberal opinions of his family did not, however, save it from the sanguinary intolerance of the Reign of Terror, and on the 8th April, 1794, his father perished at Nîmes upon the scaffold. Thenceforth the education of the future minister devolved entirely upon his mother, a woman of slight appearance and of homely manners, but endowed with great strength of character and clearness of judgment. Madame Guizot was a living type of the French Huguenots of the 16th century, stern in her principles and her faith, immovable in her convictions and her sense of duty. She formed the character of her illustrious son and shared every vicissitude of his life. In the days of his power her simple figure, always clad in deep mourning for her martyred husband, was not absent from the splendid circle of his political friends. In the days of his exile in 1848 she followed him to London, and there at a very advanced age closed her life and was buried at Kensal Green. Driven from Nîmes by the Revolution, Madame Guizot and her son repaired to Geneva, where he received his education. In spite of her decided Calvinistic opinions, the theories of Rousseau, then much in fashion, were not without their influence on Madame Guizot. She was a strong liberal, and she even adopted the notion inculcated in the *Émile* that every man ought to learn a manual trade or craft. Young Guizot was taught to be a carpenter, and he so far succeeded in his work that he made a table with his own hands, which is still preserved at Val Richer by his children. Of the progress of his graver studies little is known, for in the work which he entitled *Memoirs of my own Times* Guizot omitted all personal details of his earlier life. But his literary attainments must have been precocious and considerable, for when he arrived in Paris in 1805 to pursue his studies in the faculty of laws, he entered at eighteen as tutor into the family of M. Stapfer, formerly Swiss minister in France, and he soon began to write in a journal edited by M. Suard, the *Publiciste*. This connection introduced him to the literary society of Paris. In October, 1809, being then twenty-two, he wrote a review of M. de Chateaubriand's *Martyrs*, which procured for him the approbation and cordial thanks of that eminent person, and he continued to contribute largely to the periodical press. At Suard's he had made the acquaintance of Mademoiselle de Meulan, an accomplished lady of good family, some fourteen years older than himself, who also was engaged to contribute a series of articles to Suard's journal. These contributions were interrupted by her illness, but immediately resumed

and continued by an unknown hand. It was discovered that François Guizot had quietly supplied the deficiency on her behalf. The acquaintance thus begun ripened into friendship and love, and in 1812 Mademoiselle de Meulan consented to marry her youthful ally. She was the mother of his eldest son, a young man of great promise, who died of consumption in 1837. Madame Guizot, his first wife, died in 1827; she was the authoress of many esteemed works on female education.

During this period of his life Guizot, entirely devoted to literary pursuits, published a collection of French synonyms (1809), an essay on the fine arts (1811), and a translation of Gibbon with additional notes in 1812. These works recommended him to the notice of M. de Fontanes, then grand-master of the university of France, and there was some question of attaching him in a subordinate office to the council of state. But on political subjects a radical antagonism existed between the young constitutional publicist and the spirit of the empire. This did not prevent M. de Fontanes from selecting Guizot for the chair of modern history in Paris in 1812. His first lecture (which is reprinted in his *Memoirs*) was delivered on the 11th December of that year. The customary compliment to the all-powerful emperor he declined to insert in it, in spite of the hints given him by his patron. He had now acquired a considerable position in the society of Paris, and the friendship of Royer-Collard and the leading members of the liberal party, including the young Duc de Broglie. Absent from Paris at the moment of the fall of Napoleon in 1814, he was at once selected, on the recommendation of Royer-Collard, to serve the Government of Louis XVIII. in the capacity of secretary-general of the ministry of the interior, under the Abbé de Montesquiou. Upon the return of Napoleon from Elba he immediately resigned, on the 25th March, 1815 (the statement that he retained office under General Carnot is incorrect), and returned to his literary pursuits. The liberal professions of the emperor during the Hundred Days, though backed by Benjamin Constant, did not for a moment impose on Guizot. He was convinced that Napoleon would never govern on liberal principles, and that his power could not last. He was equally convinced that a second restoration of the Bourbons was the only mode by which constitutional monarchy could be established in France. He therefore applied himself to promote that object, and repaired to Ghent, where he saw Louis XVIII., and in the name of the liberal party pointed out to his majesty that a frank adoption of a liberal policy could alone secure the duration of the restored monarchy—advice which was ill-received by M. de Blacas and the king's confidential advisers. This visit to Ghent, at the time when France was a prey to a second invasion, was made a subject of bitter reproach to Guizot in after life by his political opponents, as an unpatriotic action. "The Man of Ghent" was one of the terms of insult frequently hurled against him in the days of his power. But the reproach appears to be wholly unfounded. The true interests of France were not in the defence of the falling empire, but in establishing a liberal policy on a monarchical basis and in combating the reactionary tendencies of the ultra-royalists. It is at any rate a remarkable circumstance that a young professor of twenty-seven, with none of the advantages of birth or political experience, should have been selected to convey so important a message to the ears of the king of France, and a proof, if any were wanting, that the Revolution had, as Guizot said, "done its work."

On the second restoration Guizot resumed office as secretary-general of the ministry of justice under M. de Marbois, but this minister resigned in 1816, and the young statesman was promoted to the council of state and to the general directorship of the departmental and communal administration of the kingdom. But the reactionary spirit of the chamber of deputies, of the royalist party, and of the successive Governments of Louis XVIII., was extremely opposed to the views of Guizot and his friends. Then it was that they endeavored by their writings and by their speeches to apply broader principles of parliamentary government to France, and to found the party which was known by the title of the "Doctrinaires." The opinions of the doctrinaires had more of the rigor of a sect than the elasticity of a political party. Adhering to the great principles of liberty and toleration, they were sternly opposed to the anarchical traditions of the Revolution. They knew that the elements of anarchy were still fermenting in the country; these they hoped to subdue, not by reactionary measures, but by the firm application of the power of a limited constitution, based on the suffrages of the middle class and defended by the highest literary talent of the times. Their motives were honorable. Their views were philosophical. But they were opposed alike to the democratical spirit of the age, to the military traditions of the empire, and to the bigotry and absolutism of the court. The fate of such a party might be foreseen. They lived by a policy of resistance; they perished by another revolution. They are remembered more for their constant opposition to popular demands than by the services they undoubtedly rendered to the cause of temperate freedom.

In the eyes of this celebrated party, and in the sanguine spirit of the times, the French Revolution had run its course. It had exhausted the popular excesses of the convention and the military despotism of the empire. The victory of the Revolution over the arbitrary powers of the crown and the unjust privileges of the aristocracy was complete. Power was transferred to the middle classes of society, and their leaders hoped to establish on the basis of a limited suffrage all the essential rights and liberties of a free people. They hoped at the same time, by the diffusion of education amongst the people, to qualify them more and more for the exercise of these rights. They combated the reactionary and intolerant influence of the church. They opposed the high prerogative doctrines of the ministers of the crown. Their policy was described by the term "juste milieu"—a *via media* between royal authority and popular government. In those days none foresaw that they were building on the sand, and that before another generation had passed away, their scientific structure of government would crumble into ruins, and France would again traverse the dreary cycle of popular revolutions and imperial despotism. In 1821, when the reaction was at its height after the murder of the Duc de Berri, and the fall of the ministry of Due Decazes, Guizot's relations to the Government of M. de Villèle became decidedly hostile. He was deprived of all his offices, and in 1825 even his course of lectures was interdicted. During the five succeeding years he played an important part among the leaders of the liberal opposition to the Government of Charles X., although he had not yet entered parliament, and this was also the time of his greatest literary activity. Within this period he published his lectures on representative government; a work on capital punishment for political offences; a collection of memoirs of the history of England in 26 volumes, and of memoirs of the history of France in 31 volumes; and a revised translation of Shakespeare. The most remarkable work from his own pen was the first part of his *History of the English Revolution from the Accession of Charles I. to that of Charles II.*,—a book of great merit and impartiality, which he resumed and completed during his exile in England after 1848. The Martignac administration restored Guizot in 1828 to his professor's chair and to the council of state. Then it was that he delivered the celebrated courses of lectures which raised his reputation as an historian to the highest point of fame, and placed him amongst the best writers of France and of Europe. These lectures formed the basis of his general *History of Civilization in Europe*, and of his *History of Civilization in France*. Our space does not allow us to offer any remark on these well-known publications. But they must ever be regarded as classics of modern historical research, and precursors of the great advance in the treatment of modern history which has marked the last half century.

Hitherto Guizot's fame rested on his merits as a writer on public affairs and as a lecturer on modern history. He had attained the age of forty-three before he entered upon the full display of his oratorical strength. In January, 1830, he was elected for the first time by the town of Lisieux to the chamber of deputies, and he retained that seat during the whole of his political life, that is, for eighteen years. The moment was critical for a representative of liberal principles and an aspirant for power. The Polignac ministry had engaged in a mortal contest between Charles X. and the national legislature, and the election of a popular man of letters by an important constituency was hailed as a triumph of the liberal cause.

Guizot immediately assumed an important position in the representative assembly, and the first speech he delivered was in defence of the celebrated address of the 221, in answer to the menacing speech from the throne, which

was followed by the dissolution of the chamber, and was the precursor of another revolution. On his returning to Paris from Nîmes on the 27th July, the fall of Charles X. was already imminent. Guizot was called upon by his friends Casimer Périer, Laffitte, Villemain, and Dupin to draw up the protest of the liberal deputies against the royal ordinances of July, whilst he applied himself with them to control the revolutiouary character of the late contest. Personally, Guizot was always of opinion that it was a great misfortune for the cause of parliamentary government iu France that the infatuation and ineptitude of Charles X. aud Prince Polignac rendered a change in the hereditary line of succession inevitable. The chamber of deputies assumed the powers of a convention, and placed the duke of Orleans on the throne. A ministry was formed under M. Laffitte,[1] and although it comprised the great names of Count Molé, Marshal Gérard, Casimir Périer, and the Duc de Broglie, the department of the interior, then the most difficult and important in the state, was allotted to Guizot. Nor was his an inactive administration. The waves of the great tempest which had just passed over France were to be stilled, the lives of the fallen ministers to be saved, stability to be given to the throne, confidence in the maintenance of peace to Europe; and, although the Laffitte cabinet was of short duration, these objects were attaiued. In 1831 Casimir Périer formed a more vigorous and compact administration, which was terminated in May, 1832, by his death; the summer of that year was marked by a formidable republican rising in Paris, and it was not till the 11th October, 1832, that a stable Government was formed, in which Marshal Soult was first minister, the Duc de Broglie took the foreign office, Thiers the home department, and Guizot contented himself with the department of public instruction. This ministry, which lasted for nearly four years, was by far the ablest and most comprehensive that ever served Louis Philippe; it combined men of the highest talents and character, and it rendered incalculable services to the nation and the crown. Guizot, however, was already marked with the stigma of unpopularity by the more advanced liberal party. He remained unpopular all his life, "not," said he, "that I court unpopularity, but that I think nothing about it." Yet never were his great abilities more useful to his country than whilst he filled this office of secondary rank but of primary importance in the department of public instruction. The duties it imposed on him were entirely congenial to his literary tastes, and he was master of the subjects they concerned. He applied himself in the first instance to carry a large measure for the education of the people, and to a great extent founded the existing educational establishments of the people of France. In fifteen years, under the influence of this law, the number of primary schools rose from ten to twenty-three thousand; normal schools for teachers, and a general system of inspection, were introduced; and boards of education, under mixed lay and clerical authority, were created. The secondary class of schools and the university of France were equally the subject of his enlightened protection and care, and a prodigious impulse was given to philosophical study and historical research. The branch of the Institute of France known as the "Académie des Sciences Morales et Politiques," which had been suppressed by Napoleon, was revived by Guizot. Some of the old members of this learned body—Talleyrand, Siéyès, Rœderer, and Lakanal—again took their seats there, and a host of more recent celebrities were added by election for the free discussion of the great problems of political and social science. The "Société de l'Histoire de France" was founded for the publication of historical works; and a vast publication of mediæval chronicles and diplomatic papers was undertaken at the expense of the state.

The object of the cabinet of October, 1832, was to organize a conservative party, and to carry on a policy of resistance to the republican faction which threatened the existence of the monarchy. It was their pride and their boast that their measures never exceeded the limits of the law, and by the exercise of legal power alone they put down an insurrection amounting to civil war in Lyons and a sanguinary revolt iu Paris. The real strength of the ministry lay not in its nominal heads, but in the fact that in this Government and this alone Guizot and Thiers acted in cordial co-operation. The two great rivals in French parliamentary eloquence followed for a time the same path; but neither of them could submit to the supremacy of the other, and circumstances threw Thiers almost continuously on a course of opposition, whilst Guizot bore the graver responsibilities of power.

Once again indeed, in 1839, they were united, but it was in opposition to M. Molé, who had formed an intermediate Government, and this coalition between Guizot and the leaders of the left centre and the left, Thiers and Odilon Barrot, is justly regarded as one of the chief inconsistencies of his life. Victory was secured at the expense of principle; but none of the three chiefs of that alliance took ministerial office, and Guizot was not sorry to accept the post of ambassador in London, which withdrew him for a time from parliamentary contests. This was in the spring of 1840, and Thiers succeeded shortly afterwards to the ministry of foreign affairs.

Guizot was received with marked distinction by the queen and by the society of London. His literary works were highly esteemed, his character was respected, and France was never more worthily represented abroad than by one of her greatest orators. He was known to be well versed in the history and the literature of England, and sincerely attached to the alliance of the two nations and the cause of peace. But, as he himself remarked, he was a stranger to England and a novice in diplomacy; and unhappily the embroiled state of the Syrian question, on which the French Government had separated itself from the joint policy of Europe, and possibly the absence of entire confidence between the ambassador and the minister of foreign affairs, placed him in an embarrassing and even false position. The warnings he transmitted to Thiers were not believed. The warlike policy of Thiers was opposed to his own convictions. The treaty of the 15th July was signed without his knowledge and executed in the teeth of his remonstrances. For some weeks Europe seemed to be on the brink of war, until the king put an end to the crisis by refusing his assent to the military preparations of Thiers, and by summoning Guizot from London to form a ministry and to aid his Majesty in what he termed "ma lutte tenace contre l'anarchie." Thus began, under dark and adverse circumstances, on the 29th October, 1840, the important administration in which Guizot remained the master-spirit for nearly eight years. He himself took the office of minister for foreign affairs, to which he added some years later, on the retirement of Marshal Soult, the ostensible rank of prime minister. His first care was the maintenance of peace and the restoration of amicable relations with the other powers of Europe. If he succeeded, as he did succeed, in calming the troubled elements and healing the wounded pride of France, the result was due mainly to the indomitable courage and splendid eloquence with which he faced a raging opposition, gave unity and strength to the conservative party, who now felt that they had a great leader at their head, and appealed to the thrift and prudence of the nation, rather than to their vanity and their ambition. In his pacific task he was fortunately seconded by the formation of Sir Robert Peel's administration in England, in the autumn of 1841. Between Lord Palmerston and Guizot there existed unhappily an incompatibility of character exceedingly dangerous in the foreign ministers of two great and in some respects rival countries. With Lord Palmerston in office, Guizot felt that he had a bitter and active antagonist in every British agent throughout the world; the combative element was strong in his own disposition; and the result was a system of perpetual conflict and counter-intrigues. Lord Palmerston held (as it appears from his own letters) that war between England and France was, sooner or later, inevitable. Guizot held that such a war would be the greatest of all calamities, and certainly never contemplated it. In Lord Aberdeen, the foreign secretary of Sir Robert Peel, Guizot found a friend and an ally perfectly congenial to himself. Their acquaintance in London had been slight, but it soon ripened into mutual regard and confidence. They were both men of high principles and honor; the Scotch Presbyterianism which had moulded the faith of Lord Aberdeen was reflected in the Huguenot minister of France; both were men of extreme simplicity of taste, joined to the refinement of scholarship and culture; both had an intense aversion to war and felt themselves ill-qualified to carry on those adventurous operations which inflamed the imagination of their respective opponents. In the eyes of Lord Palmerston and Thiers their policy was mean and pitiful; but it was a policy which secured peace to the world, and united the two great and free nations of the West in what was termed

[1] [Jacques (1767–1844), son of a Bayonne carpenter, Paris banker, of great wealth, custodian of Napoleon's and royal funds, promoted election of Louis Philippe, failed in 1831, but promptly recovered; his only daughter married the son of Marshal Ney.—Am. Ed.]

the *entente cordiale*. Neither of them would have stooped to snatch an advantage at the expense of the other; they held the common interest of peace and friendship to be paramount; and when differences arose, as they did arise, in remote parts of the world,—in Tahiti, in Morocco, on the Gold Coast, — they were reduced by this principle to their proper insignificance. The opposition in France denounced Guizot's foreign policy as basely subservient to England. He replied in terms of unmeasured contempt, —"You may raise the pile of calumny as high as you will; vous n'arriverez jamais à la hauteur de mon dédain!" The opposition in England attacked Lord Aberdeen with the same reproaches, but in vain. King Louis Philippe visited Windsor. The queen of England (in 1843) stayed at the Château d'Eu. In 1845 British and French troops fought side by side for the first time in an expedition to the River Plate.

The fall of Sir Robert Peel's Government in 1846 changed these intimate relations; and the return of Lord Palmerston to the foreign office led Guizot to believe that he was again exposed to the passionate rivalry of the British cabinet. A friendly understanding had been established at Eu between the two courts with reference to the future marriage of the young queen of Spain. The language of Lord Palmerston and the conduct of Sir Henry Bulwer at Madrid led Guizot to believe that this understanding was broken, and that it was intended to place a Coburg on the throne of Spain. Determined to resist any such intrigue, Guizot and the king plunged headlong into a counter-intrigue, wholly inconsistent with their previous engagements to England, and fatal to the happiness of the queen of Spain. By their influence she was urged into a marriage with a despicable offset of the house of Bourbon, and her sister was at the same time married to the youngest son of the French king, in direct violation of Louis Philippe's promises. This transaction, although it was hailed at the time as a triumph of the policy of France, was in truth as fatal to the monarch as it was discreditable to the minister. It was accomplished by a mixture of secrecy and violence. It was defended by subterfuges. By the dispassionate judgment of history it has been universally condemned. Its immediate effect was to destroy the Anglo-French alliance, and to throw Guizot into closer relations with the reactionary policy of Metternich and the Northern courts.

The history of Guizot's administration, the longest and the last which existed under the constitutional monarchy of France, bears the stamp of the great qualities and the great defects of his political character, for he was throughout the master-spirit of that Government. His first object was to unite and discipline the conservative party, which had been broken up by previous dissensions and ministerial changes. In this he entirely succeeded by his courage and eloquence as a parliamentary leader, and by the use of all those means of influence which France too liberally supplies to a dominant minister. No one ever doubted the purity and disinterestedness of Guizot's own conduct. He despised money; he lived and died poor; and though he encouraged the fever of money-getting in the French nation, his own habits retained their primitive simplicity. But he did not disdain to use in others the baser passions from which he was himself free. Some of his instruments were mean; he employed them to deal with meanness after its kind. Gross abuses and breaches of trust came to light even in the ranks of the Government, and under an incorruptible minister the administration was denounced as corrupt. *Licet uti alieno vitio* is a proposition as false in politics as it is in divinity.

Of his parliamentary eloquence it is impossible to speak too highly. It was terse, austere, demonstrative, and commanding—not persuasive, not humorous, seldom adorned, but condensed with the force of a supreme authority in the fewest words. He has been heard to say that he seldom had occasion to address the chambers for more than twenty minutes at a time, except when despatches were read. The consequence was that the audience hung upon his words with breathless attention. Not a syllable, not an inflection of the voice was lost—nothing was repeated; and when he ceased, it seemed as if the waves of an ocean had been spell-bound by his voice. He was essentially a ministerial speaker, far more powerful in defence than in opposition. Like Pitt he was the type of authority and resistance, unmoved by the brilliant charges, the wit, the gayety, the irony, and the discursive power of his great rival. Nor was he less a master of parliamentary tactics, and of those sudden changes and movements in debate, which, as in a battle, sometimes change the fortune of the day. His confidence in himself, and in the majority of the chamber which he had moulded to his will, was unbounded; and long success and the habit of authority led him to forget that in a country like France there was a people outside the chamber elected by a small constituency, to which the minister and the king himself were held responsible.

A Government based on the principle of resistance and repression and marked by dread and distrust of popular power, a system of diplomacy which sought to revive the traditions of the old French monarchy, a sovereign who largely exceeded the bounds of constitutional power and whose obstinacy augmented with years, a minister who, though far removed from the servility of the courtier, was too obsequious to the personal influence of the king, were all singularly at variance with the promises of the Revolution of July, and they narrowed the policy of the administration. Guizot's view of politics was essentially historical and philosophical. His tastes and his acquirements gave him little insight into the practical business of administrative government. Of finance he knew nothing; trade and commerce were strange to him, and he has been heard to express astonishment at the paramount importance Sir Robert Peel attached to his commercial policy; military and naval affairs were unfamilar to him; all these subjects he dealt with by second hand through his friends Dumon, Duchâtel, or Marshal Bugeaud. The consequence was that few measures of practical improvement were carried by his administration. Still less did the Government lend an ear to the cry for parliamentary reform. On this subject the king's prejudices were insurmountable, and his ministers had the weakness to give way to them Being asked after the Revolution of 1848 whether he thought the action and extra-constitutional influence of King Louis Philippe had been beneficial or injurious to the monarchy, Guizot replied that in the earlier years of the king's reign it had been of great use in strengthening the government and restoring order, but that in the later years it had been injurious to constitutional government and to the monarchy itself. It obviously drew down upon the king that responsibility which should have rested entirely on his ministers; and on the question of reform he was even more to be blamed than they were. It was impossible to defend a system which confined the suffrage to 200,000 citizens, and returned a chamber of whom half were placemen. Nothing would have been easier than to strengthen the conservative party by attaching the suffrage to the possession of land in France, but blank resistance was the sole answer of the Government to the just and moderate demands of the opposition. Warning after warning was addressed to them in vain by friends and by foes alike; and they remained profoundly unconscious of their danger till the moment when it overwhelmed them. It was the old old story of a hopeless conflict between a court, obstinately addicted to an effete theory of government, and the rising will of a nation, when a little timely and honest concession would have arrested the catastrophe. Strange to say, Guizot never acknowledged either at the time or to his dying day the nature of this error; and he speaks of himself in his memoirs as the much enduring champion of liberal government and constitutional law. He utterly fails to perceive that a more enlarged view of the liberal destinies of France and a less intense confidence in his own specific theory might have preserved the constitutional monarchy and averted a vast series of calamities, which were in the end fatal to every principle he most cherished. But with the stubborn conviction of absolute truth he dauntlessly adhered to his own doctrines to the end. The last scene of his political life was singularly characteristic of his inflexible adherence to a lost cause. In the afternoon of February 23, 1848, the king summoned his minister from the chamber, which was then sitting, and informed him that the aspect of Paris and the country during the banquet agitation for reform, and the alarm and division of opinion in the royal family, led him to doubt whether he could retain his ministry. That doubt, replied Guizot, is decisive of the question, and instantly resigned, returning to the chamber only to announce that the administration was at an end, and that Molé had been sent for by the king. Molé failed in

the attempt to form a Government, and between midnight and one in the morning Guizot, who had according to his custom retired early to rest, was again sent for to the Tuileries. The king asked his advice. "We are no longer the ministers of your Majesty," replied Guizot; "it rests with others to decide on the course to be pursued. But one thing appears to be evident: this street riot must be put down; these barricades must be taken; and for this purpose my opinion is that Marshal Bugeaud should be invested with full power, and ordered to take the necessary military measures, and as your Majesty has at this moment no minister, I am ready to draw up and countersign such an order." The marshal, who was present, undertook the task, saying, "I have never been beaten yet, and I shall not begin to-morrow. The barricades shall be carried before dawn." After this display of energy the king hesitated, and soon added: "I ought to tell you that M. Thiers and his friends are in the next room forming a Government!" Upon this Guizot rejoined, "Then it rests with them to do what they think fit," and left the palace. Thiers and Barrot decided to withdraw the troops. The king and Guizot next met at Claremont. This was the most perilous conjuncture of Guizot's life, but fortunately he found a safe refuge in Paris for some days in the lodging of a humble miniature painter whom he had befriended, and shortly afterwards effected his escape across the Belgian frontier and thence to London, where he arrived on the 3d March. His mother and daughters had preceded him, and he was speedily installed in a modest habitation in Pelham Crescent, Brompton.

The society of England, though many persons disapproved of much of his recent policy, received the fallen statesman with as much distinction and respect as they had shown eight years before to the king's ambassador. Sums of money were placed at his disposal, which he declined. A professorship at Oxford was spoken of, which he was unable to accept. His old friends resumed their relations with him. For himself, serene and undisturbed by a catastrophe which had shaken Europe, he immediately collected a few books and resumed the narrative of the British commonwealth, until he brought it down to Monk and Richard Cromwell.

Guizot survived the fall of the monarchy and the government he had served twenty-six years. He passed abruptly from the condition of one of the most powerful and active statesmen in Europe to the condition of a philosophical and patriotic spectator of human affairs. He was aware that the link between himself and public life was broken for ever; and he never made the slightest attempt to renew it. He was of no party, a member of no political body; no murmur of disappointed ambition, no language of asperity, ever passed his lips; it seemed as if the fever of oratorical debate and ministerial power had passed from him and left him a greater man than he had been before, in the pursuit of letters, in the conversation of his friends, and as head of the patriarchal circle of those he loved. The greater part of the year he spent at his residence at Val Richer, an Augustine monastery near Lisieux in Normandy, which had been sold at the time of the first Revolution. His two daughters, who married two descendants of the illustrious Dutch family of De Witt, so congenial in faith and manners to the Huguenots of France, kept his house. One of his sons-in-law farmed the estate. And here Guizot devoted his later years with undiminished energy to literary labor, which was in fact his chief means of subsistence. Proud, independent, simple, and contented he remained to the last; and these years of retirement were perhaps the happiest and most serene portion of his life.

Two institutions may be said even under the second empire to have retained their freedom—the Institute of France and the Protestant Consistory. In both of these Guizot continued to the last to take an active part. He was a member of three of the five academies into which the Institute of France is divided. The Academy of Moral and Political Science owed its restoration to him, and he became in 1832 one of its first associates. The Academy of Inscriptions and Belles Lettres elected him in 1833 as the successor to M. Dacier; and in 1836 he was chosen a member of the French Academy, the highest literary distinction of the country. In these learned bodies Guizot continued for nearly forty years to take a lively interest and to exercise a powerful influence. He was the jealous champion of their independence. His voice had the greatest weight in the choice of new candidates; the younger generation of French writers never looked in vain to him for encouragement; and his constant aim was to maintain the dignity and purity of the profession of letters.

In the consistory of the Protestant church in Paris Guizot exercised a similar influence. His early education and his experience of life conspired to strengthen the convictions of a religious temperament. He remained through life a firm believer in the truths of revelation, and a volume of *Meditations on the Christian Religion* was one of his latest works. But though he adhered inflexibly to the church of his fathers and combated the rationalist tendencies of the age, which seemed to threaten it with destruction, he retained not a tinge of the intolerance or asperity of the Calvinistic creed. He respected in the Church of Rome the faith of the majority of his countrymen; and the writings of the great Catholic prelates, Bossuet and Bourdaloue, were as familiar and as dear to him as those of his own persuasion, and were commonly used by him in the daily exercises of family worship.

In these literary pursuits and in the retirement of Val Richer years passed smoothly and rapidly away; and as his grandchildren grew up around him, he began to direct their attention to the history of their country. From these lessons sprang his last and not his least work, the *Histoire de France racontée à mes petits enfants*, for although this publication assumed a popular form, it is not less complete and profound than it is simple and attractive. The work extends to five large volumes, and has been brought down to the present time by his accomplished daughter Madame Guizot de Witt, from her father's notes.

Down to the summer of 1874 Guizot's mental vigor and activity were unimpaired. His frame, temperate in all things, was blessed with a singular immunity from infirmity and disease; but in the month of September of that year the vital power ebbed away, and he passed gently, reciting now and then a verse of Corneille or a text of Scripture, into his rest.

Public life, ambition, the love of power, and the triumph of debate no doubt shook and agitated his career, and sometimes misdirected it; but they produced no effect upon the solid structure of his character, which remained throughout perfectly simple, indifferent to wealth, and prouder of its own integrity than of all the honor the world could bestow. M. Guizot will be remembered in history less by what he did as a politician than by what he wrote as a man of letters, and by what he was as a man; and in these respects he takes rank amongst the most illustrious representatives of his nation and his age. (H. R.)

GUJARAT. See GUZERAT.

GUJRÁNWÁLA, a British district in the Punjab, lying between 31° 32′ and 32° 33′ N. lat., and between 73° 11′ 30″ and 74° 28′ 15″ E. long., with an area (1877) of 2563 square miles, and population (1868) of 550,576. It is bounded on the N. W. by the river Chenáb, on the S. and S. E. by the districts of Jhang and Lahore, and on the E. by the district of Siálkot. This district forms the central portion of the Rechna Doáb, intermediate between the fertile submontane plains of Siálkot and the desert expanses of Jhang. On the northern frontier, a belt of alluvial land, some 2 to 6 miles in breadth, fringes the Chenáb throughout its course. The southern portion of the plateau has a rich soil, with accessible water; the villages here lie close together, while the people are careful and industrious cultivators. But further south the ground becomes harder and drier until in the extreme south the *bár*, a flat expanse of barren land, passes slowly into the desert of Jhang. In the south-east corner of the district, the little river Degh irrigates and fertilizes a tiny valley of its own. Two or three minor watercourses are used for the purposes of irrigation in the villages through which they pass. The country is very bare of trees, and the scenery throughout is tame and in the central plateau becomes very monotonous.

The district of Gujránwála is essentially a modern one; yet it can claim considerable relics of the past, constructed during an early period of prosperity. It seems likely that the district once contained the capital of the Punjab, at an epoch when Lahore had not begun to exist. We learn from the Chinese Buddhist pilgrim, Hiouen Thsang, that about the year 630 he visited a town known as Tse-kia (or Táki), the metropolis of the whole country of the five rivers. A mound near the modern village of Asazur has been identified as the site of the ancient capital. Until the Mahometan invasions little is known of Gujránwála except that

Táki had fallen into oblivion and Lahore had become the chief city Under Mahometan rule the district flourished for a time, but a mysterious depopulation fell upon the tract, and the whole region seems to have been almost entirely abandoned. At the first beginning of the Síkh war, the waste plains of Gujránwála were seized by various military adventurers. Charat Sinh took possession of the village of Gujránwála, and here his grandson the great maháráját Ranjít Sinh was born. The Síkh rule, which was elsewhere so disastrous, appears to have been an unmitigated benefit to this district. Ranjít Sinh settled large colonies in the various villages, and encouraged cultivation throughout the depopulated plain. In 1847 the district came under British influence, in connection with the regency at Lahore; and in 1849 it was included in the territory annexed after the second Síkh war Since that time Gujránwála has enjoyed an immunity from the catastrophes of history, with the exception of the events of 1857, which belong to the general annals of India.

The population in 1868 numbered 550,576 persons,—306,296 males and 244,280 females. In religion, the district is mainly Mahometan. There were five towns, namely, Gujránwála, Wazírábád, Rámnagar, Eminábád, and Akalgarh, with a population aggregating 54,458 persons. The total cultivated area of the district amounts to 567,849 acres, while the cultivable margin reaches the high figure of 701,761 acres. The staple crop is wheat, which occupies one-third of the cultivated area. The other products are—barley, gram, tobacco, oil-seeds, vegetables, rice, Indian corn, pulses, cotton, and sugarcane. Irrigation is very general, 327,832 acres being artificially watered. The trade of the district is unimportant. The chief exports are agricultural produce, brass vessels, leathern bottles, and timber. The imports consist of salt, iron, cattle, spices, and English piecegoods. A great religious fair is held at Dhonkal. The principal channel of communication is the Northern State Railway from Lahore to Pesháwar. The Grand Trunk road, connecting the same two places, traverses the district for 42 miles. There are 1055 miles of unmetalled road in Gujránwála, besides a number of local by-ways. The Chenáb is navigable throughout for the boats of the country. The revenue in 1871 was £53,560 In 1872–73 the district contained 12 civil and 19 magisterial courts. The total police force numbered 523 men, supplemented by 1092 village watchmen. Education is still very backward, the pupils in 1873 numbered in all 5818, maintained at a cost of £2469. The mean monthly temperature in 1867 ranged from 53° in January to 95° in June. The average rainfall for the eleven years ending 1867 was 24 inches. The prevalent diseases are intermittent fever and small-pox. The death-rate in 1872 amounted to 12,592, or 23 per thousand of the population.

GUJRÁNWÁLA, the chief town and administrative headquarters of the above district in 32° 9′ 30″ N lat. and 74° 14′ E. long., with a population in 1868 of 19,381. The town is situated on the Grand Trunk road and Northern State Railway, 40 miles north of Lahore. It is of modern creation, and owes its importance to the father and grandfather of Maháráját Ranjít Sinh, whose capital it formed during the early period of the Síkh power. There is a mausoleum to Máhan Sinh, father of Ranjít Sinh, and a lofty cupola covers a portion of the ashes of the maháráját himself. The civil station lies a mile south-east of the native town. It contains the court-house, treasury, jail, dispensary, post-office, staging bungalow, and church.

GUJRÁT, or GOOJARAT, a British district in the Punjab, lying between 32° 10′ 30″ and 33° N. lat., and between 73° 20′ and 74° 31′ E. long, area (1877), 2029 square miles; population (1868), 616,347 souls. It is bounded on the N. E. by the native state of Kashmír, on the N. W. by the river Jhílam, on the W. by Shahpur district, and on the S. E. by the rivers Távi and Chenáb. The district of Gujrát comprises a narrow wedge of sub-Himálayan plain country, possessing few natural advantages. From the basin of the Chenáb on the south the general level rises rapidly towards the interior, which, owing to the great distance of the water beneath the surface, assumes a dreary and desert aspect. A range of low hills, known as the Pabbi, traverses the northern angle of Gujrát. They are composed of a friable Tertiary sandstone and conglomerate, totally destitute of vegetation, and presenting to the view a mere barren chaos of naked rock, deeply scored with precipitous ravines. Immediately below the Pabbi stretches a high plateau, terminating abruptly in a precipitous bluff some 200 feet in height At the foot of this plateau is a plain, which forms the actual valley of the Chenáb and participates in the irrigation from the river bed. The district as a whole is well wooded, and great attention has been paid to arboriculture.

Numerous relics of antiquity stud the surface of Gujrát district. Mounds of ancient construction yield numbers of early coins, and bricks are found whose size and type prove them to belong to the prehistoric period of Hindu architecture. A mound now occupied by the village of Moga or Mong has been identified as the site of Nicæa, the city built by Alexander the Great on the field of his victory over Porus. The Delhi empire established its authority in this district under Bahlol Lodi (1450–1488). A century later it was visited by Akbar, who founded Gujrát as the seat of government. During the decay of the Mughal power, the Ghakkars of Rawal Pindi overran this portion of the Punjab and established themselves in Gujrát about 1741. Meanwhile the Síkh power had been asserting itself in the eastern Punjab, and in 1765 the Ghakkar chief was defeated by Sardar Gújar Sinh, chief of the Bhangi confederacy On his death, his son succeeded him, but after a few months' warfare, in 1798, he submitted himself as vassal to the maháráját Ranjít Sinh. In 1846 Gujrát first came under the supervision of British officials. Two years later the district became the theatre for the important engagements which decided the event of the second Síkh war. After several bloody battles in which the British were unsuccessful, the Síkh power was irretrievably broken at the engagement which took place at Gujrát on the 22d of February, 1849 The Punjab lay at the feet of the conquerors, and passed by annexation under British rule.

The census of 1868 disclosed a population of 616,347 persons,—331,919 males, and 284,428 females,—of whom 537,696 were Mahometans, 53,174 Hindus, and 20,653 Síkhs. In 1875–76 the district contained four municipal towns with a population exceeding 5000—Gujrát, 19,000; Jalálpur, 14,022; Kunjah, 5354; and Dinga, 5077. Wheat forms the staple product of the district, while barley, gram, rice, pulses, oil-seeds, and cotton also cover considerable areas. Of the 708,863 acres under cultivation, 267,893 acres are provided with artificial irrigation. The chief exports are grain, *ghi*, wool, and other agricultural produce. The imports come chiefly from Lahore, Amritsar, Jammu, and Pind Dádan Khán. The Northern State Railway passes through the district from south-east to north-west, and affords a new outlet for traffic. Good branch lines of road connect Gujrát with all surrounding centres. The revenue in 1875–76 was £64,425. In the same year there were 11 civil and revenue judges. The police force (1875–76) numbered 514 men, supplemented by a body of 620 village watchmen. The number of state-supported schools amounted to 47 in 1875–76, having a joint roll of 3600 pupils. The cost of education is returned at £1613. The district school at Gujrát ranks as one of the eight "higher class" schools of the Punjab. Gujrát bears the reputation of being a healthy district; small-pox, fever, and ague occasionally prevail. The death-rate (1875–76) was 18 per thousand of the population The district contains 6 charitable dispensaries, giving relief in 1875 to 31,788 persons. The annual average rainfall during eight years ending 1873–74 was 28·5 inches. The fall is regular, and the district on the whole does not suffer much from drought.

GUJRÁT, the chief town and administrative headquarters of the above district, in 32° 34′ 30″ N. lat. and 74° 7′ 15″ E. long., with a population of 19,000, stands upon an ancient site, formerly occupied, according to tradition, by two successive cities, the second of which is supposed to have been destroyed in 1303, the year of an early Mughal invasion of Delhi. Nearly 200 years later Sher Sháh turned his attention to the surrounding country, and either he or Akbar founded the existing town. Though standing in the midst of a Ját neighborhood, the fort was first garrisoned by Gújars, and took the name of Gujrát Akbarábád. The town was rendered memorable during the second Síkh war by the battle which takes its name from this site, and which decided the fate of the campaign, bringing the whole Punjab at once under British rule. Akbar's fort, largely improved by Gújar Sinh, stands in the centre of the town. The civil station lies to the north of the native city, and contains the court-house, treasury, jail, dispensary, police-lines, staging bungalow, and post-office. The trade of Gujrát is inconsiderable.

GULF STREAM. See ATLANTIC.

GULL (Welsh, *Gwylan;* French, *Goéland*), the name commonly adopted, to the almost entire exclusion of the old English MEW (Icelandic, *Máfur;* Danish, *Maage;* Swedish, *Måse;* German, *Meve;* Dutch, *Meeuw;* French, *Mouette*), for a group of Sea-birds widely and commonly known, all belonging to the genus *Larus* of Linnæus, which subse-

quent systematists have broken up in a very arbitrary and often absurd fashion. The family *Laridæ* is composed of two chief groups, *Larinæ* and *Sterninæ*—the Gulls and the Terns, though two other Subfamilies are frequently counted, the Skuas (*Stercorariinæ*), and that formed by the single genus *Rhynchops*, the Skimmers; but there seems no strong reason why the former should not be referred to the *Larinæ* and the latter to the *Sterninæ*.

Taking the Gulls in their restricted sense, Mr. Howard Saunders, who has lately subjected the group to a rigorous revision (*Proc. Zool. Society*, 1878, pp. 155–211), admits forty-nine species of them, which he places in five genera instead of the many which some prior investigators had sought to establish. Of the genera recognized by him, *Pagophila* and *Rhodostethia* have but one species each, *Rissa* and *Xema* two, while the rest belong to *Larus*. The *Pagophila* is the so-called Ivory-Gull, *P. eburnea*, names which hardly do justice to the extreme whiteness of its plumage, to which its jet-black legs offer a strong contrast. The young, however, are spotted with black. An inhabitant of the most northern seas, examples, most commonly young birds of the year, find their way in winter to more temperate shores. Its breeding-place has seldom been discovered, and the first of its eggs ever seen by ornithologists was brought home by Sir L. M'Clintock in 1853 from Cape Krabbe (*Journ. R. Dubl. Society*, i. p. 60, pl. 1); others were subsequently obtained by Dr. Malmgren in Spitsbergen. Of the species of *Rissa*, one is the abundant and well-known Kittiwake, *R. tridactyla*, of circumpolar range, breeding, however, also in comparatively low latitudes, as on the coasts of Britain, and in winter frequenting southern waters. The other is *R. brevirostris*, limited to the North Pacific, between Alaska and Kamchatka. The singular fact requires to be noticed that in both these species the hind toe is generally deficient, but that examples of each are occasionally found in which this functionless member has not wholly disappeared. We have then the genus *Larus*, which ornithologists have hitherto attempted most unsuccessfully to subdivide. It contains the largest as well as the smallest of Gulls. In some species the adults assume a dark-colored head every breeding-season, in others any trace of dark color is the mark of immaturity. The larger species prey fiercely on other kinds of birds, while the smaller content themselves with a diet of insects and worms. But however diverse be the appearance, structure, or habits of the extremities of the series of species, they are so closely connected by intermediate forms that it is hard to find a gap between them that would justify a generic division. Of the forty-three species of this genus recognized by Mr. Saunders it would be impossible within the limits of this article to attempt to point out the peculiarities. About fifteen belong to Europe and fourteen to North America, of which (excluding stragglers) some five only are common to both countries. Our knowledge of the geographical distribution of several of them is still incomplete. Some have a very wide range, others very much the reverse, as witness *L. fuliginosus*, believed to be confined to the Galapagos, and *L. scopulinus* and *L. bulleri* to New Zealand,—the last indeed perhaps only to the South Island. The largest species of the group are the Glaucous and Greater Black-backed Gulls, *L. glaucus* and *L. marinus*, of which the former is circumpolar, and the latter nearly so—not being hitherto found between Labrador and Japan. The smallest species is the European *L. minutus*, though the North-American *L. philadelphia* does not much exceed it in size. Many of the Gulls congregate in vast numbers to breed, whether on rocky cliffs of the sea-coast or on heathy islands in inland waters. Some of the settlements of the Black-headed or "Peewit" Gull, *L. ridibundus*, are a source of no small profit to their proprietors,—the eggs, which are rightly accounted a great delicacy, being taken on an orderly system up to a certain day, and the birds carefully protected. Ross's or the Roseate Gull, *Rhodostethia rosea*, forms a well-marked genus, distinguished not so much by the pink tint of its plumage (for that is found in other species) but by its small Dove-like bill and wedge-shaped tail. It is an exceedingly scarce bird, little more than a dozen examples being known to exist in collections. Beyond its having an Arctic habitat, little has yet been ascertained about it. More rare still is one of the species of *Xema*, *X. furcatum*, of which only two specimens, both believed to have come from the Galapagos, have been seen. Its smaller congener Sabine's Gull, *X. sabinii*, is more common, and has been found breeding both in Arctic America and in Siberia, and several examples, chiefly immature birds, have been obtained in the British Islands. Both species of *Xema* are readily distinguished from all other Gulls by their forked tails. (A. N.)

GUM exists in the juices of almost all plants, but is produced in its purest form by various species of *Acacia*, *e. g.*, *Acacia Verek* (Guil. and Perrottet), *A. horrida*, *A. arabica* (Wildenow), *A. Seyel* (Delile), and *A. stenocarpa* (Hochst). The name is applied to those exudations from plants, stems, branches, or fruits which are entirely soluble or soften in water, and form with it a thick glutinous liquid or mucilage insoluble in alcohol of 60 per cent., and yield mucic and oxalic acids when treated with nitric acid. In structure gum is quite amorphous, being neither organized like starch nor crystallized like sugar. According to Trecul, the acacias and the *Rosaceæ* yield their gums most abundantly when sickly and in an abnormal state, caused by a fulness of sap in the young tissues, whereby the new cells are softened and finally disorganized; the cavities thus formed fill with liquid, which exudes, dries and constitutes the gum.

The chief varieties have hitherto been divided as follows:—(1) gum arabic, (2) gum tragacanth, (3) cherry tree gum, (4) gum of Bassora, (5) mucilage. The artificial gum dextrin has been already treated of, vol. vii. p. 126.

Gum Arabic may be taken as the type of the gums entirely soluble in water. The principal kinds are distinguished as Turkey Picked Gum, Gedda, Amrad, Gheziri, Senegal, Talca, Australian, Barbary, Cape and East India (from Bombay and Aden). Another variety, spoken of as likely, from its abundance, to be soon in the market, is obtained from the *Prosopis dulcis*, a leguminous plant, and is called gum mesquite or mezquite; it comes from Western Texas and Mexico, and is yellowish in color, very brittle, and quite soluble in water (*Pharm. Journ.* (3), vol. vi. p. 942).

Gum arabic occurs in pieces of varying size, and some kinds are full of minute cracks. The specific gravity of Turkey picked gum (the purest variety) is 1·487, or, when dried at 100° C., 1·525. It is soluble in water to an indefinite extent; boiled with dilute sulphuric acid it is converted first into dextrin, and then into a fermentable variety of sugar. Moderately strong nitric acid changes it into mucic, saccharic, tartaric, and oxalic acids. Under the influence of yeast it does not enter into the alcoholic fermentation, but Berthelot, by digesting with chalk and cheese, obtained from it 12 per cent. of its weight of alcohol, along with lactate of calcium, but no appreciable quantity of sugar. According to Frémy, gum arabic may be regarded as a potassium and calcium salt of gummic or arabic acid, of the formula $CaK_2C_{12}H_{22}O_{11}.6C_{12}H_{22}O_{11}$. Graham (*Chemical and Physical Researches*) gives dialysis as the simplest and best mode of preparing gummic acid, and states that the power of gum to penetrate the colloid septum is 400 times less than that of chloride of sodium, and further that by mixing the gum with substances of the crystalloid class the diffusibility is lowered, and may be even reduced to nothing. The mucilage must be acidulated with hydrochloric acid before dialyzing, to set free the gummic acid. Gummic acid reddens litmus, its reaction being about equal to carbonic acid. When solutions of gum arabic and gelatin are mixed, oily drops of a compound of the two are precipitated, which on standing form a nearly colorless jelly, melting at 25° C., or by the heat of the hand. This substance can be washed without decomposition. Gummic acid is soluble in water; when well dried at 100° C., it becomes transformed into metagummic acid, which is insoluble, but swells up in water like gum tragacanth.

Gum arabic, when heated to 150° C. with two parts of acetic anhydride, swells up to a mass which, when washed with boiling water, and then with alcohol, gives a white amorphous insoluble powder called acetyl arabin $C_6H_8(C_2H_3O)_2O_5$. It is saponified by alkalies, with reproduction of soluble gum. Gum arabic is not precipitated from solution by alum, stannous chloride, sulphate or nitrate of copper, or neutral lead acetate; with basic lead acetate it forms a white jelly, with ferric chloride it yields a stiff clear gelatinoid mass, and its solutions are also precipitated by borax.

The finer varieties are used as an emollient and demulcent in medicine, and in the manufacture of confectionery; the commoner qualities are used as an adhesive paste, for giving lustre to crape, silk, etc., in cloth finishing to stiffen the fibres, and in calico-printing. For labels, etc., it is usual to mix sugar or glycerin with it to prevent it from cracking.

Physiologically nothing is yet definitely known of gum

as a food material. Animals fed thereon soon die of inanition. Lehmann says it is not absorbed by the system, but according to Pavy, it is to a slight extent, as shown by the formation of amyloid substance in the liver of subjects fed on gum.

Gum senegal, a variety of gum arabic produced by *A. Verek*, occurs in pieces generally rounded, of the size of a pigeon's egg, and of a reddish or yellow color, and specific gravity 1·436. It gives with water a somewhat stronger mucilage than gum arabic, from which it is distinguished by its clear interior, fewer cracks, and greater toughness. It is imported from the river Gambia, and from Senegal and Bathurst, and is collected in December and March yearly.

Chagual gum, a new variety brought from St. Iago de Chili, resembles gum senegal. About 75 per cent. is soluble in water. Its solution is not thickened by borax, and is precipitated by neutral lead acetate; and dilute sulphuric acid converts it into dextro-glucose.

The imports of gum arabic into England during 1878 (including all the varieties) may be estimated as follows:—

	Tons.	Value.
Imports to London, about	1064	£40,000
" Liverpool, "	1554	77,000
	2618	£117,000

Of this about one-half is exported. These figures are only approximate, as, since the repeal of the duties in 1845, the returns do not discriminate between the various descriptions which are all classed together under the head of gum.[1]

Gum Tragacanth, familiarly called gum dragon, exudes from the stem, the lower part especially, of the various species of *Astragalus*, and is collected in Asia Minor, the chief port of shipment being Smyrna. Formerly only what exuded spontaneously was gathered; this was often of a brownish color; but now the flow of the gum is aided by incisions cut near the root, and the product is the fine, white, flaky variety so much valued in commerce. The chief flow of gum takes place during the night, and hot and dry weather is the most favorable for its production.

In color gum tragacanth is of a dull white; it occurs in horny, flexible, and tough, thin, twisted flakes, translucent, and with peculiar wavy lines on the surface. When dried at temperatures under 100° C. it loses about 14 per cent. of water, and is then easily powdered. Its specific gravity is 1·384. With water it swells by absorption, and with even fifty times its weight of that liquid forms a thick mucilage. Part of it only is soluble in water, and that resembles gummic acid in being precipitated by alcohol and ammonium oxalate, but differs from it in giving a precipitate with neutral lead acetate and none with borax. The insoluble part of the gum is a calcium salt of bassorin ($C_{12}H_{20}O_{10}$), which is devoid of taste and smell, forms a gelatinoid mass with water, but by continued boiling is rendered soluble, owing, according to M. Giraud, to its being changed into pectin. A small quantity of starch is always naturally present in gum tragacanth. The composition of gum tragacanth is generally given as arabin 53 per cent., bassorin and starch 33, water 11 (but M. Giraud considers its composition to be water 20 per cent.), mineral matter 3, a pectinous principle (apparently identical with the pectose of Frémy) 60, soluble gum 10, cellulose 3, starch 3, mineral matter 3, with traces of nitrogenous matter. Graham (*Chemical and Physical Researches*, p. 589) speaks of its being likely that native gums insoluble in water are the pectous form of soluble gum, and Giraud's experiments point to the correctness of that surmise.

Gum tragacanth is used in calico-printing as a thickener of colors and mordants; in medicine as a demulcent and vehicle for insoluble powders, and as an excipient in pills; and for setting and mending beetles and other insects. The imports during 1878 were—

	Packages.	Value.
To London	2570	£46,200
To Liverpool, about	1200	21,600
	3770	£67,800

Gum kuteera resembles in appearance gum tragacanth, for which the attempt has occasionally been made to substitute it. It is said to be the product of *Sterculia urens*, a plant of the natural order *Sterculiaceæ*, and is unknown to British commerce.

[1] For varieties of gum arabic, see *Pharmacographia*, pp. 209, 210; *Catalogue Museum Pharm. Soc.*, pp. 37, 38; also Pereira, *Mat. Med.*, vol. ii., pt. ii., p 334; for physiological properties, Pavy, *Foods and Dietetics*, 2d ed., pp. 112, 438; and for chemistry, Watts's *Dictionary*, vol. ii. p. 953.

Cherry Tree Gum is an exudation from trees of the genera *Prunus* and *Cerasus*. It occurs in shiny reddish lumps, resembling the commoner kinds of gum arabic. With water, in which it is only partially soluble, it forms a thick mucilage. The soluble portion is arabin, the insoluble cerasin, which according to Frémy is a calcium salt of metagummic acid ($C_{12}H_{22}O_{11}$). It is not used commercially.

Gum of Bassora, from Bassora or Bussorah in Asia, is sometimes imported into the London market under the name of the hog tragacanth. It is insipid, crackles between the teeth, occurs in variable-sized pieces, is tough, of a yellowish-white color, and opaque, and has properties similar to gum tragacanth. Its specific gravity is 1·3591. It contains only 1 per cent. of soluble gum or arabin. Under the name of Caramania gum it is mixed with inferior kinds of gum tragacanth before exportation.

Mucilage.—Very many seeds, roots, etc., when infused in boiling water, yield mucilages, which, for the most part, consist of bassorin. Linseed, quince seed, and marsh-mallow root yield it in large quantity (see also Gumbo). In their reactions the different kinds of mucilage present differences; *e. g.*, quince seed yields only oxalic acid when treated with nitric acid, and with a solution of iodine in zinc iodide it gives, after some time, a beautiful red tint. Linseed does not give the latter reaction; by treatment with boiling nitric acid it yields mucic and oxalic acids.

Gum Resins.—This term is applied to the inspissated milky juices of certain plants, which consist of gum soluble in water, resin and essential oil soluble in alcohol, other vegetable matter, and a small amount of mineral matter. They are generally opaque and solid, and often brittle. Their chief uses are in medicine. They include the following:—ammoniacum, assafœtida, bdellium, euphorbium, frankincense or olibanum, galbanum, gamboge, myrrh, opoponax, sagapanum, and scammony. Several of the resins are often improperly called gums; *e. g.*, benzoin or benjamin, copal, dammar, elemi or animi, kawrie or cowdie or Australian copal, mastic, sandrac, and shellac. (J. ST.)

GUMBINNEN, the chief town of a government district of the same name in the Prussian province of East Prussia, is situated on the Pissa, an affluent of the Pregel, and on the Eastern Railway, 22 miles south-west of Eydtkuhnen on the Russian boundaries. The surrounding country is pleasant and fruitful, and the town is well built, with spacious and regular streets shaded by linden trees. It has three Evangelical churches, a synagogue, a gymnasium, a higher burgher school, a public library, a hospital, and an infirmary. In the market square there is a statue by Rauch of Frederick William I., who in 1724 raised Gumbinnen to the rank of a town, and in 1732 brought to it a number of persons who had been driven from Salzburg by religious persecution. On the bridge over the Pissa a monument has been erected to those of the inhabitants who fell in the Franco-German war of 1870–71. Iron founding and the manufacture of machinery, wool, cotton, and linen weaving, stocking-making, tanning, brewing, and brandy-making are the principal industries. There are horse and cattle markets, and some trade in corn and linseed. The population in 1875 was, exclusive of the garrison, 14,196.

GUMBO, or Okra, termed also *Okro*, *Ochro*, *Ketmia*, *Gubbo*, and Syrian Mallow (Sanskrit, *Tindisa;* Bengali, *Dheras;* Persian, *Bámiyah*—the *Bammia* of Prosper Alpinus; French, *Gombaut*, or better *Gombo*, and *Ketmie comestible*), *Hibiscus esculentus*, L. (*H. longifolius*, Roxb.; *Abelmoschus esculentus*, Guill. and Perr.), an herbaceous hairy annual plant of the natural order *Malvaceæ*, a native of the Old World, and now naturalized or cultivated in all tropical countries. The leaves are cordate, and 3 to 5 lobed, and the flowers yellow, with a crimson centre; the ovary is 5-celled, and the fruit or pod, the *Bendi-Kai* of the Europeans of southern India, is a tapering, 10-angled, loculicidal capsule, 4 to 10 inches in length, except in the dwarf varieties of the plant, and contains numerous oval dark-colored seeds, hairy at the base. Three distinct varieties of the gumbo (*Quiabo* and *Quimgombo*) in Brazil have been described by Pacheco. The unripe fruit is eaten either pickled, or prepared like asparagus. It is also an ingredient in various dishes, *e. g.*, the *gumbo* of the Southern United States, and the *calalou* of Jamaica; and on account of the large amount of mucilage it contains, it is extensively consumed, both fresh and in the form of the prepared powder, for the thickening of broths and soups. For winter use it is salted, or sliced and dried. The fruit is grown on a very

large scale in the vicinity of Constantinople. It was one of the esculents of Egypt in the time of Abul-Abbas el-Nebâti, who journeyed to Alexandria in 1216 (Wüstenfeld, *Gesch. d. Arab. Aerzte*, p. 118, Gött., 1840), and, according to Popp, is still cultivated by the Egyptians, who called it *Bammgé*.

The seeds of the gumbo are used as a substitute for coffee. From their demulcent and emollient properties, the leaves and immature fruit have long been in repute in the East for the preparation of poultices and fomentations. Alpinus (1592) mentions the employment of their decoction in Egypt in ophthalmia, and in uterine and other complaints. In the *Pharmacopœia of India* the decoction of the fruit is recommended in catarrh, and in diseases of the genito-urinary tract, and its hot vapor in affections of the throat and fauces.

The Musk Okra (Sanskrit, *Latákasturiká, cf.* the Greek κάστωρ; Bengali, *Latákasturi;* German, *Bisamkörnerstrauch;* French, *Ketmie musquée*), *Hibiscus Abelmoschus*, L. (*Abelmoschus moschatus*, Mch.), indigenous to India, and, it is said, to Guiana and Central America, and cultivated in most warm regions of the globe, is a suffruticose plant, bearing a conical 5-ridged pod about three inches in length, within which are numerous brown reniform seeds, smaller than those of *H. esculentus*. The seeds possess a musky odor, due to an oleo-resin present in the integument, and are known to perfumers under the name of *ambrette* as a substitute for musk, instead of which drug it has been proposed to employ them medicinally. They are stated to be used by the Arabs for scenting coffee. In India they are employed for perfuming medicinal oils, and being regarded as tonic and carminative form part of sundry pharmaceutical preparations. The seeds (in the Fantee language, *Incromahom*), as we learn from Mr. E. M. Holmes, are used in Africa as beads; and powdered and steeped in rum they are valued in the West Indies as a remedy for snake-bites. The plant yields an excellent fibre, and, being rich in mucilage, is employed in Upper India for the clarifying of sugar. The best-perfumed seeds are reported to come from Martinique.

See P. Alpinus, *De Plantis Ægypti*, cap. xxvii. p. 38, Ven., 1592; Macfadyen, *The Flora of Jamaica*, p. 67, 1837; J. Sontheimer's *Abd Allah ibn Ahmad*, etc., i. p. 118, Stuttg., 1840–42; P. P. Pacheco, "La Ketmie Potagère ou Comestible," *La Belgique Horticole*, iv. p. 63, 1853; Della Sudda, "De l'Emploi à Constantinople de la Racine de l'Hibiscus esculentus," *Répert. de Pharm.*, Jan., 1860, p. 229; Bentham and Hooker, *Gen. Plant.*, i. pp. 207, 208, 1862; Grisebach, *Flora of the Brit. West Ind. Is.*, p. 84, 1864; E. J. Waring, *Pharm. of India*, p. 35, 1868; O. Popp, "Ueber die Aschenbestandtheile der Samen von Acacia nilotica und Hibiscus esculentus in Aegypten," *Arch. der Pharm.*, cxcv. p. 140, 1871; Hooker, *Flora of Brit. India*, i. pp. 342, 343, 1872; Drury, *The Useful Plants of India*, pp. 1, 2, 2d edit. 1873; U. C. Dutt, *The Mat. Med. of the Hindus*, pp. 123, 321, 1877; and Lanessan, *Hist. des Drogues*, i. pp. 181–184, 1878.

GUMRI, or as it is now more frequently called ALEXANDROPOL, in honor of the empress Alexandra, a town of Russian Armenia in the province of Erivan, on the old frontier of the Turkish territory which was formed by the river Arpachai. It is situated at a height of 5268 (according to Abich, 4819) feet above the sea, on an eminence which commands the environs, but is somewhat defective in a military point of view because the neighboring valleys form a kind of screened approaches. The fortifications, erected in 1837 by command of Nicholas I., are the strongest in that part of Asia with the exception of those of Kars, and would be quite impregnable to an Eastern army. Like the ordinary houses of the town, they are built of limestone; and they consist of regular bastions casemated and mounted with guns and surrounded with a ditch. There are several handsome Armenian churches in Gumri, one of the finest of which was built in 1872. The town passed to Russia by the peace of Adrianople. In 1840 it was made a district town of the Gruzeno-Imeritian government, and in 1850 it was incorporated with the Erivan government. In 1832 it contained only about 60 houses, but they had increased to 1200 in 1838. At present its population is 30,616.

GUM-TREE. See EUCALYPTUS.

GUN-COTTON (*Pyroxilin, Coton poudre, Fulmi coton, Schiessbaumwolle*). In 1838 Pélouze observed that when cotton fabrics or paper were immersed in cold concentrated nitric acid for a short time, the free acid being subsequently removed by washing, these materials became, without important alteration of structure, converted into substances possessed of explosive properties. These were at the time accepted as closely allied to the substance named *xyloidin*, described some years previously by Braconnet, which is obtained by adding water to a solution of starch in cold nitric acid. But subsequent observation established the identity of these explosive products with the explosive cotton, or gun-cotton, of which in 1845 Schönbein announced the discovery, and which he at once proposed as a substitute for gunpowder. Soon after this announcement Böttger and Otto published the method of producing gun-cotton by immersing carded cotton in cold concentrated nitric acid, and subsequently Knop introduced the more advantageous method of treating the cotton wool with a mixture of nitric and sulphuric acids, the latter being used as a dehydrater of the nitric acid, and as an absorbent of the water eliminated by the nitrification of the cellulose or cotton fibre. The composition of gun-cotton was subsequently made the subject of study by Böttger, Pélouze, Péligot, Von Kirchhoff, Sobrero, Béchamp, Porret, Crum, Gladstone, Hadow, and others, and various formulæ were proposed as representing its composition. The divergence of opinion on this point arose partly from difficulties attending the preparation of uniform products, and the obtaining of trustworthy analytical results with these, and partly from differences of opinion regarding the nature of the chemical reaction, whereby the cellulose becomes converted into an explosive body. The products obtained in the earlier investigations differed very much as regards their solubility in mixtures of alcohol and ether, and also with respect to the proportion which their weight bore to that of the cotton wool employed in the experimental operations. Crum was the first to entertain the view that gun-cotton might be regarded as cellulose, in which the two or three atoms of hydrogen are replaced by their equivalent of nitric peroxide. This view was afterwards also advanced by Gerhardt, and it received strong support from the researches of Hadow, whose results established the fact that several distinct varieties of pyroxilin could be produced by varying the proportions of nitric and sulphuric acids used, and who definitely established the composition of three of these, the most explosive of which constituted the chief proportion of the product ordinarily obtained as gun-cotton, and had the composition expressed by the name trinitrocellulose. This highest nitro-product in its pure state is insoluble in mixtures of ether and alcohol, whereas the lower products (one of which is the so-called *collodion gun-cotton*, used for photographic purposes, see COLLODION, vol. vi. p. 134) differed in regard to their ready solubility in different mixtures of those solvents. Crum's formula for pyroxilin, thus confirmed by Hadow, was afterwards strongly supported by Schrötter, Redtenbacher, and Schneider, in their joint investigation of gun-cotton manufactured in Austria by the improved process of Von Lenk, and though again disputed by Pélouze and Maury, and by Champion and Pellet, the correctness of the formula $C_6H_7N_3O_{11}$ (or $C_6H_7O_5\ 3\ N_2$), originally proposed by Crum, was conclusively established in 1866 by the exhaustive analytical and synthetical experiments of Abel. In the manufacture of gun-cotton, even when most carefully conducted, the most explosive product, trinitrocellulose, is never obtained in a condition even approaching purity; it always contains an admixture (ranging from 4 to 10 per cent. in the products of highest quality) of the lower nitrocellulose products, *i. e.*, the soluble varieties of gun-cotton. In addition to these impurities it contains, even when the cotton employed has been submitted to purification by treatment with alkali, small proportions of nitrogenized matters, soluble in alcohol, formed from resinous or fatty substances retained within the cotton fibre. These substances are very much more prone to undergo decomposition (with development of nitrogen acids) by exposure to heat or light than the cellulose derivatives themselves; and Abel's experiments demonstrated that the uncertain stability of gun-cotton, which brought this material into bad repute not long after its discovery, from the occurrence of disastrous explosions arising apparently from its spontaneous decomposition, was ascribable primarily to the development of free acid in the gun-cotton by the action of comparatively moderate heat or of light upon these impurities.

The occurrence of a violent explosion at the works of Messrs. Hall of Faversham, not long after they had commenced the manufacture of Schönbein's gun-cotton wool, followed by a similar casualty in France, led to the abandonment of endeavors to apply this substance, within a brief period of its discovery, except in Austria, where Von Lenk persevered in attempts to devise means for obtaining it in a purer and therefore more stable condition, as well as for bringing its explosive action sufficiently under control to permit of its advantageous employment as a substitute for

gunpowder, not only for destructive but also for projectile purposes. The system of manufacture elaborated by Von Lenk consisted in loosely spinning long staple cotton into yarn of various sizes and different compactness; this yarn was converted into gun-cotton by very careful treatment with a large excess of the strongest nitric and sulphuric acids, the product being immersed for many weeks in running water, and then treated with weak alkali; the gun-cotton yarn and thread were either wound more or less compactly on reels or cores, for employment in firearms, or made up into very compact ropes with hollow cores, or into plaits, of lamp-wick form, for employment in shells or mines. The rapidity of explosion of the gun-cotton, *in open air*, or under slight confinement, was thus brought to a great extent under control, but if the resistance opposed to the expansion of the highly heated gases upon the first ignition of the confined gun-cotton developed sufficient pressure to cause them at once to penetrate the inner structure of gun-cotton fibre which composed a charge, a sudden and violent explosion was thus brought about. Hence no practical advance was made in the reduction of the violence of action of gun-cotton by Von Lenk's researches. By the system which Abel has more recently elaborated the fibre after its conversion into gun-cotton is reduced to a very fine state of division; when in this condition the explosive substance is readily converted into sheets or granules, or by compression into homogeneous masses of various degrees of compactness, and of any desired form. In this manner the rapidity of action or explosion of gun-cotton may be reduced to a minimum, though uniformity of action in firearms is still very difficult to attain with it. As the reduction of the gun-cotton fibre to a very fine state of division greatly facilitates the removal by washing, and by alkaline treatment, of the small quantities of unstable impurities already spoken of, the stability of gun-cotton as now manufactured is much greater than that of former products. Compressed gun-cotton needs, like the other forms in which this explosive has been used, very strong confinement for the development of violent explosion, but this can be readily accomplished without any confinement of the substance, through the agency of an initiative detonation; the explosion of 2 grains of strongly confined mercuric fulminate *in close contact with the compressed material* suffices to ensure this result (see *Detonation*, article Explosives, vol. viii. p. 708). Gun-cotton contains in the normal (air dry) condition 2 per cent. of water. The compressed material of the ordinary density (=about 1) contains from 25 to 30 per cent. of water when saturated; even with 15 per cent. it is uninflammable, and when containing 17–20 per cent. it may be cut and drilled with perfect safety. If gun-cotton contains more than the normal 2 per cent. of water it can no longer be detonated by the minimum quantity of fulminate, and the strength of the initiative detonation has to be increased in proportion to the amount of water it contains; when it contains 17 per cent. of water, its detonation cannot be accomplished with less than 200 grains of confined fulminate. An initiative charge of 1 ounce of air dry gun-cotton (detonated by means of an ordinary fulminate fuze) suffices, however, to ensure the detonation of wet gun-cotton (as used in mines, torpedoes, rockets, etc.). The susceptibility of gun-cotton to detonation when wet (and therefore perfectly uninflammable) gives this substance a great advantage over other explosive agents, as it may be stored in a perfectly harmless condition (wet gun-cotton being quite unalterable) and at once used in that state as a powerful destructive agent through the agency of a detonating charge. The explosive action of wet gun-cotton is somewhat sharper than that of the dry material, the detonation being transmitted through its mass with greater rapidity in consequence of the displacement of air in its pores by the incompressible liquid. Gun-cotton, if it consists entirely of trinitrocellulose, does not contain sufficient oxygen for the complete oxidation of its carbon; hence more work can be accomplished with a given weight of gun-cotton if a solid oxidizing agent (a nitrate or a chlorate) be incorporated with it in proportion sufficient for complete oxidation. The compressed preparations (chlorated or nitrated gun-cotton) are as sensitive to detonation as gun-cotton itself, but are less sudden or sharp in their action. These preparations, first manufactured by Abel, were extensively experimented with some years ago, and one of them, prepared with barium nitrate, is now manufactured under the name of *tonite* for blasting purposes. Preparations allied to gun-cotton, in the production of which wood-fibre is used as the starting point, are manufactured for sporting and blasting purposes under the name of Schulze's powder, sawdust powder, and patent gunpowder. (F. A. A.)

GUNDULITSCH, Ivan (1588–1638), called Giovanni Gondola, one of the most celebrated Dalmatian poets, was born August 8, 1588, at Ragusa. His early education was superintended by two Jesuits, S. Muzzi and R. Ricasoli, the latter of whom instructed him in philosophy. At the age of twenty Gundulitsch applied himself to the study of jurisprudence; and three years afterwards he was entrusted with a high official post in the Ragusan republic. Farther particulars of his life are not known; he died December 8, 1638. Among his numerous poems the greatest is an epic entitled *Osman u dvadeset pievanjah* (Osman in twenty cantos), printed for the first time at Ragusa in 1826, and reprinted at Agram in 1854, with a biographical sketch of the author by A. T. It was written to celebrate the victory of the Poles over the Turks and Tartars in the campaign of 1621. Cantos 14 and 15 are lost, having been suppressed by the Government of Ragusa on account of their writer's animosity against the Turks; but in their place others have been added by P. Sargo. An Italian version of this poem appeared in 1827. Of Gundulitsch's other poems, the *Hymn on the Greatness of God* and the *Tears of the Afflicted Son*, and his dramas the *Rape of Proserpine* and the *Sacrifice of Love*, deserve notice. He also made several metrical translations from the Italian poets. Gundulitsch's poems, besides their literary value, are especially interesting to a student of history, as they give a faithful picture of the time in which they were composed. A complete edition of his works, edited by V. Babukich, was published by the Illyrian university in 2 vols., Agram, 1847.

GUNDWANA, a form of the name Gondwana (*q. v.*).

GUNMAKING. Under this head falls the manufacture of every description of firearm, from the pistol to the 100-ton gun. The term "small arms" includes sporting and military weapons carried by the shooter; instruments fitted for firing a rapid succession of bullets through one or more barrels from a rest are termed "machine guns;" while the heavier pieces, used exclusively in war, are denominated "ordnance."

Small Arms.

The date and circumstances of the introduction of portable firearms are involved in obscurity. No doubt many attempts were made and failed previously, but gunpowder does not appear to have come into practical use as a rival to the crossbow for the propulsion of bolts or bullets till the reign of Edward III.; in 1375 mention is made of men armed with "gonnes" at an attack made on a Yorkshire manor-house. The *arquebuse à mèche* was employed in Germany in 1378, and it is therefore probable that some rough weapon was introduced much earlier. The hand-gun (fig. 1) was used by both infantry and cavalry; it consisted of a simple iron or brass tube with touch-hole at the top, fixed on a straight stock of wood; when used on foot, the soldier held it firmly by passing the stock under the arm; when used on horseback the stock was shortened to butt against the breast, the barrel resting on a fork secured to the saddle bow. About the beginning of the reign of Henry VII. the hand-gun was improved by the addition of a cock, which was brought down by a trigger to a pan at the side of the barrel; this cock held a match which ignited a priming in the pan, the priming communicating with the charge by a small hole. The next alteration consisted in the introduction of the wheel-lock, in which a steel wheel, rasped at the edge, protruded into the priming pan. Into the cock was fitted a piece of sulphuret of iron (pyrites) instead of a match; this was kept down to the priming pan by a spring; another spring, when wound up, acted on the wheel, which, when released by the trigger, spun round, rubbing against the pyrites and causing sparks, which set fire to the priming. The wheel-lock was, however, found to be complicated, expensive, and uncertain, so that the match-lock remained in use till the middle of the 17th century, when it was displaced by the flint-lock, the earliest form of which the "snaphaunce," seems to have been invented about the end of the 16th century in Germany. In this lock the priming pan was provided with a steel cover and the cock held a flint; on pulling the trigger the cock fell, the flint struck the steel cover, forcing it back from the pan, evolving at the same time sparks, which fired

the priming. During these developments of the lock the shape of the barrel was gradually changed; in 1621 the length of that of the musket was 4 feet, and the size of the bore such that twelve bullets weighed 1 lb. Soon after this the infantry soldier was supplied with a dagger which fitted into the muzzle and served as a pike. This was improved at Bayonne into the bayonet, and during the latter part of the 17th century was still farther improved by the addition of a socket, so that the musket could be fired while the bayonet was fixed ready for use. Little change in firearms took place in the 18th century, but in 1807 a Scotch clergyman named Forsyth obtained a patent for priming with fulminating powder, an invention which, though it slumbered till 1834, was destined to cause a complete revolution in the mechanism of firearms. Early in the present reign its value was fully recognized; the magazine of detonating composition and the priming pan

Fig. 1.—Hand-Gun.

used by Mr. Forsyth were improved into the cap and nipple, and the flint-lock was entirely superseded. At this point the progress of invention renders it necessary for us to treat separately the two branches of the subject, and to divide sporting from military arms.

Sporting guns.

For sporting purposes smooth-bored shot-guns and grooved rifles are employed. Both are nearly always double-barrelled, and of late years the old muzzle-loaders have been almost entirely supplanted by the many breech-loading systems recently invented, which enable the sportsman to reload with greatly increased rapidity and uniformity, the latter quality being specially important in rifle shooting. The chief parts composing the arm are the barrel, the lock, and the stock.

Barrels.

Barrels for sporting arms are made of four different kinds of material—Damascus twist, laminated steel, stub iron, and mild cast-steel; besides these, common material is worked up into cheap barrels for exportation. Damascus twist consists of alternate rods of iron and steel placed one upon another; usually six of each kind are thus arranged; they are then forged and thoroughly welded together into a solid bar, which is afterwards rolled into rods, having a section about $\frac{1}{8}$ inch square. The rod thus formed is raised to a brightish red heat, and one end of it is placed in a revolving chuck, while the other remains fixed; the turning of the chucks subjects the rod to a severe twisting throughout its whole length, so that at last it acquires the appearance of a screw having a very fine thread. Three of these rods are then placed together, the twist of one being in a contrary direction to that of the other two. They are then welded together into a bar, and rolled into a strip about $\frac{3}{4}$ inch in width. The thickness of this strip depends on the part of the barrel it is intended to form; if for the breech end it is made $\frac{1}{4}$ inch thick, if for the centre $\frac{3}{16}$ inch, if for the muzzle $\frac{1}{8}$ inch. These strips are now ready for coiling, which is performed by raising the strip to a bright red heat, fixing one end of it to a hook projection from a taper mandril, which is placed in a machine and provided with a handle. On turning the handle the strip is wound round the mandril into a coil about 10 inches in length. The coil is then welded by about 3 inches at a time till the spirals unite to form a hollow cylinder; it is then hammered on a small mandril till the welding is complete. Three coils welded together end to end form a barrel, to which the three different thicknesses of metal above mentioned give a slightly conical form, approximating to the ultimate shape. About three-fourths of the material is cut away in the making; 16 lb of iron are used in the first instance to make a pair of barrels, which weigh only 8 lb when the welding is finished, and only between 3 and 4 lb after boring and grinding. In the manufacture of laminated steel barrels the best quality of steel scrap, after thorough cleaning in a revolving drum, is mixed with a small proportion of charcoal iron. The mixture is heated in a furnace, and puddled into a ball, which is well worked up under a forge hammer. It is then drawn out under a tilt hammer, and rolled into strips of the required length and thickness, after which it is treated as above described. This material is much esteemed for its hardness and closeness of grain, but it does not possess the elegant marking and appearance of the Damascus twist. Stub iron for barrels was formerly made by putting a quantity of old horse-shoes or stubs into an iron ring, welding them into a solid mass, and then rolling them out to strips of the requisite dimensions. Now a mixture of best wrought scrap, and sometimes steel scrap with stubs, is preferred, as giving more hardness and durability to the barrels. A description of the manufacture of cast-steel barrels will be found below, in connection with military rifles. A sham-twist barrel is apt to impose on the purchaser; plain iron is cheaper than twisted iron, and sometimes a thin coil of twist is rolled round a plain inner tube; the whole is then welded together, and has all the appearance of a genuine twisted barrel. Other cheap barrels are made by rolling up strips of iron plate, and welding them together so that each barrel has a weld running down its whole length. As the breech end is thicker than the muzzle end. these barrels are usually made in two lengths.

Boring and stripping.

In the rough state just described the barrels are sent from the forge to the gunmaker, who bores them carefully out to nearly the finished size. He then turns them down at intervals, obtaining correct surfaces by means of inside and outside gauges. The barrels are then "stripped"—that is, turned down the whole length to correspond with the bore. For double guns two barrels are now brazed together, near the muzzle and near the middle. At the breech the barrels are separated by a "steel lump." The axes of the barrels are not quite parallel to each other, but are usually adjusted to cross at about 40 yards from the gun. When packed together, a rib is soldered on down the entire length, and they are sent to be proved at the proof-house of the Company of Gunmakers at Whitechapel or Birmingham.

Proof.

The scale of proof is fixed by Act of Parliament, according to the size of the bore; it is considerably more than double

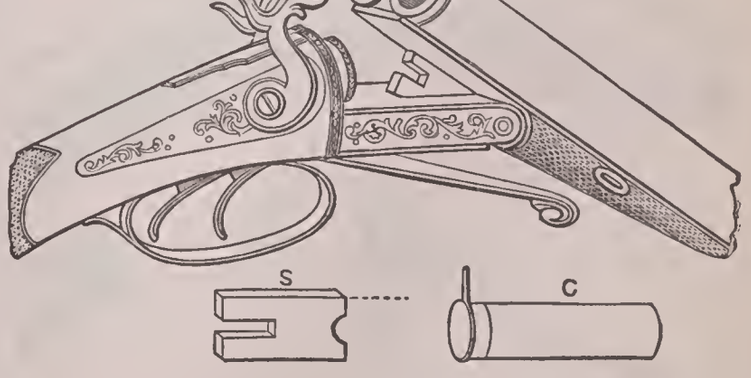


Fig. 2.—Early breech-loader. C, pinfire cartridge; S, single grip.

the ordinary shooting charge. For the provisional proof, muzzle-loaders have the breech screwed in before firing; breech-loading barrels are pressed against a false breech. The second or definitive proof is less severe, and is carried out at a later stage, when the action of the breech-

loader, or the percussion fitting of the muzzle-loader is completed.

Stocks. The best stocks are made of English or Italian walnut, pieces of which reach the gunmaker roughly shaped. They are so cut that the grain shall run lengthways down the stock, and the wood is dried and seasoned to prevent warping. For expensive guns, much attention is paid to beauty of mottling and depth of color. A considerable variety of tools is employed in shaping the stocks and cutting out the beds for locks, processes which,

Locks. for sporting pieces, are performed by hand. All parts of the lock except the plate are of steel, and reach the gunmaker hammered into shape. The lock-plate is of wrought iron, case-hardened. The parts are worked to fit by hand with a number of special tools. Bar locks are those which have a forward action, arranged so that the main-spring fits under the bar below the breech end of the barrels; back-action locks have the spring reversed, so as to extend down the hand or grip of the stock.

Furniture. The remaining portions of the gun are termed the furniture. They are the heel-plate which covers the butt, the break off into which the breaching hooks for muzzle-loaders, the trigger plate, the trigger guard, the hammers, the escutcheons, and bolt fastening the barrel to the stock, etc. For breech-loaders the action is a most important part of the furniture. The ingenuity of gunmakers has devised an immense variety of actions, and every day sees progress made in strength and simplicity.

Breech-loaders. M. Lefaucheux is entled to the credit of inventing the modern sporting breech-loader. He first hit on the combination of a pair of barrels open at the breech, playing on a hinge and abutting against a false breech (fig. 2), with a strong-based cartridge-case containing powder and shot ready for firing, and supplied with its own means of ignition. His early guns were found weak in the fastening of the barrels to the stock, while the mode of igniting the charge was far from perfect. It consisted of a pin passing through the upper part of the cartridge case, the point resting just above a percussion cap placed at the centre of the base of the charge; the hammer fell on the head of the pin, driving the point into the cap, and exploding the detonating composition. The gas was found to escape through the pin hole, the extraction was sometimes difficult, and a fall on hard ground would occasionally explode the cartridge; for these reasons the pin system was superseded by the central-fire method (fig. 3), in which the base of the cartridge case was made to hold a small

Fig. 3.—Central-fire cartridge.

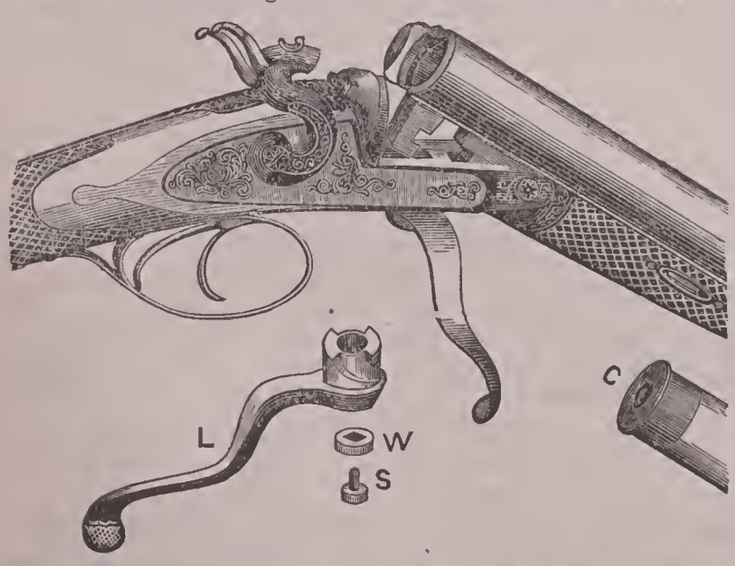


Fig. 4.—Central-fire Gun. C, central-fire cartridge; L, lever; W, washer; S, screw.

anvil, on to which the cap was driven by a needle or striker passing through the false breech, and receiving the blow of the hammer. Fig. 4 shows a central-fire gun, having the action considerably strengthened by the double grip In this system the extraction is accomplished automatically, by a piece of steel fitting between the two barrels, and so cut as to clip the rims of both cartridges. To this extractor is attached a rod which runs down between the barrels through a hole in the steel lump as far as the hinge; on opening the joint the rod is driven backward, carrying with it the head and forcing the cartridge cases out of the barrels. Guns on the central-fire system afford no indication of being loaded; extraction and loading are, however, so rapid and easy that every sportsman should invariably withdraw the cartridges on laying down his gun, and reload on again taking the field. Hammers sometimes catch in the brambles, or even in the clothes of the shooter; even the double grip has been known to yield under the effect of the heavy charges now used. The latest guns leave little room for improvement in respect to the action. Fig. 5 shows one of the newest developments. The hammers are abolished altogether, the

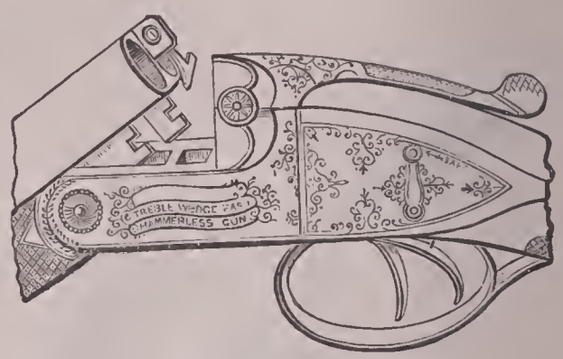


Fig. 5.—Improved breech-loading action.

striker being a needle in the interior, which is driven against the cap of a central-fire cartridge by a spring when the trigger is pressed; a lever on the top is pushed aside by the thumb, liberating the catch which holds the barrels against the false breech; the barrels then drop from the hinge, and are open for loading. On raising the barrels, the action snaps to, and holds them fast; the dropping of the barrels causes an extractor to withdraw the empty cartridge cases. A key at the side regulates the cocking and safety of the lock and striker. The sizes of barrels are designated according to the weight of the solid spherical lead ball which will just fit them, and hence their diameters vary inversely as the cube roots of their numbers. In the case of No. 12 bore, the ball fitting it weighs 12 to the pound, and measures ·729 in. in diameter. Ounce bullets (No. 16) fit a bore of ·662 in. in diameter.

Form of barrel bore in shot-guns. Barrels were formerly bored cylindrically, but the experiments of gunmakers led them to suppose that better shooting could be obtained by boring to shapes departing in various ways from the simple cylinder. The first modification introduced consisted in enlarging the breech end slightly for about 10 inches; subsequently the last few inches at the muzzle were enlarged also, so that the barrel really consisted of two frusta of cones, having the smaller ends together,—the position of the narrowest part, like many other matters, was dependent on the fancy of the gunmaker. Of late an attempt has been made to reduce the interior form of the barrel to something like a system, and several kinds of "choke" boring have been introduced. The object to be attained with a shot-gun is to so arrange the charge that the pellets shall be uniformly and thickly distributed round the mean trajectory, and shall also occupy a small space longitudinally. In fig. 6 a side view of the charge as it passes through the air is given, *ab* being the mean trajectory. Exact experiments to determine the proportions of the cloud of shot fired from different guns do not exist, but, judging from observation, they will usually not depart greatly from those of the figure. In fig. 7 is seen the appearance of the target after being struck by the charge. The test of excellence is regularity of pattern, combined with penetration; that is, a circle of 30 inches diameter should be so pitted by the shot at 40 yards range that gaps of the size of a small bird should nowhere exist, while the individual pellets should retain force enough to penetrate

a certain number of sheets of brown paper. As the shot pass along a barrel driven violently forward by the pow-

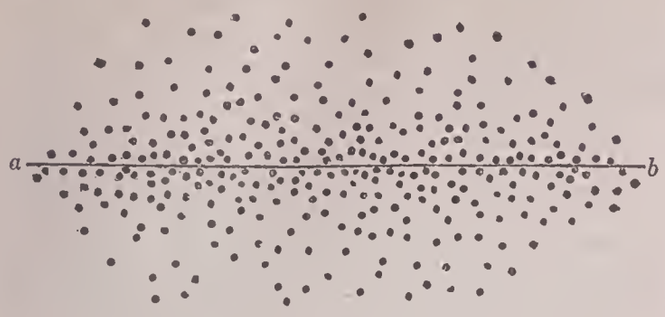


Fig. 6.

der gas, it is probable that the edges of the charge are retarded by friction against the sides of the bore, so that

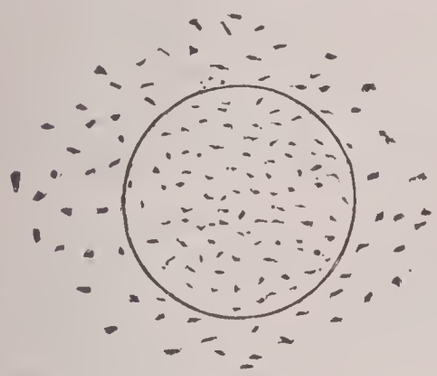


Fig. 7.

the centre portion extricates itself rather sooner than the edges, and travels with a slightly higher velocity. Supposing the charge to retain an average velocity, on reaching the object fired at, of 300 feet per second, and the leading pellets to have gained 10 feet on the hindmost ones, so that the charge is distributed over a length of 10 feet, a period of time of $\frac{1}{30}$th of a second will elapse between the blows of the first and last pellet. If the object be stationary, this interval will be almost imperceptible, and the pattern made on the target by the impact of the shot will exhibit no trace of it. But if the object be a bird flying across at the rate of 60 feet per second (about 40 miles an hour), it will traverse a space of 2 feet in the interval, and so will not receive the charge at all in the manner shown on the target. Figs. 8, 9, 10 show some of the choke bores fancied by different makers.[1]

Sporting rifles.

The manufacture of sporting rifles does not greatly differ from that of shot-guns. Greater strength and weight of barrel are necessary to resist the pressure of the charge, withstand the wedging action of the bullet, and deaden the recoil. The breech-closing action also demands greater strength, but the general arrangements are not different in principle. Rifles for sporting purposes differ from military pieces in being double-barreled, and in requiring accuracy and penetration at short ranges, instead of a flat trajectory at very considerable distances. Hence they generally resemble the shot-guns in their action, and fire more powder in proportion to the weight of the bullet than military rifles.

In fig. 11 the treble grip snap action is shown as specially devised for rifles firing heavy charges. In addition to the holding power thus provided, a piece is sometimes made to extend from the rib between the barrels, terminating in a projection which catches in a recess in the top of the false breech, when the barrels are closed; or the catch shown in fig. 5 may be adopted. Some makers, instead of using the hinge principle introduced by Lefaucheux, close the breech in other ways; thus in the Henry action the barrel does not move, but is closed at the breech end by a sliding vertical block, which is depressed for the admission of the cartridge by a lever underneath the trigger guard; the striker passes through the block, which on being lowered extracts the cartridge. The power of a modern rifle is limited only by the power of the shooter to withstand the effect of recoil and to use a heavy piece. The momentum of the bullet forwards up to the time of its leaving the muzzle is equal (neglecting the weight and motion of the gas generated by the powder charge) to that of the gun backwards at any instant. Supposing the gun to weigh 150 times as much as the bullet, it will acquire a velocity against the shoulder equal to the 150th part of that acquired by the bullet. Practically it is this velocity which measures the severity of the recoil, and the heavier the gun and the more powerful the shooter the more momentum can he afford to impart to his bullet. This momentum may be composed of high speed and low weight, or of low speed and high weight. A light bullet starting with a high velocity travels fast at first and drops but little at a short range; it speedily, however, suffers retardation by the resistance of the air, and would soon be beaten by a heavier bullet of the same diameter starting with the same momentum. The Express rifles carry out this principle with great completeness, employing heavy powder charges and imparting very high speed to a light bullet, so that a range of about 130 to 150 yards is traversed with a drop not exceeding 1 foot. Fig. 12 shows the nature of bullet generally used for these pieces; the hollow in the centre permits the lead to expand and flatten out on striking, inflicting a wound of great severity. Explosive bullets are also employed by some sportsmen. In fig. 13 are shown rifle cartridges loaded ready for use. The solid brass-drawn case is now almost universally adopted, both for sporting and military purposes. The Martini-Henry rifles used by the British army, however, still use the soft brass-crimped case.

Military rifles.

Military Rifles.—The principle of rifling small arms seems to have been discovered about the beginning of the 16th century, but does not appear to have been employed for warlike purposes till the middle of the 17th. In 1680 each troop of life-guards was supplied with eight rifled carbines. In 1800 the 95th regiment, now the rifle brigade, was armed with a 20-bore muzzle-loading rifle. The difficulty of loading a rifle after firing a few rounds was the great obstacle to its use in the field. Several methods were devised of providing anvils

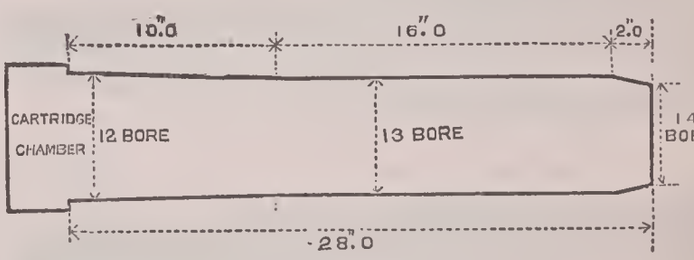


Fig. 8.—Plain choke.

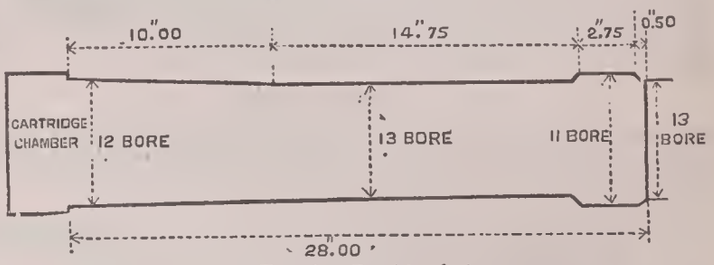


Fig. 9.—Double choke.

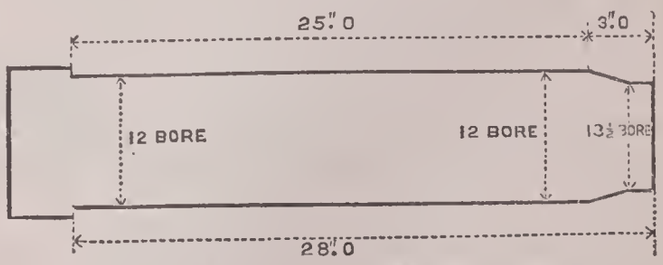


Fig. 10.—Greener's choke.

1 No accurate or crucial experiments have as yet been carried out to determine the true action of these forms, but the editor of *The Field* is now preparing instruments and endeavoring to approach the subject in a scientific manner. The general principles, as far as they can be gathered at present, are, that enlarging or relieving the barrel slightly reduces the friction and allows the shot to acquire greater velocity, while choking the barrel at the muzzle has the effect of directing the outer pellets inwards, and so concentrating the charge.

at the bottom of the bore on which a loose ball dropped in could be hammered to fit the grooves, but the principle of

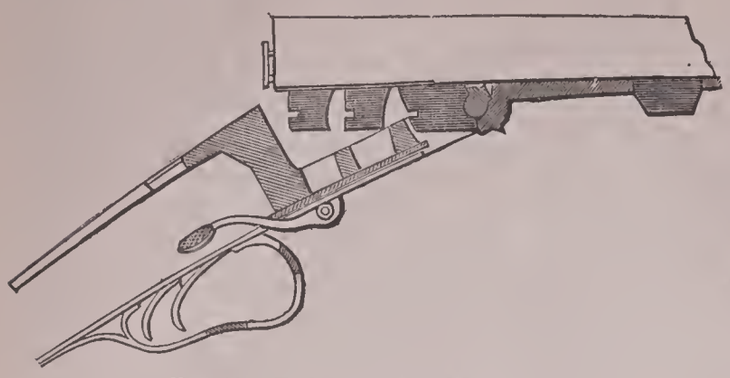


Fig. 11.—Treble grip snap action.

expansion by the action of the powder was not brought forward till 1836, when Mr. Greener submitted an egg-shaped bullet, having an opening at one end to receive a conical plug, which when driven home by the gas expanded the bullet into the grooves. Shortly after this the French chasseurs were armed with a rifle throwing an elongated bullet with a hollow-coned base. This was improved by Captain Minié, who added an iron cup to fit into the cone and expand it when forced home by the gas. For this cup a wooden plug was substituted in the three-grooved Enfield rifle in 1855. About this time Sir J. Whitworth brought forward his hexagonal rifling, the guiding idea of which was that every part of the hexagon except the actual corner should do its share of the work of giving rotation. He proposed for a barrel 39 inches long a bore of ·45 inch, having

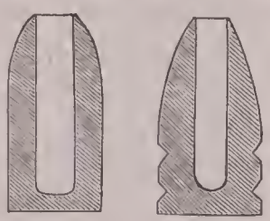


Fig. 12.

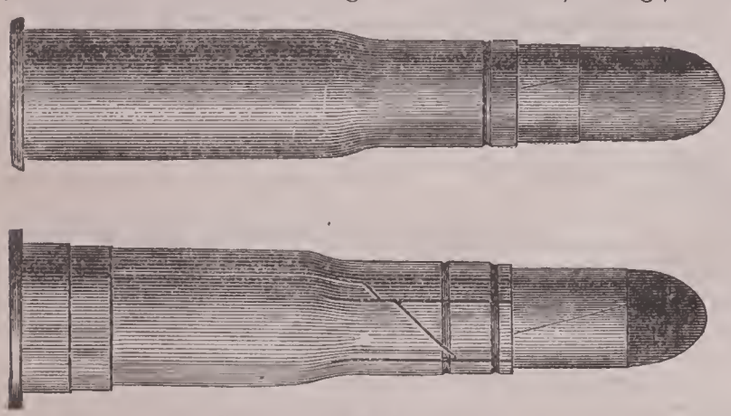


Fig. 13.—Rifle cartridges.

one turn in 20 inches. This was intended to be suitable either for an expanding bullet, or for one possessing an easy mechanical fit. The length of the bullet was increased, and the form thus modified suffered much less from the resistance of the air than the previous patterns. The question of breech-loading for military weapons now began to assume importance. About 1841 the Prussians had adopted the needle gun, a breech-loader on the bolt principle. It was a rough weapon compared with the pieces lately introduced, but a great advance on any known at the time. A conical bullet rested on a thick wad, behind which was packed the powder, the whole being enclosed in strong lubricated paper. The detonator was in the centre of the hinder surface of the wad, so that to explode it a needle had to be driven forward from the breech through the base of the cartridge and through the powder. This was accomplished by the action of a spiral spring, when set free by the pulling of the trigger. This arrangement possessed many defects: the gas escaped freely at the breech; the long needles rusted and broke; the springs failed; and the weight of the piece was excessive. Such failings caused the sterling merit of the principle to be underrated, and it was not till 1864 that a committee of officers recommended the introduction of breech-loading arms for general adoption in the British army. The triumph of Prussia in the Seven Weeks' War with Austria in 1866 at once drew attention to the urgency of the case, and caused all civilized powers to re-arm their troops. In England the Enfield rifles (three-grooved expanding bullet muzzle-loaders) were converted into breech-loaders by the adoption of the Snider method, which consisted in cutting away 2 inches of the upper part of the breech end of the barrel so as to admit the cartridge, which was pushed forward into a chamber formed by enlarging the end of the bore. A block, opening on a hinge, was then shut down to fill up the space behind, forming a false breech against which the base of the cartridge abutted. The striker consisted of a needle passing through this breech block; when struck from behind by the hammer it was driven against a cap in the base of the cartridge, exploding the charge. By this means the existing rifles were rapidly converted, and the army was provided with a breech-loader of satisfactory efficiency should any emergency arise. Proposals were then invited, and a number of inventions submitted, the result of which was that in 1869 the combination of the Martini breech action with the Henry barrel was decided on for future manufacture, and the whole of the British army is now provided with these weapons (see figs. 14, 15, 16, 17). The general principles of manufacture are the same for all kinds of military breech-loading rifles. It will be sufficient to give the details of one *in extenso*.

The manufacture of the Martini-Henry rifle, as carried out at the Government factory near Enfield, involves 2004 separate operations which have to be performed on each rifle before it is complete for issue. This number is subject to slight variations caused by changes of pattern from time to time. It will be sufficient if the principle of these operations are described, without entering minutely into details.

The rifle is composed of three parts:—the barrel, carrying the sights; the stock, into which fits the cleaning rod; the body, containing the lock and breech action. The soldier is also provided with a bayonet to fit on the muzzle.

Barrel. The *barrel* is made of mild steel manufactured on the Siemens principle. Cylinders of this material, 16 inches long and 1½ in. thick, are supplied by contract, and tests are made of a proportion from time to time. These cylinders are first rolled in the factory to a long cone, having slightly greater dimensions than the exterior of the finished barrel. The cylinder is heated in the furnace and passed straight through a series of eight pairs of rolls; each pair is grooved to receive it, the grooves becoming narrower and shallower as each successive pair is reached. The pairs are alternately vertical and horizontal; when they are in full work they can roll about 250 cylinders per hour.

The cone is next placed between friction rollers; these are set at a slight angle, so that in revolving they pass the cone along slowly. It emerges from their clutch polished with the compression, and showing their action by a close spiral traced on the surface. We have now a solid piece of mild steel, slightly thicker than the barrel, fairly straight, and thoroughly well-consolidated.

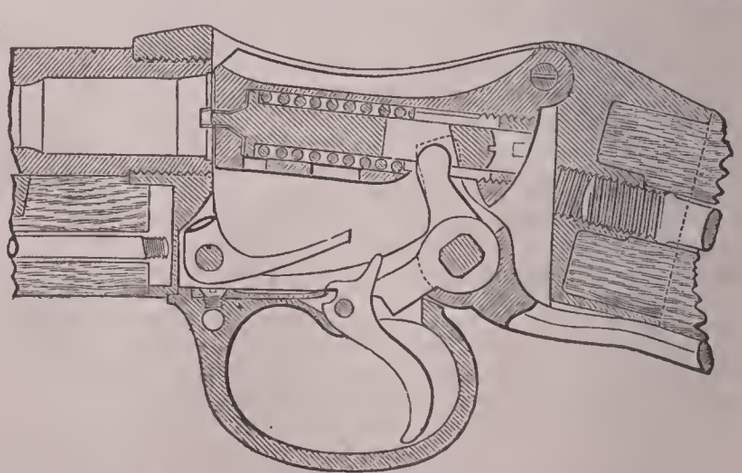


Fig. 14.—Martini breech action (closed).

The next step is to obtain true bearings for boring the interior and turning the exterior. The cone is placed in a clamp milling machine, and the ends milled down. This

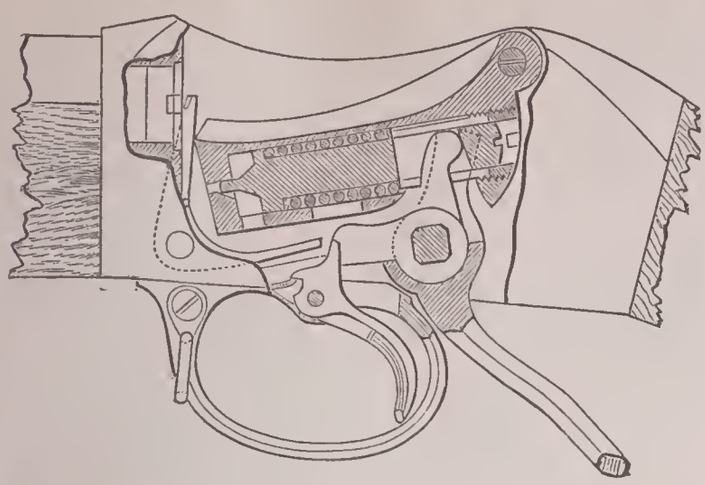


Fig. 15.—Martini breech action (open).

operation requires some judgment; the milling-down of the ends must be so performed that the centres shall be approximately true centres; that is, the amount of metal to be subsequently turned down off the exterior of the barrel shall be about equal all round. The ends, when milled down, serve for bearings by which the cone is next held horizontally, and drilled in a double-acting machine for 1½ in.; these act as centres when the barrel is placed vertically and drilled through from each end. Three tools are used, the last being of slightly greater diameter than the others. A shoulder is left in the centre to avoid the inconvenience of the tools from opposite ends not exactly meeting in the middle, as might be the case with the long slender drills necessarily employed. This shoulder is removed by a square tapered tool or "bit." We have now a cone slightly larger

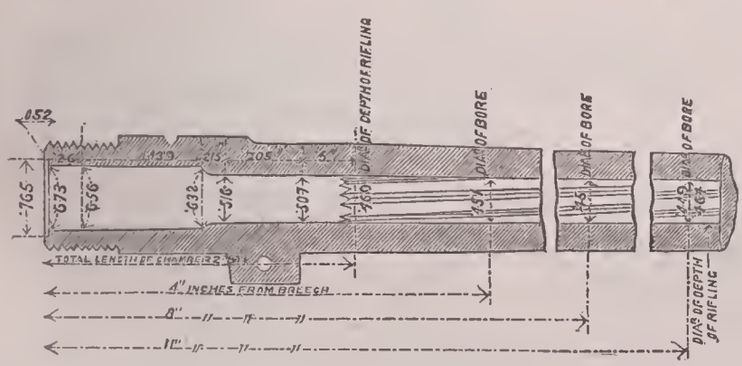


Fig. 16.—Henry barrel.

than the barrel, with a hole through it ·433 in. in diameter. This hole is then bored out to ·444 inch. Having now got

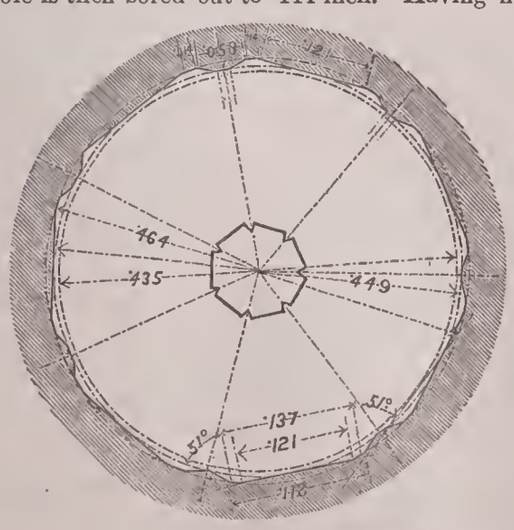


Fig. 17.—Henry rifling (true size and magnified).

a true inside, the next step is to obtain a true outside from it.

The cone is placed vertically in a machine, the lower end fitting accurately on a pin, the upper end passing loosely through a hollow chuck, which revolves round a centre in truth with the centre of the pin and the axis of the bore of the cone; the exterior of the cone, being slightly irregular, will be out of truth; sulphur therefore is melted and poured into the hollow chuck, filling up the space between the interior of the chuck and the exterior of the cone, and hardening on cooling. The chuck then holds the cone by the outside in truth, and serves as a bearing. The cone is then placed in a lathe, and two or three short cuts taken off the outside as bearings for the rough turning. This is called "spotting." It is now rough and finish-turned, the outside becoming concentric with the inside; and the cone becomes a *barrel*.

Testing barrels.

It is next tested for truth of interior. Two tests are employed,—the first being that by *shading*. The barrel is placed in a rest, so arranged that the eye looking through the tube sees the straight line of the top of a window cutting horizontally across the aperture a little above the centre. If the barrel is accurately straight and brightly polished, the shadow thrown by the dark window-frame down the tube appears as in fig. 18. The interior circle shows the window as seen through the barrel, with the dark frame cutting across; the next circle shows the shadow extending in a cone from A to B and C. This shadow is quite dark, and AB, AC are quite straight. BC is a portion of the arc cutting off the shadow sharply at a point half-way down the barrel. There are two outer circles extending to the eye, and approximately resembling the sketch in shading. If the barrel is untrue in interior surface, or bent, the cone will at once lose its regularity, and the sides AB, AC will no longer be straight. Should they be irregular, the barrel is "set" by striking with a hammer or ebonite mallet across a setting block.

Fig. 18.—Testing by shading.

The barrel is next placed in a machine, and a horizontal spindle is run through it; on this spindle are two close-fitting gauges, one in the centre and one at the end; the barrel is then caused to revolve on the spindle, and an indicator with a long arm recording small graduations is inserted at the free end between the spindle and the barrel; any irregularity of turning is multiplied 200 times by the long arm, and becomes at once apparent.

After passing these tests the barrel is finish-turned; the back sight is soldered on and screwed, and the fore sight is brazed on; the size of bore is then gauged, after which the process of polishing is completed and the barrel is ready for rifling.

Rifling.

The rifling consists of seven grooves of the form shown in fig. 17. The twist is such that the bullet makes one complete revolution while travelling 22 inches; that is, one turn in 49 calibres of 0·45 in., to employ the phraseology generally applied to the rifling of cannon. Each groove is cut separately by a tool which acts when pulled; it forms the groove by five successive cuts, being forced to project a little more at each cut; it thus passes thirty-five times up and down the barrel to complete the rifling, which can be done in half an hour. The size of bore is now finally tested; it must lie between 0·449 and 0·451 inch. The rifling is similarly tested, and the twist gauged.

Cartridge chamber.

The breech end of the barrel is next chambered out to receive the cartridge, which is of the kind known as "bottle-shaped." The exterior of the breech end is of "Nock's" form, the upper surface being a flat, true to the bore. This flat guides all the fittings; the barrel is placed in a machine true to the flat, and the sights are gauged for line and elevation. No allowance is made for the deflection due to twist of rifling, it

being very slight. The barrel is lastly screwed at the breech end to fit the body.

Proving. Each barrel is twice subjected to proof by powder, once before rifling, once after. Sixteen are placed in a cast-iron frame; a temporary steel screw, furnished with a vent, closes each breech end, which rests against a leaden bar. The barrels are loaded from the muzzle; a train of powder ignited by a cap fires them simultaneously; the bullets are caught in a hollow cast-iron receiving frame, shaped like the shell of a snail. The charge for the first proof is 7½ drs. (=205 grs.) of powder and a bullet weighing 715 grs., secured by a half inch cork wad forced down over it. The second proof is the same, except that only 5 drs. (=137 grs.) of powder are used. The service charge is 85 grs. of powder with a bullet of 480 grs.

The barrel when finished is browned by being coated with browning mixture, and caused to rust in a steam tank; it is then brushed with wire brushes. This process is repeated four times, after which the exterior is oiled over. The browning mixture consists of—

Spirits of wine	5 oz.	Corrosive sublimate	4 oz.
Spirits of nitre	8 "	Blue vitriol	4 "
Tincture of steel	8 "	Water	1 gal.
Nitric acid	4 "		

Stock. The *stock* is in two parts,—the butt and the fore-end. They are of Italian walnut wood, and are supplied roughly shaped. They are tested for straightness of grain; weight, as indicating strength; "shakes" or cracks; "galls," caused by injuries over which the wood has grown; saltness (which would cause absorption of moisture and consequent rusting), by putting a shaving into a solution of nitrate of silver; and also for appearance. Those accepted are thoroughly seasoned by keeping, or dried in a desiccating chamber, warmed by hot air; they then go to the shaping machines, where they are cut to size by revolving cutters, making 4000 revolutions per minute, and are afterwards turned in copying lathes, hollowed out by copying gouges, and bored to take the fittings. They are then tested, machined, hand-finished, and oiled up.

Body. The *body* is of mild steel; it is stamped out from the bar; it is then drifted through by a slightly tapered bar carrying a succession of cutters on it. The front part of the body is then screwed to suit the screw on the barrel, so that when home it shall fit accurately to the breech end. The lever, and indeed all parts except screws and springs, are stamped out of solid bar. Each part is milled by machinery to a correct fit; every fitting is interchangeable, and nothing is marked for selection to fit anything else. Each part is browned in the same way as the barrels, or blued.

On completion all parts are taken to the assembling room, where they are fitted together, screwed up, and turned out as finished rifles; after which they are taken to the practice ground, and tested for accuracy and extraction of cartridge by being fired from a rest at a target, the range being 500 yards.

Bayonet. The *bayonet* consists of a steel blade welded to a wrought-iron socket. Steel of a superior quality being used, it is supplied in bars, is cut into lengths, and is welded by the aid of borax to a short rod of rolled iron. The two are so put together as to form a right angle; the steel bar is put into a "Rydering" machine, which gives it a great number of rapid blows, and shapes it roughly into a blade. It is then rolled and cooled gradually under charcoal and coal-dust for annealing purposes. The socket is then drilled, and the blade ground. They are then bent into position and become a bayonet. Turning and finish-boring complete the sockets, while the blades are fine-ground, hardened, tempered, tested, and polished. The sockets are then browned and adjusted to the rifles.

About 1400 operatives are employed at the Government factory; each Martini-Henry rifle costs about 48s., all expenses reckoned; and to render the establishment thoroughly remunerative, the out-turn should be about a rifle a week per man.

Varieties of muskets. The systems of breech-loading muskets employed by different nations are shown in the following table:

Country.	Nature.	No. of Motions.	Action.
Austria	Werndl	5	Block rotating sideways.
Bavaria	Werder	4	Falling block.
Denmark	Remington	5	Block hinged to rear, supported by a cam.
England	Martini-Henry	4	Falling block.
France	Gras	4	Sliding bolt.
Germany	Mauser	4	Do.
Italy	Vetterli	4	Do. (magazine gun).
Russia	Berdan	5	Block hinged to front (old). Sliding bolt (new).
Spain	Remington	5	Block hinged to rear, supported by a cam.
Sweden	Do.	5	Do.
Switzerland	Vetterli	4	Sliding bolt (magazine gun).
Turkey	Martini-Henry	4	Falling block.
United States	Springfield	5	Block hinged to front.

It will be noticed that the Vetterli gun, used by the Italians and Swiss, is a repeater or magazine gun. It contains a supply of eleven cartridges, arranged in a tube running under the barrel, and forced by a spring into the loading position one by one, as the previously fired empty one is extracted. The arm can thus fire twelve rounds with great rapidity without reloading; it can also be used as an ordinary breech-loader, a fresh cartridge being inserted at every round, and the magazine kept constantly full. This is no doubt a great advantage under certain circumstances, but entails grave inconveniences. Thus the Vetterli gun, with magazine full, weighs just half as much again as the Martini-Henry, and gives less energy to its bullet at the muzzle in the proportion of 5 to 8, a proportion which increases to the disadvantage of the magazine gun as the range increases. Still, for a *mêlée*, and at short ranges, the Vetterli is no doubt a very formidable piece.

These considerations have led the Government of the United States to make trials of a number of magazine guns, of which one, the Hotchkiss,[1] has been selected for adoption. The working of it is shown in fig. 19. The magazine is contained in the stock, and holds five cartridges, a sixth being in the chamber ready for loading. These cartridges are the same as those used for Government Springfield rifles; they are pushed successively into the loading position by a spiral spring till the magazine is empty, or a fresh cartridge can be inserted after each round as in an ordinary breech-loader. The action of bringing the knob-handle upright and withdrawing the bolt extracts and throws out the emptied cartridge to the side; the next cartridge is then pushed up into the loading position by the spring, and is forced into the barrel when the handle presses the bolt forward; this action also cocks the piece, but the striker cannot reach the cartridge till the knob-handle is turned down, and the bolt thus locked in position. The weight of the piece fully loaded is 9½ lb. Trials of this weapon are about to be made by the English Government.

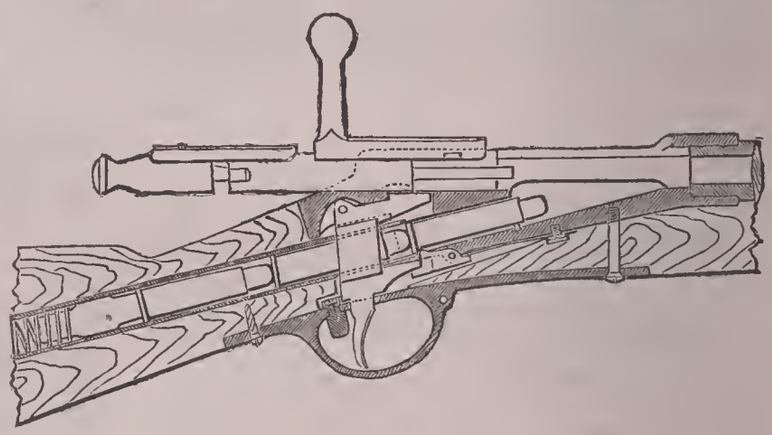


Fig. 19.—Hotchkiss Magazine Gun.

Of all the military rifles adopted by the various Governments, the Martini-Henry is the most powerful; the practical test it underwent in Turkey, where a cheap gun of this pattern was supplied on contract by an American firm during the war of 1877–78, was most satisfactory.

Pistols. *Pistols.*—These handy little weapons were formerly made as single or double-barrelled smooth-bored muzzle-loaders, and their system involved no departure in principle from the ordinary firearm of the

[1] [Benjamin B. Hotchkiss (1830–85), a Connecticut artillerist, invented also revolving cannon, rifle-projectiles, and metallic cartridges, which he introduced into Europe. Died in Paris.—Am. Ed.]

day. The introduction of the revolver as a practical weapon was a great step in advance; the idea is old, and roughly constructed weapons on the same plan have long existed in museums of old arms; Colonel Colt of the United States revived it, and is the father of the modern revolver. In his pistol a revolving muzzle-loading cylinder contains a number of chambers, usually five or six, bored from the front parallel to the axis; the back of the cylinder is left solid, and forms the breech; a nipple is screwed into each chamber. As the cylinder revolves, each chamber arrives at the top, and is then opposite to a barrel; the pistol is cocked by the thumb, an action which locks the chamber against the barrel, so that the two form a continuous bore; the trigger is pulled in the usual way, and the hammer brought down on the upper nipple, exploding the charge in the top chamber. The action of recocking brings the next chamber into position. When on half-cock, the cylinder revolves freely. Since Colt's time great improvements have been made in these handy weapons; the trigger was made to cock the hammer, turn the cylinder, and fire the charge by one continuous draw; this arrangement enabled the shooter to fire all the shots very rapidly without lowering his hand: the strength of mainspring required, however, rendered it very difficult to shoot with any degree of accuracy, especially as the exact moment when the hammer would fall was hard to estimate. A second improvement gave the shooter the choice of cocking the hammer and firing it in the usual way, if he preferred it. The next step was to make the chambers breech-loading, by boring them right through, and packing the powder and bullet in a strong based cartridge, carrying its own ignition. In pistols constructed on this plan the chamber arriving at the top is brought against a false breech through which the striker is driven by the hammer. In the latest pattern of this pistol, the cylinder and barrel open away from the false breech on a hinge underneath; the action of opening throws out the empty cartridge-cases. If the user is on horseback, he thrusts the barrel muzzle downwards into his breast, belt, or holster, the hinge remaining open; fresh cartridges are taken out of the pouch and placed in the chambers; the breech is closed sharply on the hinge and is held by a snap-catch; the pistol is then withdrawn ready for use. All this can be very quickly done with one hand at full gallop.

Machine Guns.

This term comprehends all weapons made to fire a rapid succession of bullets from a stand or carriage, so that, while requiring but two or three men to work them, they may throw in a fire equal to that of a detachment of infantry. In the Franco-German war of 1870 a species of *mitrailleur* was largely employed, and when used under favorable conditions attained fair success. It consisted of a number of barrels (usually 25 or 37) secured in a frame round an axis, and parallel to it. The barrels were open at the breech, and were loaded by a disc pierced to correspond with them containing a cartridge in each chamber. This disc was placed against the breech end of the barrels, the false breech containing the strikers was held firmly against it, and the whole of the charges were exploded at once. This arrangement had many defects. The recoil of so many charges fired simultaneously required strength and weight; at short ranges the bullets all went to the same spot; the number of rounds could not be regulated at pleasure; and only volleys could be fired. The Gatling machine gun, which first appeared in the United States, was vastly superior to the mitrailleur, and speedily obtained entrance into the armies of most of the civilized powers. Figs. 20 to 26 show the general construction of the weapon. In fig. 20 the Gatling is ready for firing.

Mitrailleur.

Gatling gun.

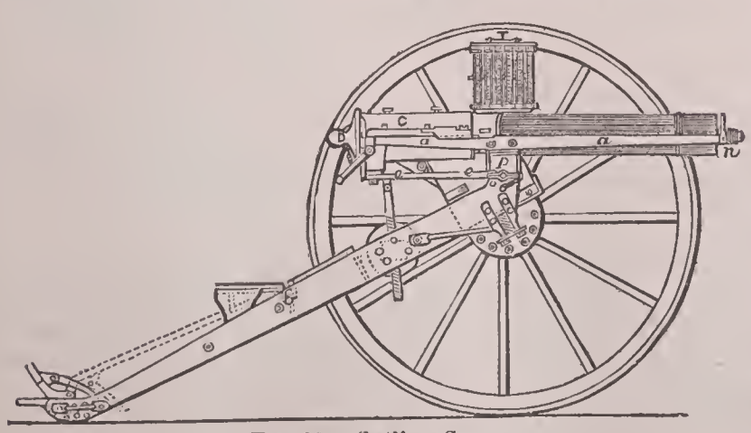


Fig. 20.—Gatling Gun.

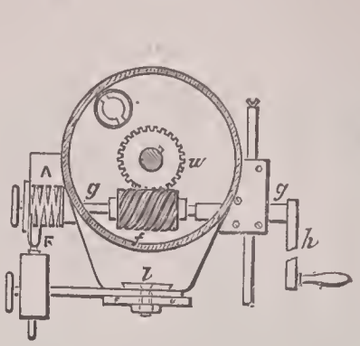


Fig. 21.

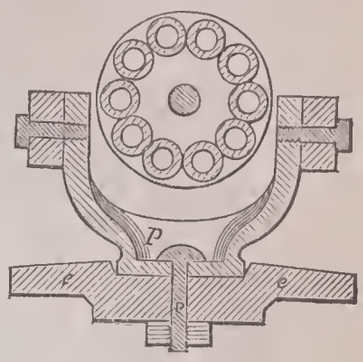


Fig. 22.

A block of ten barrels is secured round an axis, which is fixed in a frame *aa*. On turning the handle *h* (fig. 21), the spindle *gg* causes the worm *f* to act on the pinion *w*, making the axis and barrels revolve. A drum T (figs. 20, 24, 25) is placed on the top at the breech end of the barrels over a hopper, through a slot in which the cartridges drop into the carrier, which consists of ten grooves or chambers M (fig. 23) corresponding to the ten barrels. The construction of the lock is shown in fig. 26. It consists of a bolt, through which passes a striker driven by a spiral spring. AAAA is a cam, sloping as in the drawing, which it must be understood represents the circular construction opened out and laid flat. As the barrels, carrier, and locks revolve, the slope of the cam forces the locks forward and backward alternately. At position I. the cartridge has just fallen into the carrier, the lock and bolt are completely withdrawn. At positions II., III., IV., the cam is forcing them forward, so that the bolt pushes the cartridge into the barrel. At IV. the cocking cam R begins to compress the spiral spring, releasing it at V. Position VI. shows the cartridge just after firing; the extracting hook, omitted in the previous positions, is here represented in the act of clutching the base of the cartridge case, which is withdrawn as the locks retreat down the slope of the cam, till at X. it falls through an aperture to the ground. The line *ab* marks the commencement of the rifling. In fig. 20 the drum T consists of a number of vertical channels radiating from the centre. The cartridges are arranged horizontally, one above the other, in these channels, bullet ends inwards. The drum revolves on the pivot *b* (fig. 23), and the cartridges fall through the aperture B. When all the channels are emptied, a full drum is brought from the limber, and substituted for the empty one. Each barrel fires in turn as it comes to a certain position, so that by turning the handle quickly an almost continuous stream of bullets can be ejected. An experimental pattern of Gatling has been lately tried, fitted with a multiplying arrangement which could be made to fire nearly 1000 shots a minute. In fig. 21 an automatic traversing arrangement is shown, which can be put in or out of gear as desired, and by means of which the amount of traverse can be regulated. The spindle *gg* turns the wheel A, projections on which act on the arm F, and traverse the breech through a small

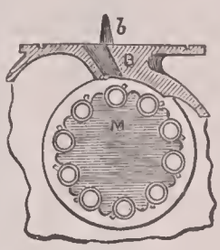


Fig. 23.

Fig. 24.

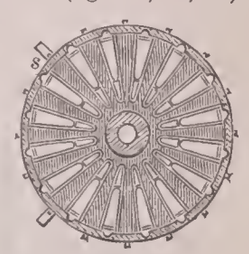


Fig. 25.

arc, thus spreading the bullets laterally over the required front.

Effective though this piece is for land service, especially in defending approaches, it is scarcely suitable for the navy, as the mobility of the boats or vessels carrying it causes immense waste of ammunition, it being impossible to fire more than a few rounds at the object before an important change of direction occurs. The Nordenfelt machine gun, shown in figs. 27 to 31, is found specially suitable under these circumstances. The barrels are here placed horizontally, and have no movement. A box containing the locks, bolts, strikers and spiral springs, one of each corresponding to each barrel, moves straight backwards and forwards when worked by the handle of the lever on the right. When the box is drawn back the cartridges fall from the holder on the top into the carriers simultaneously. When the box is pushed forward the bolts push the cartridges into the barrel, cocking-catches compress the spiral springs, the lever releases the catches one after the other at very minute intervals of time, and the cartridges are fired in rapid succession. In this piece, careful aim can be taken from a moving platform, and at the right moment the barrels can be fired at the object almost simultaneously; they could be made to fire at the same instant,

Nordenfelt gun.

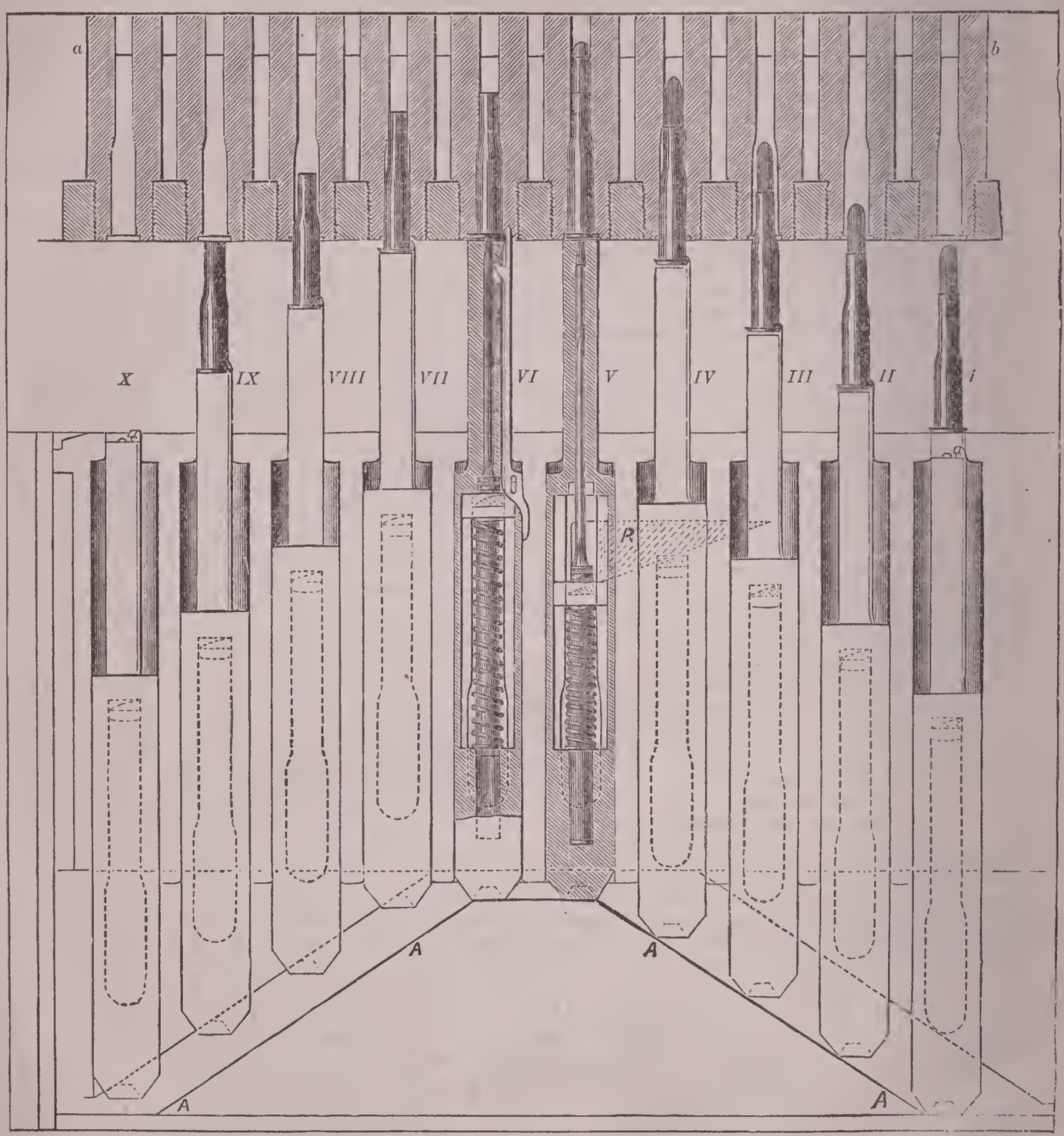


Fig. 26.—Lock of Gatling Gun.

but in this case the advantage of being able to fire single shots would be lost, and the recoil would be increased. This gun would probably never be able to fire with such extreme rapidity as the experimental form of Gatling mentioned above, but it could be made to fire six or seven hundred rounds a minute. It is generally considered that a machine gun should be able to fire easily two hundred rounds in half a minute.

Ordnance.

Ordnance.

The manufacture of ordnance is a much more scientific and complicated study than that of small arms. As the forces increase in magnitude and intensity, while the ultimate strength of material remains constant, the nicety of adaptation of means to ends grows *pari passu* with the guns. In producing a piece of ordnance, two distinct sets of conditions are involved—those belonging to its actual construction, and those by which its proportions are regulated. In constructing a gun, the material must be so selected and disposed as economically and safely to sustain the effect of the forces developed by the charge; in designing a gun, it is necessary to know the

nature and direction of the forces which will combine to produce the desired ballistic results. The two sets of conditions are as distinct as those involved in the separate operations of writing and printing this article.

Construction. CONSTRUCTION.—Nearly all the accurate knowledge as yet obtained of the true action of gunpowder has been acquired within the last twenty years. The general idea previously held was that the explosion was instantaneous, and that the more violent the powder the greater would be the velocity of the projectile. The mode of proving the quality of the explosive was to place a small quantity in a short mortar, and to measure the distance to which it projected a light shell—a test altogether wrong in principle, as will be shown later on. No accurate idea had been formed of the true pressure of the powder gas on the bore during discharge; but it was understood that a gun was subjected to two principal strains or stresses—a circumferential tension tending to split the gun open longitudinally, and a longitudinal tension tending to pull the gun apart in the direction of its length.

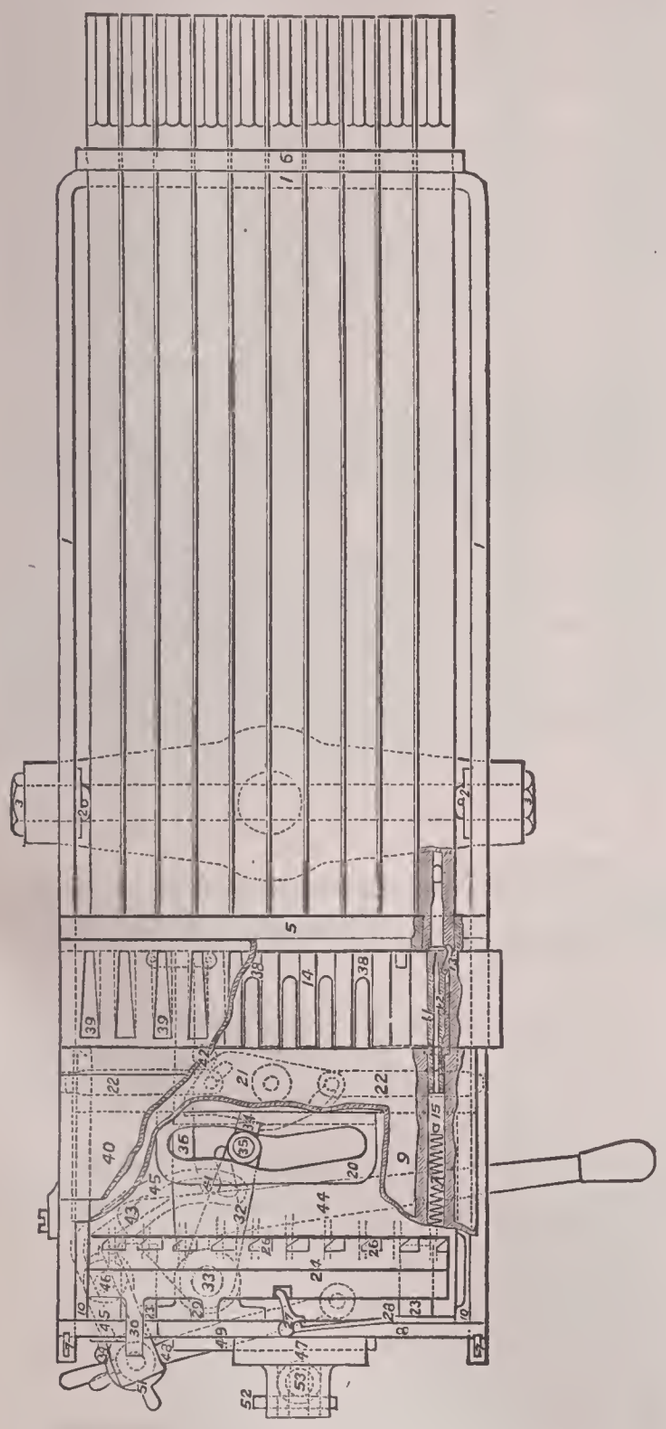


FIG. 27.—Nordenfelt Machine Gun. 1–10, parts of frame; 11, breech plug; 12, striker; 13, extractor; 14, cartridge receiver; 15–18, 23–31, lock and trigger parts; 19–22, locking action; 32–35, loading action; 36–39, cartridge receiver; 40, cover; 41–44, parts of hand-lever; 45–49, traversing action; 50–55, elevating and trailing action; 56, 57, hopper and slide.

When guns are made of cast metal, and are, in fact, homogeneous hollow cylinders, a limit is soon reached beyond which additional thickness is practically useless in giving strength to resist the circumferential tension. Supposing the metal employed to be incompressible, each concentric layer would take up a strain on discharge inversely proportionate to the square of its distance from the axis of the bore. Every metal, however, is compressible as well as extensible, and hence the exterior always affords more support to the interior than the foregoing rule indicates. The great aim then of a gunmaker is so to select and arrange his material that the exterior shall take up as much as possible of the strain thrown upon the interior.

Homogeneous guns.

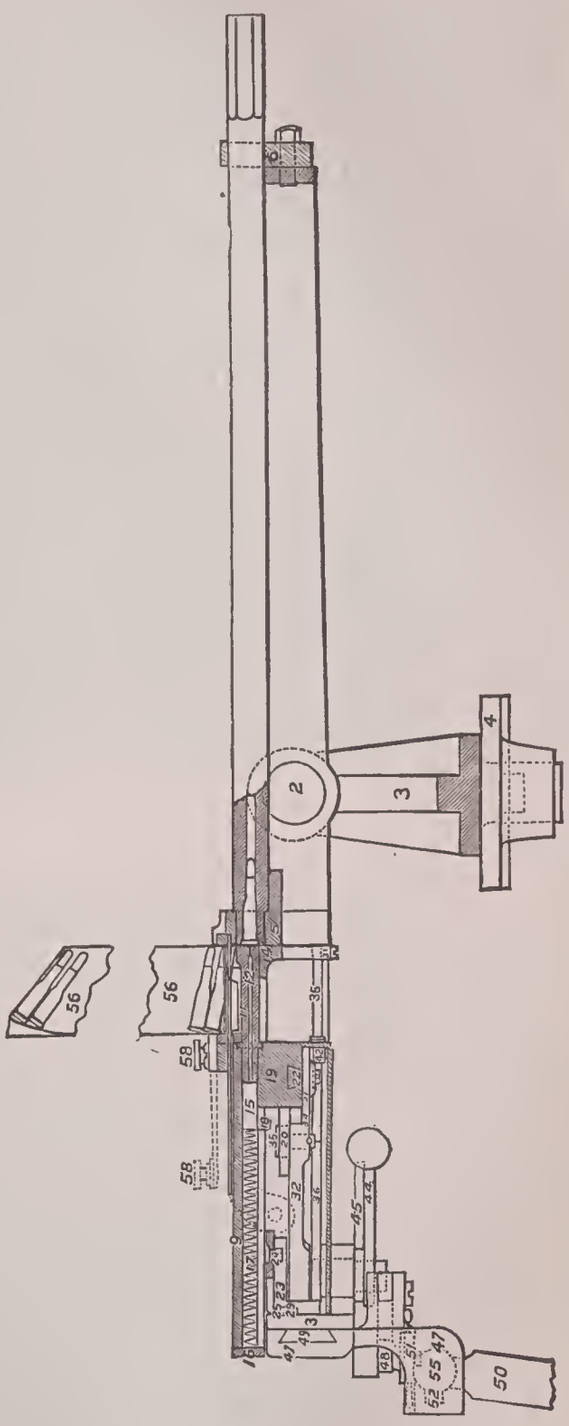


FIG. 28.

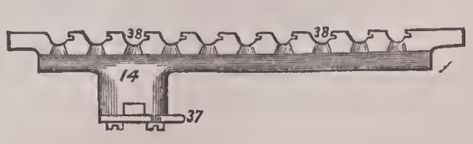


FIG. 29.

In America, Captain Rodman introduced a method of casting guns hollow and cooling them down from the interior, so that the inner portions being first solidified were compressed and supported by the contraction of the outer parts when they subsequently cooled down. Thus, on

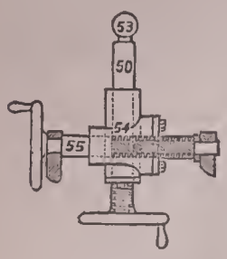


Fig. 30.

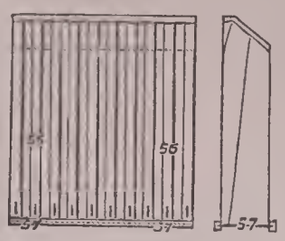


Fig. 31.

discharge, the compressed inner portions expanded under the action of the powder gas to or beyond their natural diameter, throwing at once the strain on the outer portions which were already in a state of tension. But however well cast-iron may be disposed, it is naturally too weak and brittle for use with heavy guns, and those nations which employ it thus do so because it is comparatively cheap and easy to manufacture, and not because it is the best material. Austria and Russia have of late years made light guns of bronze cast in chill, and subjected to the wedging action of steel mandrils driven through the bore. The several layers of the metal are thus placed in a state of tension as regards the exterior, and of compression as regards the interior. At the present day systems of building up guns have been devised so that each portion of the metal is made to bear its fair share of the strain.

The longitudinal tension is usually less important than the circumferential stress. It is considered to be provided against in homogeneous guns if the metal is as thick over the bottom of the bore as round the end. The strain is now measured by calculating the total pressure of the powder gas on the bottom of the bore, and comparing it with the area of the transverse section of the gun at the same place. This is not absolutely correct; but, practically, the chief modes of gun construction now adopted leave a considerable margin of strength in this direction.

Built-up guns.

Sir William Armstrong first successfully employed the principle of initial tensions for all parts of a gun. In his system, wrought-iron coils are shrunk over one another, so that the inner tube is placed in a state of compression and the outer portions in a state of tension, an endeavor being made to so regulate the amount of tension that each coil should perform its maximum duty in resisting the pressure from within. Further, he arranged the fibre of the several portions so as to be in the best positions for withstanding the pressures. It must be noted that wrought-iron bar is about twice as strong in the direction of the fibre as across it. He therefore constructed the exterior of the gun of coiled bars of wrought iron welded into hoops and shrunk one over the other, thus disposing the fibre to resist the circumferential strain. These outer coils were shrunk over a hollow cylinder of forged iron, having the fibre running lengthways so as to resist the longitudinal strain. Within this cylinder or forged breech-piece was placed a steel tube, gripped in like manner by shrinkage.

Shrinkage.

This grand principle of modern gun construction is carried out by turning the inner coil in a lathe to an exterior diameter slightly greater than the interior diameter to which the outer coil is bored. The outer coil is expanded by the application of heat, and slipped over the inner one. It contracts on cooling, and if the strength of the two coils is properly adjusted, the outer will remain in a state of tension, and the inner in a state of compression. On this view, the ideal gun would be constructed of a vast number of excessively thin rings so shrunk over each other that, on discharge, each should be equally strained. An attempt has been made by Mr. Longridge, M. I. C. E., to approximate to this condition by winding steel wire under tension round a steel tube. This system, though possessing much ingenuity, has never made way, and might possibly be found wanting in longitudinal strength.

Great success attended the early introduction of the coil principle. Guns of considerable size were made: the largest weighed as much as 23 tons, and projected a 600-lb shot with a fair velocity. It was found, however, that much difficulty attended the accurate shrinking of a number of thin rings, and that occasionally one or more of the outer ones would be strained to cracking, while the inner ones were intact. The original mode of construction was therefore modified, as experience was gained in the Government factory at Woolwich. Acting under General Campbell, R. A., Mr. Fraser, M. I. C. E., thickened the coils, and extended their use to the breech-piece, it being found that the longitudinal disposition of the fibre in that part was not required to sustain the longitudinal strain, and that the steel tube forming the bore was better supported by coils.

The manufacture of ordnance at Woolwich and Elswick may be briefly described as follows. Steel cylinders, slightly larger than the exterior dimensions of the inner tubes, are supplied by contractors. They are tested for quality of metal, and toughened after being bored by being raised to the temperature shown by the tests to be most suitable to the particular cylinder, and then plunged in oil. They are subsequently tested by water pressure at 4 tons

Fig. 32.

per square inch. The tubes are not bored quite through for muzzle-loaders; a solid end is left to form the bottom of the bore. The rest of the gun is made of wrought iron. The material is chiefly received from the contractor in the

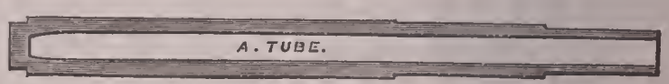


Fig. 33.

form of wrought scrap, but a certain proportion of iron puddled in the works is used also. Blooms of these materials

Fig. 34.

are rolled into flat bars, which are fagoted together and rolled into long bars of the section required for the part of the gun for which they are intended. These bars are then placed in a long narrow reverberatory furnace, and raised

Fig. 35.

to a bright red heat. When ready for coiling, one end is drawn out and fixed to a revolving mandril, which pulls the bar out and winds it into a coil-

Coiling.

Fig. 36.

like rope round a capstan. Sometimes a second bar is wound round outside the first coil; in this case the mandril

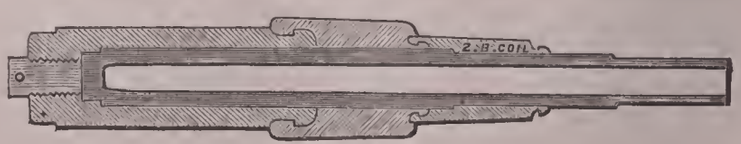
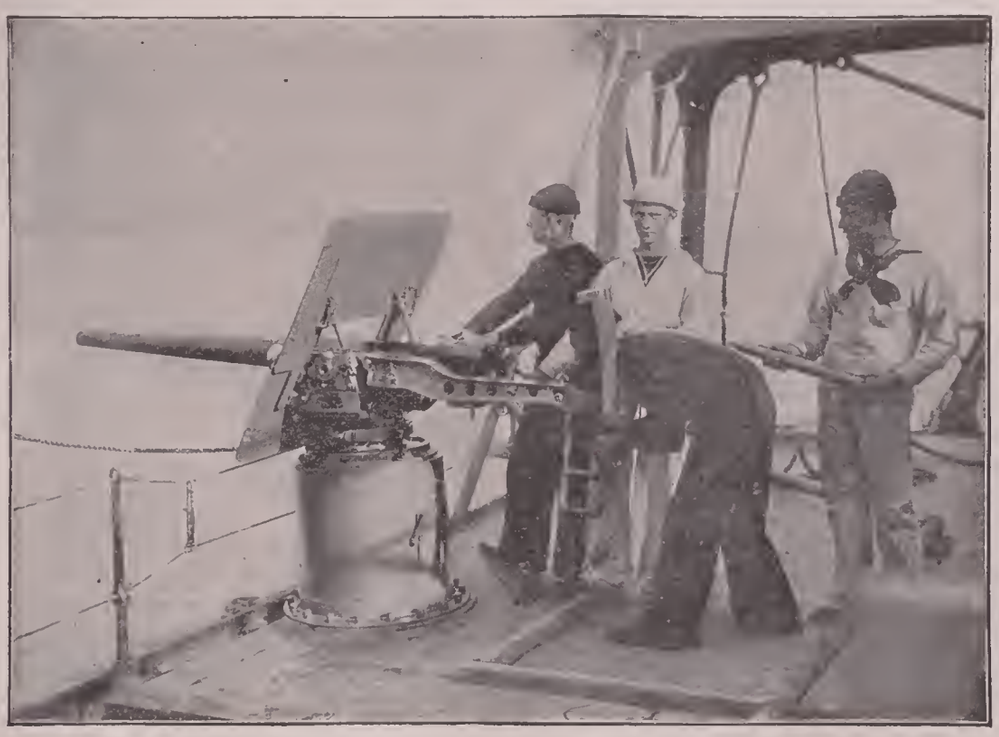


Fig. 37.

is made to revolve in the opposite direction. The coil is next placed upright in a reverberatory furnace, and raised

SIGNALING ON BOARD A WAR-SHIP

THIRTEEN-INCH SHELLS



HOTCHKISS RAPID-FIRE GUN

to a white or "welding" heat. In this state it is placed under a steam hammer, and welded till it becomes a compact hollow cylinder. On cooling it is bored and turned to the proper dimensions. Two parts of the gun are made of forged iron (not coiled),—the cascable screw which supports the breech end of the tube, and the hoop which carries the trunnions. The latter is either welded to the outer coil or shrunk on.

Building up.

Figs. 32–39 show the method of building up Woolwich ordnance as exemplified in the 80-ton guns. The various coils are hooked together by shoulders to prevent slipping or distortion from the shock of discharge. Thus, in fig. 36, shoulders are turned on the exterior of the breech-piece and inside the 1B coil; the latter is expanded by being raised to a dull red heat and slipped over the tube from the muzzle end. The expansion enables the shoulders to pass, and on cooling they grip each other as shown, while the 1B coil contracts on and slightly compresses the part of the tube within it.

Converted guns.

A method of strengthening and utilizing as rifled guns some of the old cast-iron ordnance of the service has been largely employed to supply pieces of secondary power and excellence for land fronts and for practice. It was brought forward in its present shape by Sir W. Palliser in 1863, and is now being much used in the United States' gun factories. The cast-iron block or gun is bored out to the requisite dimensions, and a tube of coiled wrought iron is thrust

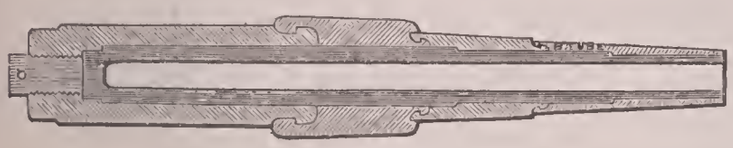


Fig. 38.

into it; no shrinking is here employed, but a tolerable fit is ensured by accurate turning. When fitted, the tube is secured by a collar screwed in at the muzzle; a plug of iron passes through the under side of the gun into the tube near the trunnions to prevent any shift of position. The tube is in two parts, the breech end being turned down and a second tube shrunk over it. The bottom of the bore is formed by a wrought-iron cup, which is forged and stamped into shape under a

Fig. 39.

steam hammer. A screw is cut on the outside of the cup and inside the end of the tube; the cup is then screwed tightly home. The tube is next severely tested by water pressure, after which the second tube is shrunk on. The whole tube is then fitted into the cast-iron casing, the greatest care being taken that the breech end bears firmly home. The gun is now ready for rifling, and, after that operation is performed, undergoes proof by firing heavy charges, which expand the tube closely against the cast-iron envelope, which then takes up the strain and affords the necessary support. The relation between the powers of the three classes of guns will be gathered from the following comparison:—

Nature of Gun.	Weight of Gun.	Weight of Projectile.	Weight of Charge.	Calibre.	Energy of Projectile at 1000 yards.	Energy of Projectile at 2000 yards.
	cwt.	lb.	lb.	ins.	foot-tons.	foot-tons.
Cast-iron 68-pr., smooth bore	95	68	16	8·12	298	136
Palliser 80-pr., converted from 68-pr. above	100	80	10	6·30	602	488
Wrought-iron 7-in. Woolwich gun	90	115	22	7·00	1042	814

Steel guns.

The great German gunmaker, Krupp, employs nothing but steel in the manufacture of his ordnance. His earlier pieces were bored from solid blocks of this metal forged under heavy hammers. They were homogeneous, and therefore the exterior did not assist the interior to bear the strain of the powder gas on discharge to the extent which scientific methods of construction admit. Still the excellent quality of the material enabled the artillerist to get results from these pieces which have been surpassed only by the coil guns, and by Krupp's later productions. As, however, progress was made and the ratio of power to weight increased, it was found necessary to introduce a system of building up for steel ordnance also, and Krupp adopted the principle of shrinkage to which the English guns owed so much. The interior of the recent German gun is a steel tube as in the Armstrong construction, but it is very much thicker and forms the body of the piece, instead of being chiefly used to provide a sound surface for the bore. It is thickest over the powder and shot cham-

Krupp's construction.

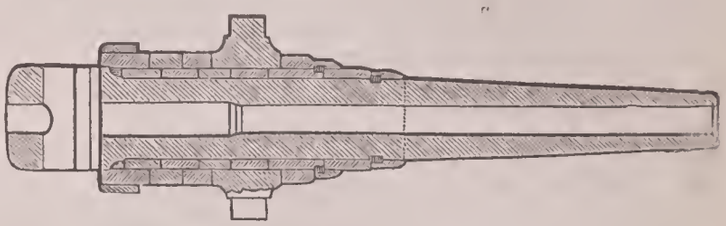


Fig. 40.—Section of Krupp Gun.

bers, tapering towards the muzzle (fig. 40). Over the thickest part, and in some guns over a considerable portion of the chase, hoops of cast steel are shrunk on,—the shrinkage being adjusted to bring the strength of the outer hoops into play to support the body of the gun on discharge. The number of hoops depends on the size of the gun and the severity of the strain it has to withstand; they are usually much more numerous than the English coils, and the section of a heavy Krupp gun presents somewhat the appearance of a stone wall. It is believed that the steel is not toughened in oil, but the details of manufacture have not as yet been made public.

Steel of the excellent quality employed by Krupp is undoubtedly a stronger material than wrought iron; its present trustworthiness is, however, of late date, and it has hardly gained the general confidence accorded to wrought iron. Possibly the method of construction adopted by Krupp, containing as it does a number of unwelded joints, scarcely permits the several parts of the guns to support each other as efficiently as is the case with the magnificent forgings of the coil system; be this as it may, the German pieces, though made of stronger and more expensive material than the English ones, are just as heavy for any given power, proportions and ammunition being similar.

In France and Italy a combination of cast iron and steel has been introduced with a view to economy. The interior of the gun is a moderately thick steel tube as in the coil guns; over this is a thick cast-iron body, corresponding to the steel body of the Krupp guns. On the exterior are shrunk steel hoops.

Sir J. Whitworth uses his fluid-compressed steel for the manufacture of ordnance. He forces massive hoops over a central tube, and over one another by hydraulic pressure or by shrinkage.

Mr. Vavasseur employs Firth's crucible steel for his guns, which are built up somewhat in the same way as Krupp's. He also uses exterior coils of wrought iron in some patterns.

Systems of Loading.—The comparative advantages of breech-loading and muzzle-loading for ordnance on service are fully discussed in the article GUNNERY. We have now to mention the principal modes of closing the breech, either permanently as in muzzle-loaders, or temporarily as in breech-loaders. The former is comparatively a simple matter. When the whole gun, or the interior of it, is formed of cast metal, iron, bronze, or steel, the block is merely bored to the required depth, and the end left unbored to form the breech. Should the inner part of the gun be formed of wrought material, such as coils, it becomes necessary to close the end with some device which shall render it gas-tight and strong. Several kinds of cups and plugs have been tried for this purpose, the most successful of which is the cup already mentioned in the description of the converted guns. When we come to the temporary closing of the end of the bore demanded by breech-loading, a far more difficult problem presents itself.

This problem has been more or less satisfactorily solved in a great variety of ways, but it will be sufficient to examine the three principal types or systems of breech-loading employed in modern artillery. They are popularly known as the Armstrong, the Krupp, and the French systems.

Armstrong breech-loading system.

The Armstrong system is the earliest of these in point of date. In it a slot is cut through the top of the breech of the gun into the tube at A (fig. 41); a breech block (fig. 43), through which the vent is driven, is dropped into this slot, and is pressed firmly against the bore from behind by the breech screw (fig. 42), which is provided with two powerful lever handles for the purpose. Where the breech block or vent piece, as it is usually called, presses against the lip of the bore, both surfaces are of copper, and are renewed from time to time as channels are worn through between them by the rush of the escaping powder gas. There are many guns, from 6-pounders to 7-inch, made on this plan in the British service, and at the time of their introduction they constituted a great advance in gun construction. Experience in the field and at practice has, however, revealed many grave faults in them. No joint consisting simply of two abutting surfaces can be made so tight as to prevent the gas from escaping on the discharge of the piece; the pressure in the powder chamber is so great that a considerable expansion takes place for the moment, and permits a fan of flame to flash out. The eroding effects of gas in motion at high pressure are extraordinarily destructive, and constant necessity for repair arises from this cause. It has also been found that in rapid firing the breech screw may be too quickly forced home, nipping the vent piece before it has fallen into its proper position; the end of the bore is then not sealed, and important and perhaps dangerous accidents occur. Moreover, even with moderate-sized ordnance, the vent piece becomes too heavy for convenient lifting.

Krupp breech-loading system.

In the Krupp system (fig. 44), a slot is cut through both sides of the breech of the gun; in this slot, in the latest patterns, runs a cylindro-prismatic wedge, or, in other words, a wedge of D section, the round side to the rear. The flat side forms the bottom of the bore. For loading, the wedge is pulled out to the left side of the piece as far as the stop will allow it to go, the shell and cartridge are thrust up the gun from behind, the wedge is pushed in, and is pressed hard home

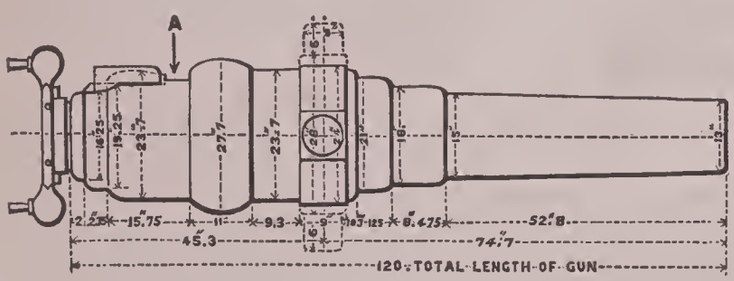


Fig. 41.—7-inch Armstrong Breech-loader.

and secured by an ingeniously-contrived screw with powerful handles. As was mentioned with regard to the Armstrong system, no amount of pressing home and securing

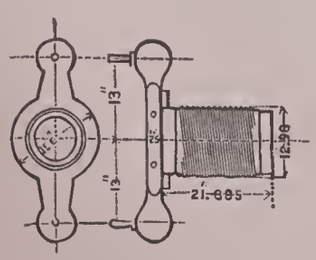


Fig. 42.—Breech Screw.

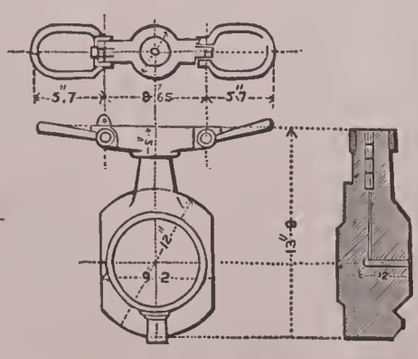


Fig. 43.—Vent Piece.

would by itself be of any avail in preventing escape of gas at the breech, and a special arrangement is therefore provided for this purpose (fig. 45). The end of the bore is enlarged, and into the recess thus formed fits a Broadwell ring, against which the face of the wedge abuts when forced home.

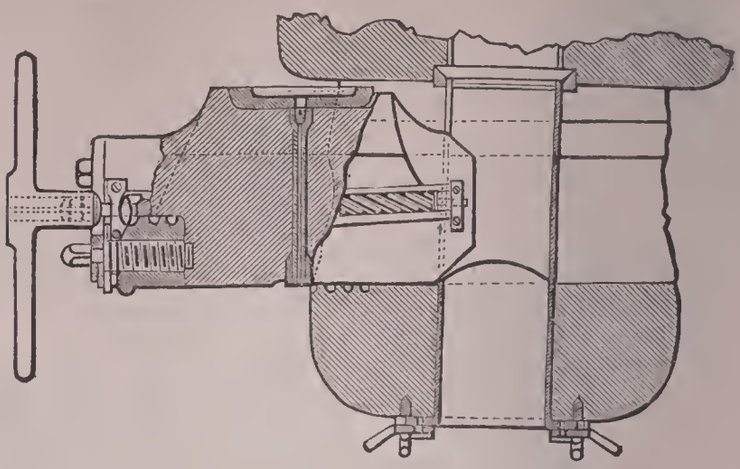


Fig. 44.—Krupp's breech action, cylindro-prismatic wedge.

The ring is so formed that it must always fit against the wedge, and be pressed firmly to it by the action of the gas

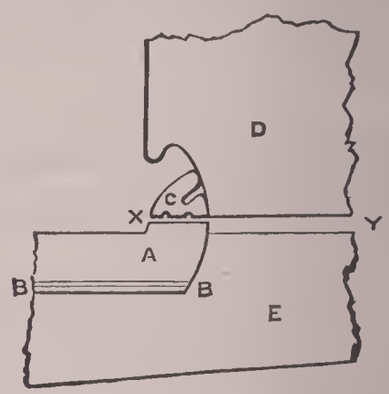


Fig. 45.—A, steel facing-plate; BB, copper discs; C, steel Broadwell ring; D, body of gun; E, wedge; X, interior of gun; Y, exterior of gun.

on firing. This is accomplished by making the recessed surface of the gun and the exterior surface of the ring portions of a sphere. In spite of the theoretical perfection of the system, and the excellence of manufacture attained, it has always been found that after a time—after firing a very variable number of rounds—gas would begin to escape, and then speedily cut a channel between the ring and the wedge. Krupp has fully recognized this, and has been successful in minimizing and localizing the injury thus caused. The gas has two ways of escape: it can pass either between the ring C and the body of the gun D, and so out to Y; or from X to Y. Several forms of Broadwell ring have been tried by Krupp; the form shown in fig. 45 is now in use. When the gun is fired the gas acts on the rounded surface of the ring C, pressing it down hard against the facing-plate A, and also expanding it against the body of the gun D. The tendency of the gas is also to expand the body of the gun away from the ring, and many bronze guns have been destroyed from this cause, having expanded more than the ring was able to follow. A recess is cut in the exterior of the ring, partly to give it greater spring and partly to afford a relief channel for any gas that may have forced its way in. The form of ring here shown appears to have overcome the efforts of the gas to escape in this direction.

Broadwell ring.

Having stopped the gas from getting round the outside of the ring and injuring the gun, we have now to consider the results of escape from X to Y. A channel cut through here would disable ring and wedge, which, though not so bad as disabling ring and gun, would yet be productive of much inconvenience. The insertion of the steel facing-plate A at once saves the wedge and localizes the injury. It allows, moreover, of the introduction of copper discs behind the plate, for the purpose of making up for wear, compression of metal of wedge, etc. Two relief channels are cut

round that surface of the ring which abuts on the facing-plate. Spare Broadwell rings and facing-plates are supplied with the guns; should wear set in and escape of gas ensue, the defective fittings can be removed from the gun and new ones inserted in a couple of minutes. Each set should last on the average for several hundred rounds.

French breech-loading system.

In the French system no slot is cut in the gun (fig. 46). The breech is closed by a screw plug from the rear, which swings on a hinge to the side when withdrawn. The male screw on the plug and the female screw in the gun are divided circumferentially into six parts, of which three have the threads cut away, so that the surface is alternately screw and plain cylinder. When the threads of the plug coincide with the plain parts in the gun, the plug can be moved straight in or out. When pushed in, one-sixth of a turn engages the threads, which thus give half the bearing of an

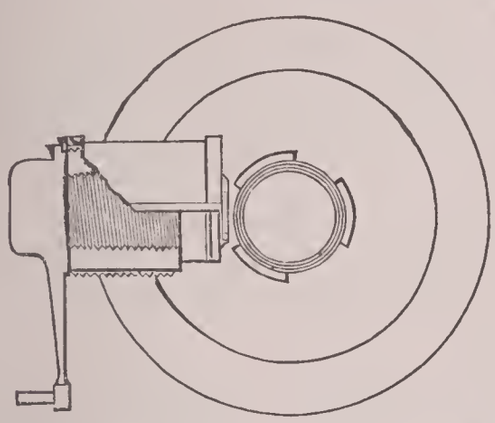


FIG. 46.—French breech action, interrupted screw.

ordinary screw. This is called the interrupted screw system. The plug is larger than the bore, so as to afford room for the shell and cartridge to be thrust in. The end of the bore is recessed to take a ring against which the end of the plug abuts, somewhat as in Krupp's guns; or a cup of steel is fixed on the end of the plug, which is slightly convex; the pressure of the gas drives the flat back of the cup firmly against the convex surface, bending out the lips, which are at the same time pressed against the sides of the gun by the gas. This method has been lately introduced by the Elswick Company.

It is difficult to award superiority to the Krupp or the French system. Each appears to possess some little advantage over the other, and both have attained great success. The Krupp system has undergone the more thorough testing in the field, and has the merit of allowing the parts which become damaged by the escape of gas to be replaced with greater ease and quickness. The French system, on the other hand, takes up less of the gun, so that in a piece of given length the bore may be upwards of one calibre longer than with Krupp's. In the French system, also, the breech-fittings are less exposed to damage by the enemy's fire, being behind the gun instead of at the side.

Gun designing.

DESIGNING.—A gun, like all other machines, must be designed to fulfil certain definite conditions. Its projectile may be required to pierce a given thickness of armor at a given distance; or weight of piece may be the limit, and it may be wished to throw the most powerful shell or shrapnel to a given distance with a given elevation, consistent with that limit. To work out problems of this nature, it is all-important to possess an accurate knowledge of the action of the charge inside the bore. By means of the Noble chronoscope and the crusher gauge (see GUNNERY), this knowledge is obtained, and we shall now explain how the indications of these instruments are employed to assist in determining the proportions of ordnance.

Gunpowder is not properly so much an explosive as a substance burning and giving off gas with great rapidity. It offers in this respect a marked contrast to gun-cotton, dynamite, and other true explosives. If one of these agents be detonated, the detonation is immediately carried through the mass, whatever its size, and the whole at once turns into gas. Gunpowder, on the other hand, as far as is known at present, cannot be detonated, but simply evolves its gas by burning in layers from the outside to the inside. Thus a large grain will take longer to burn up and become entirely converted into gas than a small one will; hence the effect of enlarging the grains is to render the action of the charge less violent, the composition of the powder being the same in all gun charges. The projectile is driven out of the bore by the pressure of the gas on its base,—that is, on an area which varies with the square of the calibre. The weight of projectiles of similar form varies with the cube of the calibre. Hence the larger the gun the heavier will be the column of metal or projectile driven by each square inch of its base; and the greater must be either the pressure applied, or the time of its application, if a given velocity is to be attained. The great object of the gunmaker is to obtain the highest possible ratio of muzzle velocity to breech pressure. His ideal would be a charge so arranged that a pressure equal to the amount the gun is constructed to bear should be uniformly maintained till the shot has left the muzzle. Science is still a long way from this, but has done a good deal towards it in the last few years. A charge of gunpowder, composed of service ingredients in service proportions, exploded in a closed vessel at a density of 1·00 (equal to that of water), sets up a pressure of 43 tons per square inch; at a density of 0·75, of 23·2 tons; at 0·50, of 11·8 tons. Supposing a gun cartridge to be rammed home to the density of water, and entirely converted into gas before the projectile began to move, the pressure in the bore would rise to 43 tons per square inch at the breech, and fall towards the muzzle, as the travel of the shot afforded increasing room for expansion behind it. The column of metal to be moved, even in the heaviest projectiles yet known, is only a few pounds to the square inch of base, while the maximum pressure of the powder gas is measured in tons; it is clear therefore that the shot must get under way at some period antecedent to the setting up of the maximum pressure. In a breech-loader, where the projectile has to be forced through a bore slightly less than its greatest diameter, it will be detained longer than in a muzzle-loader, where it moves freely away, but the difference is insignificant as regards the present argument. The result of the shot's early motion is that space is at once given for expansion, and the normal 43 tons is never reached. Before these matters were fully understood, badly-proportioned charges of violent powder were found sometimes to set up what are known to artillerists as "wave pressures," which were dynamical in character, being caused by rushes of gas from one end of the charge to the other, so that the gauges indicated far higher pressures at the ends of the powder chamber than in the centre. This has now been overcome, and a great increase of both power and safety has been obtained. Several important improvements have been made of late years; the principal ones are three in number:—(1) a great stride was made in the manufacture of powder when pebbles, prisms, and 1½-inch cubes were introduced; (2) the discovery of the beneficial effect of "chambering," that is, of boring out the powder chamber to a greater diameter than that of the rest of the bore; (3) the method of "air spacing" the cartridge, so that a certain weight of powder should have a certain definite space allotted to it, irrespective of the actual volume of the powder grains. Thus in the 80-ton gun powder cubes of 1½ in. edge are used, having an absolute density a little over 1·75, or about 15·7 cubic inches to the pound. If these grains were rammed tightly home in a silk-cloth bag, the space occupied behind the shot would be 24·6 cubic inches per pound; as actually used, an air-space over and within the cartridge is left, so that the space behind the shot amounts to 34 cubic inches per pound. This density would set up a pressure in a closed vessel of 26·6 tons per square inch, but the relief afforded by the shot's motion reduces it to about 19 tons per square inch. The effect of chambering out the end of the bore where the powder lies is practically to permit a small gun to consume effectively the charge of a larger one. The cartridge is shortened, and the mechanical conditions of burning are greatly improved, so that, with large charges, higher velocity with lower pressure is obtained from a chambered than from an unchambered gun. The above information is derived from the indications of the crusher gauge, which registers the pressure of the gas at various parts of the bore. The chronoscope measures the rate at which the projectile acquires velocity during its travel from the breech to the muzzle. Knowing the increment of velocity at any point, we can calculate the amount of pressure required to produce this increment, and thus confirmation is obtained of the accuracy of the records obtained by the crusher gauge. The

Pressure of powder gas.

Air spacing.

Chambering.

following table gives the increase obtained at successive stages in the development of the power of the 80-ton gun, which was first under-bored for experiment, and gradually brought to its present dimensions:—

Table showing Experiments with 80-ton Gun. Powder, Service P_2 ($1\frac{1}{2}$-inch cubes).

Calibre.	Diam. of Chamber.	Weight of Charge.	Density of Charge.	Weight of Projectile.	Mean Pressure in Chamber.	Muzzle Velocity.	Muzzle Energy.	Muzzle Energy per Ton of Mean Pressure.	Penetrating Power into Armor at 1000 yds.	Thickness of Armor which would be penetrated at 1000 yds.
ins.	ins.	lb.	cubic ins. per lb.	lb.	tons per sq. in.	f.s.	ft.-tons.	$\frac{E}{P}$	ft.-tons per in. of shot's circumf.	ins.
14·5	14·5	220	25·6	1259	22·9	1502	19,637	857·5	373	22·7
15·0	15·0	220	25·6	1466	23·8	1423	20,577	864·6	383	23·1
15·0	15·0	290	30·0	1466	22·4	1511	23,205	1036·0	433	25·1
15·0	16·0	310	30·0	1466	22·5	1553	24,493	1089·0	457	25·8
16·0	16·0	350	32·0	1703	20·4	1505	26,740	1311·0	466	26·1
16·0	18·0	425	34·0	1703	19·3	1588	29,745	1543·0	523	28·1
16·0	18·0	460[1]	31·4	1703	19·1	1626	31,527	1651·0	545	30·2

It will be observed that each improvement has tended to facility of consumption of increased charges, so that while the pressures are diminished, the penetrating power of the projectile is augmented, a heavier and more destructive shell being driven through thicker armor.

The manner in which the various principles, of which an explanation has been above attempted, are practically applied is laborious and complicated; the conditions are often conflicting, and the ultimate dimensions of a piece of ordnance is commonly a compromise. A couple of simple examples will illustrate the *modus operandi*. Suppose that it is required to design a gun which shall not exceed a given length, but shall throw a projectile capable of piercing a given thickness of iron at a given range. There are several formulæ of a more or less empirical nature for calculating the perforating power of a projectile moving with a known velocity. Penetration is by some regarded as a punching action, by some as a wedging action; probably it is a compound of the two. Recent experiments carried on with the very high velocity of about 2000 f. s. have thrown some doubt on the soundness of any of the formulæ. That generally used in England is as follows:—

Perforation of armor.

Let W = weight of projectile in tons;
r = radius of do. in inches;
v = velocity of do. in feet per second;
$E = \frac{Wv^2}{2g}$ = energy of do. in foot-tons;
t = thickness of plate perforated in inches;

then $$\frac{E}{2\pi r} = 2{\cdot}52t^{1.6}.$$

This formula tells the gun-designer what energy is necessary to overcome the resistance of the plate. Guided by experience, he assumes for the moment a striking velocity; the other component of the energy, the weight of the projectile, is then directly arrived at. The proportions of armor-piercing shell are the same for all guns, so that the weight guides the dimensions, and the calibre of the gun follows. Should this appear to be in no way unsuitable to the length already laid down in the conditions, the gun-designer calculates the loss of velocity in the given range and from the striking velocity deduces the muzzle velocity and the muzzle energy. The excellent labors (*Researches on Explosives*) of Captain A. Noble, F.R.S., of Elswick, and Professor Abel, F.R.S., have shown how to calculate the amount of work done by a pound of powder for every volume of expansion its gas undergoes; the results of many careful experiments and much intricate calculation are embodied in the accompanying table, which affords the means of determining the total work performed by any charge in any gun. A certain portion of this work is expended in heating the gun and projectile, in giving rotation, and so forth; the remainder appears as the energy of translation of the shot on leaving the muzzle. Large guns realize a greater proportion of the total work than small ones; the gunmaker knows very approximately by experience what percentage may be expected from certain classes of ordnance with certain descriptions of powder. Roughly the factor of effect may be put within the following limits:—for mountain guns, 45 to 50 per cent.; field guns, 60 to 65 per cent.; medium guns, 70 to 80 per cent.; heavy guns, 85 to 95 per cent. The method of calculation will be best understood from an example. Suppose a charge of 425 lb of P_2 powder is to be fired from the 80-ton gun chambered to 18 inches diameter; the projectile weighs 1700 lb, and the space behind it is 14,450 cubic inches. The whole content of the bore is 60,400 cubic inches, and the volume of the charge is (425 × 27·7) 11,773 cubic inches, the number of expansions therefore is 5·13; the table shows that powder gas expanding to this extent from a density equal to that of water can perform work amounting to 92·4 foot-tons per lb. Since, however, the charge burns up in and has to fill (425 × 34) 14,450 cubic

Work done by gunpowder.

Action of charge in bore.

$\frac{B}{C}$, where B = content of bore in cub. in., and C = vol. of charge at 27·7 cub. in. per lb.	Total work Gunpowder is capable of performing per lb of charge burned, in foot-tons.	$\frac{B}{C}$, where B = content of bore in cub. in., and C = vol. of charge at 27·7 cub. in. per lb.	Total work Gunpowder is capable of performing per lb of charge burned, in foot-tons.
1·00	0·0	4·0	82·1
1·02	1·9	4·5	87·1
1·04	3·8	5·0	91·4
1·06	5·5	5·5	95·2
1·08	7·2	6·0	98·6
1·10	8·9	6·5	101·7
1·12	10·4	7·0	104·6
1·14	11·9	7·5	107·2
1·16	13·3	8·0	109·6
1·18	14·7	8·5	111·8
1·20	16·1	9·0	113·9
1·25	19·2	9·5	116·0
1·30	22·1	10·0	117·8
1·35	24·9	11·0	121·2
1·40	27·4	12·0	124·2
1·45	29·8	13·0	127·0
1·50	32·0	14·0	129·6
1·55	34·1	15·0	132·0
1·60	36·1	16·0	134·2
1·70	39·8	17·0	136·2
1·80	43·1	18·0	138·1
1·90	46·2	19·0	139·9
2·00	49·1	20·0	141·6
2·50	60·6	25·0	149·0
3·00	69·3	30·0	154·8
3·50	76·3	35·0	159·7

inches before doing work, the energy due to this extent of expansion (1·227) is lost, and 17·7 foot-tons per lb must be deducted, leaving (92·4 − 17·7) 74·7 foot-tons per lb as the total work the charge is capable of performing under these conditions. It is known from the preliminary tests of the powder that in the 80-ton gun between 92 and 95 per cent. of the total work will be realized. Hence the energy of the projectile will lie between 29,210 and 30,155 foot-tons, and its muzzle velocity between 1581 and 1600 f. s. A reference to the first table on this page will show that the result actually arrived at lies nearly midway between these limits. In this manner the charge required to impart the necessary energy to a shot of given weight in a given length of bore, and, conversely, the length of bore which will contain the requisite number of expansions of a given charge, are easily found; hence the charge required to produce the necessary energy is readily found; the air-space and the dimensions of the powder chamber follow, and the inside of the gun is settled. The gun designer now has to put walls round his bore. Guided by the knowledge previously mentioned as

[1] Mild prismatic powder (German).

derived from the crusher gauge and the chronoscope, he lays down the pressures at each point of the interior, and calculates the amount and strength of the metal to be used, according to the special system of construction employed, and thus the exterior of the gun is settled. To give another instance:—let it be required to construct the most powerful howitzer that can be made for the siege train. The conditions are given thus:—recoil (of piece only) must not exceed 20 feet per second; weight of piece must not exceed 70 cwt.; limiting purposes are to breach at 1500 yards, with not more than 5° elevation, and to bombard at 5000 yards, with not more than 35° elevation. A piece weighing 70 cwt. and running back at 20 f. s. velocity gives 156,800 units of momentum (in pounds and foot-seconds); the initial momentum of the gun in recoiling is practically equal to the momentum of the shot on leaving the muzzle. Hence the shell must have 156,800 units of momentum, which may be composed of high velocity and light weight, or low velocity and heavy weight. For breaching purposes, accuracy and penetration are essential qualities; a shell varying in length from two and a half to three times its diameter will be suitable for the purpose. We have now a neat problem in ballistics, viz., To find the calibre of a shell of the proper length, of such a weight that, with the muzzle velocity required to give a range of 1500 yards at 5° elevation, the muzzle momentum shall be 156,800 units. This problem is readily solved by the methods indicated in the article GUNNERY, and it is found that a shell 8·0 in. in diameter, weighing 170 lb, and having a muzzle velocity of 940 f. s., will be slightly on the safe side of the limits. Proceeding in a similar manner, a shell 8·0 in. in diameter, weighing 230 lb, starting with a velocity of 675 f. s., satisfies the conditions of bombardment. The calibre being thus settled, the proportions of the piece remain to be worked out. As there is no difficulty in obtaining a velocity so low as 940 f. s. with a small charge and low pressure, the length of the bore and the disposition of the metal can be adjusted to suit, not only the strain of discharge, but the conditions of service. In the gun now under consideration, the bore is made as long as possible, and the weight of metal thrown as far forward as possible consistently with preserving due strength at the breech. The reasons for this are threefold:—first, the longer the bore the less is the breech pressure required to produce a given muzzle velocity, and the less is the maximum strain thrown upon the studs, gas check, or other rotating agent; next, the more forward the general disposition of the metal, the farther from the breech end will be the centre of gravity, and consequently the trunnions,—a position which favors steady shooting and absence of jump; thirdly, a siege howitzer, being always fired under cover, is little exposed except near the muzzle, which should therefore be made as strong as possible to avoid injury from anything less than a direct hit by unburst shell.

Example of designing.

Rifling.—Spherical projectiles fired from smooth-bored guns seldom or never pursue the mean trajectory. The centre of the ball's figure will rarely coincide exactly with the centre of gravity, and the pressure of the air during flight will then act with unequal effect on different parts of the surface. This inequality will be increased by accidental imperfections or roughness. The difference between the diameter of the bore and that of the projectile is termed "windage;" when this is considerable, it is a principal cause of error in shooting, as the ball rebounds from side to side against the walls of the piece as it is driven along, its actual direction of departure depending on the effect of the last bump before it leaves the muzzle. Accuracy of manufacture may greatly mitigate these errors, but will never entirely remove them; it is therefore found necessary to cause the projectile to rotate rapidly round an axis coincident with the axis of the gun; by this means the inequalities in the action of the pressure of the air, due to the imperfections above mentioned, take effect in all directions in turn as the projectile rotates, and hence neutralize each other. Extending this principle, the stability imparted to a shot by its moment of rotation is such that elongated projectiles can be employed and driven point first at high speed through the air. The course of the projectile from the time of its leaving the muzzle to the end of its flight belongs to GUNNERY (*q. v.*) Here we have to consider the modes in which the interior of the gun is made to impart rotation to the projectile. Rotation is usually expressed in angular velocity; a shot is said, in popular language, to make so many turns per second. Mathematically, the unit of angular velocity consists of rotation through the unit of circular measure in one second; the unit of circular measure is the angle subtended by an arc equal to radius, viz., 57° 17′ 44″ 48‴. If we call this angle ω, a complete rotation will be expressed by $2\pi\omega$. In considering the energy stored up in a shot's rotation, or, what is the same thing, the work done in producing that rotation, the weight of the projectile W, and its radius of gyration ρ, must be taken into account. The energy of a travelling body is $\frac{Wv^2}{2g}$; the weight of a rotating one is supposed to be concentrated at the end of the radius of gyration; then if Ω be the angular velocity, the velocity of a travelling body will correspond with $\rho\Omega$ in a rotating one, and the energy of rotation will be expressed by $\frac{W}{2g}\rho^2\Omega^2$. The proportions of service projectiles differ for different guns, the thicknesses of sides and base and the shape of head varying; but roughly for common shell the value of ρ may be taken as $0{\cdot}40d$ (d = diameter), for Palliser projectiles as $0{\cdot}38d$, and for shrapnel as $0{\cdot}36d$. For artillery purposes a projectile is said to turn once in so many calibres, that is, to make one complete revolution in travelling a distance equal to so many times the diameter of the bore. Supposing a given length of groove in the bore to make a known angle with a line parallel to the axis of the gun, determining the arc through which the surface of the shot must turn while advancing the length of the groove, it is evident that the angular velocity attained by the shot will entirely depend on the velocity of translation or forward movement. Again, the greater the diameter of the bore the less will be the proportion borne by the arc turned through to the whole circumference; consequently the bigger the gun the less the angular velocity of the projectile, if the angle of rifling and the velocity of translation remain constant; the velocity of rotation of a point on the surface will, under these conditions, always be uniform. It is generally considered that with studded muzzle-loading service projectiles, having a length equal to about $2\frac{1}{2}$ to 3 times their diameter, the velocity of rotation of a service point of about 110 f. s. is sufficient to keep them steady, allowing for loss of spin by atmospheric friction up to any probable range. Supposing the interior of the gun to be opened out and laid flat, the groove (of a uniform twist) will be straight, and since the shot guided by it makes a complete revolution in n calibres, the angle made by the groove with a line parallel to the gun's axis may be expressed by $\tan.^{-1}\frac{\pi}{n}$. In designing the piece, the muzzle velocity is determined on, and also the velocity of rotation to be communicated to the projectile; the combination of the two fixes the final angle of the groove. Now it is easy to see that the spin of the shot on leaving the bore depends only on the conditions immediately preceding. The rate at which the work of giving rotation is done during the travel of the projectile from breech to muzzle is an entirely different question. If a shot be rotating, its tendency is, putting friction aside for the moment, to continue to rotate with the same velocity. No work is done in keeping up this rate of rotation, but work would be done in accelerating or retarding it. Thus in apportioning the work done on the shot in giving rotation at different parts of the bore, we have to consider, not the actual angular velocity, but the increments of angular velocity. The work then can be distributed at pleasure over the whole length of the groove, by varying the angle it makes with a line parallel to the gun's axis, as it runs along the

Principles of rifling.

Uniform and increasing twists.

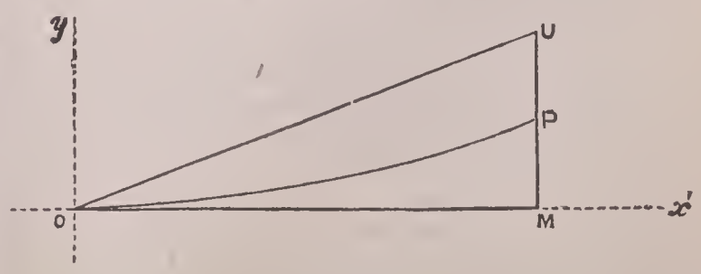


FIG. 47.

bore. Supposing, as before, the interior surface of the gun to be opened out and laid flat, then OU (fig. 47) will represent a groove having a uniform twist, that is, making a constant angle with a line OM parallel to the axis of the piece. O denotes the commencement of the rifling at the breech end of the bore, UPM the muzzle. Guns are rifled with any number of grooves exceeding two, but it is not necessary to consider more than one. With the groove OU, every increment of angular velocity imparted to the shot is due to an increment in the velocity of translation; and therefore the pressure between the sides of the grooves, and the studs, gas check, lead coating, or whatever fitting on the shot is employed for the purpose, bears a constant relation to the pressure of the powder gas on the base of the shot driving it forward. The table given below shows the result of this with great clearness. In order to mitigate the unevenness of strain, recourse was had to the increasing twist; and a curved groove was employed which, when developed as in fig. 47, forms the parabola OP, beginning at the point O, parallel to OM, and terminating at P, parallel to OU. The equation to OU is $x = py$; that to OP is $x^2 = py$. Since OP is a parabola having its vertex at O, and since the tangent at P is parallel to OU, therefore UP = PM, which shows that the shot, though rotating in either case with equal angular velocity on leaving the muzzle, has, up to that moment, with the parabolic twist turned through an angle half as great as would be the case with the uniform twist. The table below exemplifies the principle on which curves or rifling are, or should be, constructed. The first three columns speak for themselves; the fourth is arrived at by multiplying the area of the shot's base by the gas pressure per square inch recorded on the gauges, and given in the 5th column. Columns 6 and 7 are worked out from formulæ due to Captain Noble of Elswick; in column 6 the pressures due to a uniform twist are given. It will be seen that they bear a constant proportion to the pressures of the gas recorded in columns 4 and 5, and that the maximum rises to a considerable height soon after the shot has begun to move, while at the muzzle little work is done. In column 7 the calculations are made to suit a curve consisting of a portion of a parabola, starting from the vertex where

Pressures on grooves.

Table showing Pressures of Grooves on Studs in the 38-ton Gun, with various Curves of Rifling. Charge 130 lb. Cubical Powder of 1·25-inch edge. Projectile, 800 lb. Calibre, 12·5 inches.

Travel of Shot through Bore.	Time of Travel.	Velocity. acquired.	Pressure on base of shot.	Pressure per square inch of Base.	Pressure on Studs with Uniform Twist of 1 turn in 35 Cals. $z = kr\phi$.	Pressure on Studs, Parabola, Twist 0 to 1 in 35. Cals. $z^2 = kr\phi$.	Pressure on Studs, Semi-Cubical Parabola, 1 in 200 Cals. to 1 in 35 Cals. $z^{\frac{3}{2}} = kr\phi$.
ft.	secs.	f. s.	tons.	tons.	tons.	tous.	tons.
0	·00000	0	2000 (estimated)	16·3	79·3	0	31·4
·1	·00143	140	2221·3	18·1	88·1	1.65	22·6
·5	·00273	474	3320·3	27·0	131·6	15·6	59·8
1·0	·00360	676	2060·6	16·8	81·7	26·8	61·3
2·0	·00490	869	1394·1	11·4	55·3	42·1	65·1
3·0	·00598	987	1095·0	8·9	43.4	53·1	66·3
4·0	·00695	1074	908·8	7·4	36·0	61·95	66·3
5·0	·00785	1142	746·4	6·1	29·6	68·7	85·0
6·0	·00871	1195	668·3	5·4	26·5	75·0	64·7
7·0	·00953	1242	592·8	4·8	23·5	80·3	63·9
8·0	·01032	1277	499·4	4·1	19·8	83·3	61·0
9·0	·01109	1309	421·9	3·5	16·7	86·2	58.95
10·0	·01184	1335	355·6	2·9	14·1	88·2	56·6
11·0	·01258	1355	265·1	2·2	10·5	88·1	53·95
12·0	·01331	1369	188·7	1·5	7·5	87·3	48·8
13·0	·01404	1379	131·6	1·1	5·2	{ 86.4 / 5·2 }	{ 45·2 / 5·2 }
14.0	·01476	1385	120·9	1·0	4·8	4·8	4·8

the groove is parallel to the axis of the piece, and rising to the required twist at one foot from the muzzle, thence proceeding uniformly. In this curve the maximum strain is greatly reduced, the pressure gradually rising with the increase of twist. The figures are derived from another formula worked out by Captain Noble. Column 8 shows the pressures required to give the necessary rotation when the curve of groove is a semicubical parabola, having for equation $x^{\frac{3}{2}} = py$. In the instance chosen, the early part of the curve is rejected, and it starts from 1 turn in 200 cals., arriving at the required twist at a foot from the muzzle as before. The figures are derived from a calculation worked out on the principle devised by Captain Noble. Here the maximum is yet further reduced, and some approach to uniformity of strain is made. The diagram in Plate IV. shows the pressures graphically.

Let R = rotation pressure between studs and grooves;
G = gas pressure on base of shot;
μ = coefficient of friction;
h = pitch of rifling;
k = tan. of angle made by groove with plane traverse to axis;
ϕ = angle turned through by shot;
θ = angle made by groove with line parallel to axis;
ρ = radius of gyration;
z = travel of shot along bore;
v = velocity of shot;
M = mass of shot $= \frac{W}{g}$;
r = radius of shot.

Then in a uniform twist ($z = kr\phi$)

$$R = \frac{2\pi\rho^2(1+k^2)^{\frac{1}{2}}}{hr(k-\mu)+2\pi\rho^2(\mu k+1)} \cdot G;$$

in a parabolic twist ($z^2 = kr\phi$)

$$R = \frac{2\rho^2(4z^2+k^2)^{\frac{1}{2}}(Gz+Mv^2)}{kr^2(k-2\mu z)+2\rho^2 z(2z+\mu k)};$$

in a semicubical twist ($z^{\frac{3}{2}} = kr\phi$)

$$R = \frac{3\rho^2\left(G\sqrt{z}+\frac{Mv^2}{2\sqrt{z}}\right)(9z+4k^2)^{\frac{1}{2}}}{kr^2(4k-6\mu\sqrt{z})+3\rho^2\sqrt{z}(3\sqrt{z}+2k\mu)}.$$

Lieut. Younghusband, R. N., gives the following formula, which is applicable to curves of any equation, and will be found much handier than the above by those familiar with differential calculus:—

$$R = \frac{\rho^2\left(G\tan\theta+\frac{d^2y}{dx^2}Mv^2\right)\sec\theta}{r^2(1+\tan^2\theta)-\mu\tan\theta\,(r^2-\rho^2)}\sqrt{1+\mu^2}.$$

A radical difference exists between the rifling of muzzle-loaders and that usually employed for breech-loaders. When the projectile has to be pushed down the gun from the front, it must be smaller than the bore; when it is thrust home from behind, it may be rather larger than the bore. Hence the earlier muzzle-loading shells were provided with ribs or studs which fitted in the grooves, and guided the projectile in its rotatory course; while the earlier breech-loading shells were coated with lead, into which the lands of the bore bit sharply as the powder gas forced the projectile between them. All rifled ordnance were formerly rifled with a uniform twist; indeed, it is clear that where ribs are cast or fixed on the projectile, or where they are formed in the soft envelope by the first action of the grooves, no alteration in the angle of rifling is possible, since the ribs can only make a constant angle with a line parallel to the axis of the piece, and cannot fit a groove making a varying angle with it. The smaller and earlier muzzle-loading rifled projectiles were fitted with two rows of studs, front

and rear, and equal in size, so that a front and rear stud travelled in each groove, and practically constituted the ends of a rib. As the guns grew, it was found that the great strain of giving rotation at starting frequently forced the bronze studs out of the recesses machined for them in the sides of the shells, and scooped away the driving edges of the grooves even when the gun lining was of steel. The shell might have been cast with ribs on them, but certain difficulties of manufacture stood in the way, and the excessive strain would still have existed though its effects might have been mitigated. The increasing twist was therefore devised, and the rows of studs increased in number from two to three in the larger natures of projectiles. Three studs are allotted to each groove; the rear one is the largest, the front one the smallest. They are so placed that the line of their loading sides is parallel to the angle made by the groove at the breach, while the line of their driving edges is parallel to the angle made by the groove at the muzzle. In Plate IV. fig. 1 shows their position when the shell is home, and also when about to leave the bore. Thus, theoretically, the middle and leading stud should never come into play till the last moment, and the rear stud should do all the work of rotation. Practically, however, the rear stud, being of bronze, wears down against the edge of the hard groove; the centre stud obtains a bearing; the wear continues, and the leading stud takes up its share of duty; so that all three really act during the passage of the projectile through the bore. This method of employing the increasing twist necessitates wide grooves, and is unsuitable for small guns. A different plan therefore was devised to meet their case. Two rows of studs, front and rear, were so arranged that each ran in a groove of its own. The curve of the grooves belonging to the rear stud began at 0°, and reached the final angle at a distance from the muzzle equal to the distance between the front and rear rows, after which it proceeded in a straight line. The curve of the grooves belonging to the front studs began at 0°, at a distance in front of the commencement of the other grooves equal to the distance between the rows, and reached its final angle at the muzzle. Thus the two curves were alike, but one was always a constant distance in front of the other, and every stud acted through the entire length. Fig. 2 in Plate IV. shows the position of the studs when the shot is home, and also when it is about to leave the bore.

Modes of giving rotation.

Studs.

Muzzle-loading rifling had reached this stage of progress at a time when the great wear caused by the rush of gas over the shot necessitated the adoption of some method of sealing the escape. After many trials, it was found that a flanged copper disc fitted on to the base of the projectile would expand under the first pressure of the gas, and cut off the windage completely. This saved the wear of the guns, and added to their power. It was found, moreover, that the flanges of these "gas checks" expanded in the grooves, and being firmly attached to the shell afforded an additional means of giving rotation. The next step was to remove the studs altogether, using a smooth projectile, and substituting many small grooves for few large ones. This method of giving rotation has been adopted in all recently-designed pieces, and appears likely to give entire satisfaction. When muzzle-loading guns were first rifled, many attempts were made to give rotation by expanding projectiles, but they proved unsuccessful, because at that time the increasing twist was not known, and the action of a violent powder and the uniform twist was that the rotator had to expand into the grooves, and at the same instant to communicate a rapid spin to the shell. It was unable to combine these operations, and the projections driven out by the gas could never settle to their work, being constantly cut down by the edges of the grooves. The result was that the shell "stripped," and left the bore without regular rotation. In the case of the twist which begins at 0°, the projections have time to expand comfortably, and adapt themselves to the shape of the grooves before they are called on to perform the work of rotation. On the other hand, since the gas presses out the flanges against the bore and into the grooves, and affords them support in this position, it is desirable that its pressure should correspond with their pressure on the driving edges of the grooves. This would be exactly met by the uniform twist, but that is inadmissible for the reason just given. The parabola, on the other hand, throws the principal rotating strain forward towards the muzzle, where the gas pressure is least (Plate IV.). The case is practically met by the semicubical parabola, which is the curve adopted in the 80-ton gun. While progress was thus being made in the rifling of muzzle-loaders, the rival system had not remained inactive; the use of lead coating had been found to involve a loss of power in the projectile as regarded both the amount of bursting charge or bullets carried, and the penetration into armor, on to the surface of which the lead flew forward in a splash, when the shell struck. Moreover, the lead envelope would not lend itself to the exigencies of the increasing twist. To meet these difficulties, two undercut rings were machined round the smooth projectile, one near the base, the other near the shoulder. Into these slots were pressed stout copper wires, the rear one bringing up the diameter of the shell beyond that of the bore, so as to take the rifling when forced through the piece on discharge, the front one just fitting the lands, but not entering the grooves, so as to rotate irrespective of them, and thus keep the fore part of the shot steady. Projectiles thus fitted are more effective than the lead-coated ones, and are adapted to any twist of rifling. The latest breech-loaders made by the Elswick Company use the new arrangement described above for muzzle-loaders—the smooth shell with a gas check on the base. This appears to be the best form of projectile, and has the advantage of suiting either system. A few words on the section of groove best suited to various purposes will conclude the subject of rifling. The rotation is impressed on the projectile by a force acting tangentially to the surface. This principle would be represented in its extreme form by making the section of the shell to resemble a cog-wheel, the grooves and lands of the gun being bored to fit. With muzzle-loading systems where windage has been necessary, the sides of the projections on the projectile, and of the grooves in the bore, have been sloped to enable the projections to run up the sides of the grooves, and so distribute the windage equally all round. The extreme form of this principle is Lancaster's oval bore, the section of which departs but slightly from a circle. All attempts at "centring" the projectile by sloping the bearings tend to convert it into a wedge, which expends that part of the force resolved radially in a crushing action on the shell, and a rending action on the gun. The slope may, however, be made of such a degree as to cause the projectile to centre fairly without exercising any important effect on the bore. In breech-loading systems, where the lands bite into the rotator, the driving edge strikes the projectile in, or nearly in, the prolongation of the radius, care being taken that the points of action are as many as possible consistently with leaving enough material between to stand the wear and the strain. Where gas checks expand in the grooves, these should be broad and flat, so that a complete fit and a strong projection should result. The driving edges should here also form a prolongation of the radius of the projectile.

Gas checks.

Lead coating.

Copper bands.

Centring.

Conclusion.—What may be the future of fire-arms it is impossible to predict, but it seems probable that the limit of power will be found to lie in the recoil. For shoulder guns, methods of withstanding increased velocities may be devised, but the weight of springs, pads, etc., will prevent the soldier or the sportsman from carrying this principle very far. For ordnance, the field artillery appear even now to be very near the limit of what power can be gained consistently with high mobility. Siege and heavy guns will no doubt gain by the increased application of hydraulics; but it is difficult to see how progress can go much further except in the matter of size, to which there appears to be practically no limit. Accuracy may be improved by more perfect methods of range finding, but, as regards the actual shooting of the guns, it is already in advance of the difficulties of atmospheric irregularity, which affects the smaller projectiles greatly. The reader who wishes to study the subject closely and technically is referred to the list of works given at the end of the article on GUNNERY. (E. M.)

Conclusion.

GUNNERY. In its early days this science might have been simply defined as the art of determining the motions of projectiles discharged from pieces of ordnance; in its present state it includes also the employment of projectiles specially adapted to the purpose in view, and the manipulation of artillery so to enable the projectiles to produce the maximum effect.

Theory of Gunnery.—Instruments of great precision, mechanical construction of much accuracy, and a considerable knowledge of the higher mathematics are necessary to obtain and make use of trustworthy data for the establishment of sound principles on which to base the theory of gunnery. It is therefore not surprising that, owing to the early discovery of gunpowder, the art was long practised in a rude manner, without any attempt being made to reduce it to a science. Thus, though firearms appear to have been in use from the early part of the 14th century, little of value was understood of the laws regulating the flight of projectiles till the time of Nicholas Tartaglia, who published a treatise on the subject at Venice in 1537. About sixty years before that date, Leonardo da Vinci had enunciated some of the mathematical principles of trajectories in a manner which shows him to have possessed far more insight than any of his contemporaries; but he did not pursue the inquiry, and Tartaglia may be regarded as the father of ballistics. He was a man of great talent and ingenuity, but unfortunately had no opportunities of observing artillery practice; he was unable, therefore, to bring his calculations and speculations to the test of fact, and failed to carry conviction to the minds of the philosophers of the age. Before his time it had been generally believed that a ball on leaving the bore of a gun proceeded for some distance in a straight path,—a fallacy which lurks in the phrase "point-blank," not yet expunged from popular speech. He saw, however, that "a piece of artillery cannot shoot one pace in a right line," and propounded the axiom that "the more swifter a pellet doth flie, the lesse crooked is his range,"—a truth expressed at the present day by the statement that a high velocity gives a flat trajectory. This eminent philosopher claimed the invention of the gunner's quadrant; he took into account in his calculations the resistance of the air, but placed the angle of elevation at which the maximum range would be obtained at 45°, which would only be the case *in vacuo*. Galileo was the next mathematician of note who investigated the subject. In his *Dialogues on Motion*, published in 1638, he recognized fully the resistance of the air, and pushed on the inquiry in the direction indicated by Tartaglia. It was not, however, till Newton's time that a substantial basis was laid down for a true theory of gunnery. The grand discovery of the law of gravitation revealed the hitherto unguessed secret of the projectile's fall to earth. The great improvements in mathematical methods of analysis invented by him rendered possible solutions of previously impracticable problems; while the splendor of his achievements in natural science stimulated philosophers of all countries. Towards the end of the 17th century he investigated the trajectory of a projectile on the supposition that the resistance of the air varied as the first power of the velocity. Bernoulli in 1718 gave a solution of the problem, on the supposition that the resistance varied as any given power of the velocity. This solution was, however, left in such a complicated state that no practical use can be made of it. No further progress was made till Benjamin Robins in 1742 published his *New Principles of Gunnery*, in which he furnishes a notable example of the manner in which theory should be wedded to practice, and hypothesis to experiment. Had Robins been in the possession of accurate instruments he would probably have arrived at results of considerable correctness. He invented the ballistic pendulum, and was the first to ascertain experimentally with any degree of correctness the velocities of projectiles on leaving a gun. A "triangle" or gyn supported a pendulum of iron having a massive wooden bob; to the bob was fixed a steel ribbon which passed through a steel clamp set to the desired pressure. A bullet fired into the wooden bob caused the pendulum to swing; the length of the arc described was recorded by the steel ribbon; the weight of the bullet and the conditions of oscillation of the pendulum being known, the velocity of the bullet could be calculated from the length of the arc. The weight of Robins's first pendulum was 56 lb, and it was therefore only suited for small arms. It could measure the velocity at only one point each round, and therefore, to ascertain the velocity lost by a ball in passing through the air, it was necessary to fire a series of rounds at one distance, and afterwards a similar series of rounds at another distance. Velocities of 1700 feet per second were measured, and the loss of velocity due to the resistance of the air, up to a distance of 250 feet from the muzzle, was approximately ascertained. Robins discovered that the resistance of the air was greatly increased as soon as the ball travelled faster than sound, and attributed it to the creation of a vacuum behind the shot, into which the air could not rush with speed greater than that of sound. Count Rumford in 1751 made use of the recoil to measure the velocities of bullets, on the principle that the momentum of the bullet forward was equal to the momentum of the gun backward. To carry this out, the gun was suspended as a pendulum, and the length of the arc it described on firing measured. By firing a bullet from a gun thus suspended into the ballistic pendulum, two independent records were obtained, and it would have been easy to calculate the loss of velocity, from the muzzle to any range at which the pendulum could be hit, by the combination. The roughness of the methods unfortunately did not permit completely satisfactory results. Dr. Hutton next took up the inquiry, and increased the weight of the pendulum and the bullets. No very great advance, however, seems to have been made till 1840, when experiments on the resistance of the air to the motion of spherical shot were carried on at Metz by the French Government. MM. Piobert, Morin, and Didion were the chief experimenters. They raised the weight of the receiving pendulum to nearly 6 tons, and fired into it 50-pound balls at a range of 330 feet. The information now obtained spread over a much wider field than that traversed by Robins. It was even found possible to construct the trajectories of projectiles with some approach to truth, and empirical formulæ were laid down by which ranges and times of flight could be approximately calculated. It was not, however, till the introduction of electricity as a means of determining the velocities of projectiles that accurate knowledge of the resistance of the air was obtained. In 1840 Professor Wheatstone invented an instrument for this purpose, called the electro-magnetic chronoscope. He has had many successors,

Early views.

Tartaglia.

Newton.

Robins.

Didion.

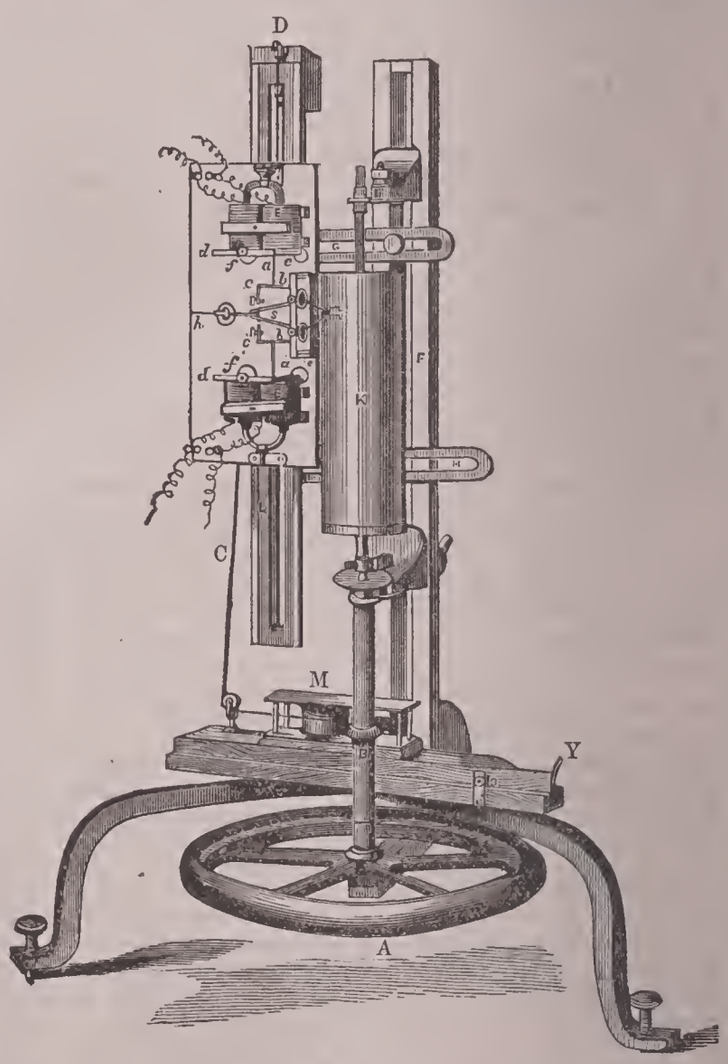
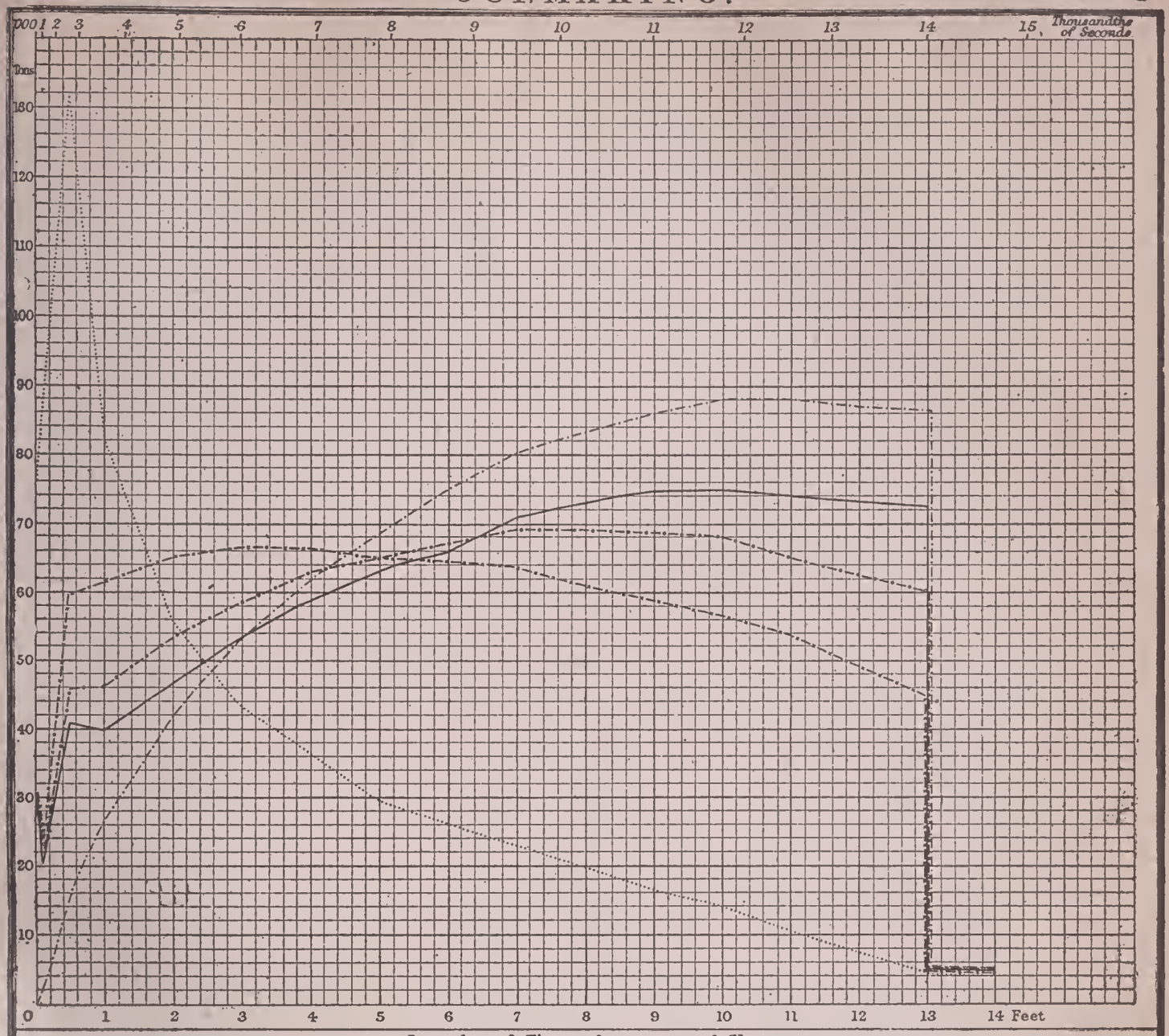


Fig. 1.—Bashforth Chronograph.



Length and Time of traverse of Shot

DIAGRAM SHEWING THE PRESSURE OF GROOVES ON STUDS, WITH VARIOUS TWISTS, AT EACH FOOT ALONG THE BORE.

.....	*Uniform*	*1 turn in 35 cals.*	$Z = k r \varphi$
-.-.-.	*Parabola*	*0 to Do*	$Z^2 = k r \varphi$
———	*Parabola*	*1 in 200 to 1 turn in 35 cals*	$Z^2 = k r \varphi$
-.-.-.	*Semi-cubical Parabola*	*Do Do*	$Z^{\frac{1}{2}} = k r \varphi$
-.-.-.	*Seven fourths Curve*	*Do Do*	$Z^{\frac{7}{4}} = k r \varphi$

Double groove rifling
Twist increasing from 0 to 1 turn in 16 cals

fig. 2.

Single groove rifling (Service)
Twist increasing from 0 to 1 turn in 16 cals

fig. 1.

W. & A. K. Johnston, Edinburgh, and London

Electric velocity instruments.

whose productions exhibit a great amount of ingenuity; those from which the most valuable results have been obtained, and which are in use at the present moment, are the Bashforth chronograph, the Noble chronoscope, the Le Boulengé chronograph, and the Watkin chronograph.

The general principle on which these four instruments are designed is that a projectile after leaving the gun shall sever a fine wire stretched across a screen, thus breaking an electric current, and causing a record to be made by the instrument at the moment. The Le Boulengé is connected with two wire screens only, the others with several. As two records are necessary to obtain a velocity, reading the time taken by the shot to pass between two screens, the number of points of a shot's flight at which an instrument is capable of indicating the velocity is one less than the number of screens employed. The chronograph invented by the Rev. F. Bashforth, late professor of mathematics to the Advanced Class of the Royal Artillery, is shown in fig. 1.

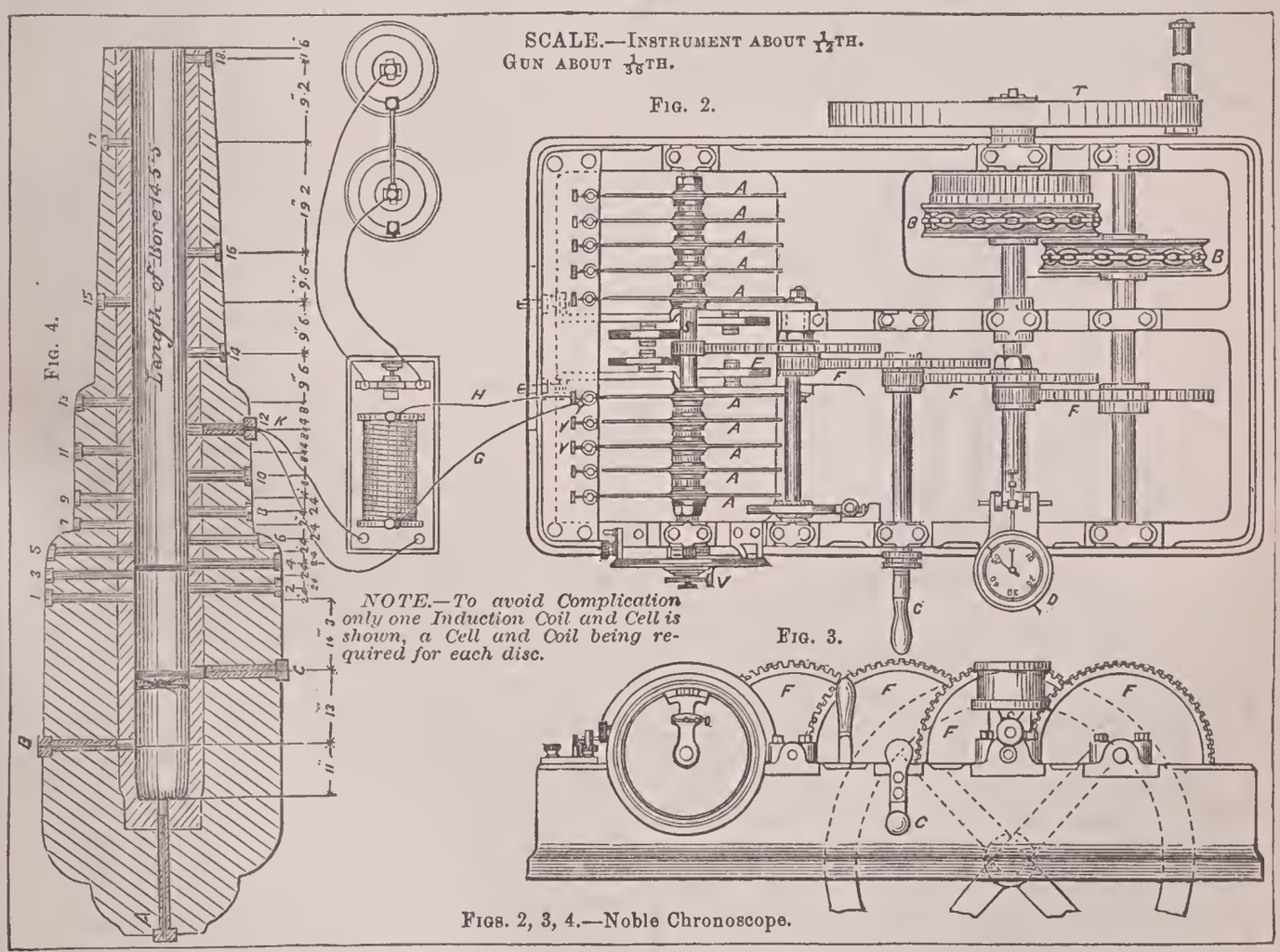
Bashforth chronograph.

A is a fly-wheel, which, in revolving, carries with it K, a cylinder covered with paper specially prepared to receive the records of the clock and screen. B is a toothed wheel which turns the drum M and unwinds the string CD, thus allowing the platform S to descend slowly down the slide L. E, E′ are two electromagnets, whose keepers are supported by the frames *d*, *d′*; *f*, *f′* are the ends of springs which act against the attraction of the electromagnets. There are two distinct currents—one through the screens and E, the other through the clock and E′. When these are interrupted, one by the shot cutting a screen, or the other by the clock beating seconds, so that the magnetism is destroyed, the spring *f* or *f′* carries back its keeper, which, by means of the arm *a* or *a′*, gives a blow to the lever *b* or *b′*, causing the marker *m* or *m′* to depart from the uniform spiral it has been describing—a spiral consisting of a double line running round the cylinder. The apparatus is adjusted so that the platform L, and consequently the markers *m*, *m′*, descend about ¼ inch for each revolution of the cylinder; the folds of the spiral are thus ¼ inch apart. The cylinder is made to revolve with considerable rapidity, so that the intervals between the successive clock marks indicating seconds measure from 20 to 25 inches; hence the screen marks indicating the moment of the severance of the wire by the shot can be allotted to their proper value in seconds with great accuracy. The screens are so contrived that the current, interrupted by the passage of the shot through one, is completed again before the next is reached. To accomplish this, the cutting of the wire is made to release a spring which makes a fresh contact; thus any number of screens can be used and a corresponding number of records obtained.

Noble chronoscope.

The chronoscope invented by Captain Noble of Elswick, late Royal Artillery (figs. 2, 3, 4), is constructed to furnish eight or more records, according to the number of discs, and is so excellently adapted for the measurement of exceedingly minute portions of time that it is usually employed to ascertain the velocity acquired by the shot in moving from a state of rest inside the gun at different parts of the bore. It is thus intimately connected with gunmaking, but having the same character as other velocity instruments, is described here. The screens used for recording the flight of the shot through the air are now discarded, and the "cutting plugs," shown in figs. 5, 6, 7, are substituted for them. In figs. 5 and 6 B is the bore, and A a flat-headed shot or cylinder passing along it in the direction of the arrow. The plugs are screwed into the sides of the gun, as in fig. 7, which gives an end view of the bore. As the shot passes, its foremost edge pushes up the knife D, cutting the wire *e*, which passes in at one side of the plug C, then through a hole in the knife D, and out again at the other side of the plug. The ends of this wire are connected with the main wires leading to the instrument, and the knife D, in cutting it, interrupts the current. Fig. 4 shows a 10-inch gun pierced to receive cutting plugs in eighteen places. The main wires run from a plug to the primary of a Ruhmkorff coil, fig. 2, near the instrument, with which the secondary communicates. Figs. 2 and 3 show the instrument in plan and elevation.

Cutting plugs.



Figs. 2, 3, 4.—Noble Chronoscope.

A, A are disks, 36 inches in circumference, fixed on a horizontal shaft S. This shaft is caused to rotate, so that the edge of the disks travel at about 1100 inches per second, by a series of toothed wheels F, F, gearing as shown, and worked into rapid motion by the handle C. This motion is kept up with regularity by the descent of the weight B acting on the hindmost shaft, the speed of which is multiplied 200 times at the shaft S. At V is a vernier, reading a graduated circle, which

is fixed on the shaft S. The edges of the disks are covered with a coating of lampblack. One of the secondary wires G is brought from the coil, and placed in communication with the revolving disk; the other secondary wire H is fixed in a discharger Y, just clear of the edge of the disk. A stop-clock is placed on a stand D, and records the rate of revolution of one of the shafts. When the gun is fired the shot begins to move, and, as it travels along the bore, cuts the wires of the plugs in

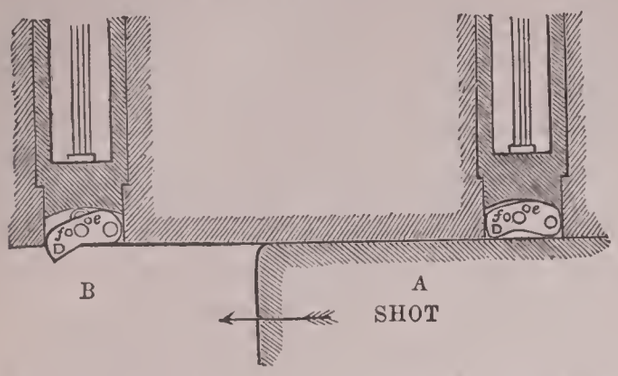


Fig. 5.—Cutting plug, knife down.

Fig. 6.—Cutting plug, knife up.

succession, breaking the primary currents, and causing sparks to pass in the secondary current from the dischargers Y, Y, to the disks A, A, which are in rapid revolution. The sparks burn off the lampblack and record their positions on the disks by a minute spot. Now if the shot could cut all the plug-wires simultaneously, all the spots on the disks would be in a straight line, but it does not do so, and during the intervals between the cutting of successive plug-wires the disks continue to rotate, so that the line of spots forms a spiral round the cylinder repre-

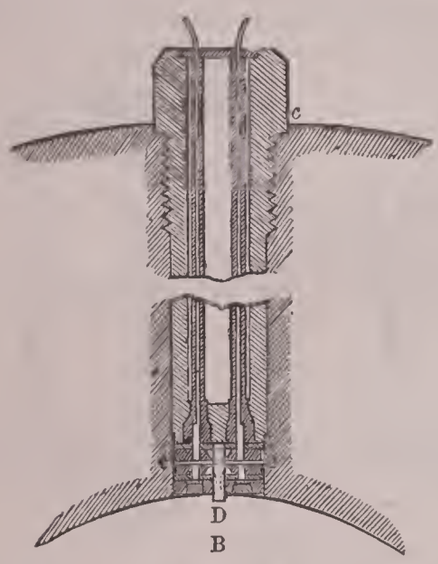


Fig. 7.—Cutting plug, ready for firing

sented by the disks, as is apparent on bringing the machine to rest. The shaft S is then turned so as to place each spot in succession opposite an index, and the spaces travelled by the circumferences of the disks between the spots are read off on the graduated circle. As the circumference of the disks is made to travel at the rate of 1100 inches per second, and the vernier reads to thousandths of an inch, the machine indicates portions of time rather less than a millionth of a second; it is, in fact, practically correct to hundred-thousandths of a second. A millionth is about the same fraction of a second as a second is of a fortnight. Thus the distance between two successive spots gives the actual time occupied by the shot in moving over the portion of the bore between two corresponding successive plugs, and therefore the velocity acquired at some point of this travel. As the *increment* of velocity is constantly decreasing after the charge is fairly lighted, the point at which the measured velocity is acquired is very slightly behind the middle of the space between the two plugs. The observations are worked out, accidental errors eliminated, and the results put in the form shown in column 3 of Table I.

Crusher gauge.

The "crusher gauge" (fig. 8) is so closely associated in its use with the Noble chronoscope that it is convenient to give a description of it here, though its indications are valuable to the gunmaker rather than to the gunner. In fig. 4 are shown three plugs, A, B, and C, driven through the walls of the gun, and terminating flush with the bore. These plugs contain gauges for measuring directly the pressure of the gas on the surface of the bore. They are of the same diameter as the cutting plugs, and can be used in any of the twenty-one holes pierced in the gun. Fig. 8 shows the construction. The

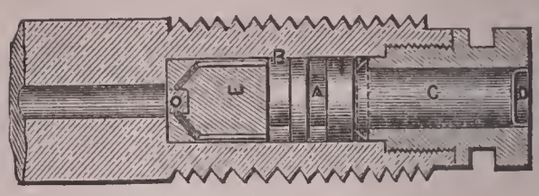


Fig. 8.—Crusher gauge.

bottom of the plug is chambered out, and a steel anvil E is placed at the top of the chamber. Against this anvil is pressed a cylinder of pure copper A, carefully tested for quality, which is held in its place by a spring B. A piston C fits accurately the lower part of the chamber, any ingress

Table I.

Distance of Plug from bottom of Bore.	Mean of 4 Rounds.		
	Pressure.	Velocity.	Difference in Velocity.
	tons per sq. in.	f. s.	f. s.
Axis,	23·8		
1 ft.	23·8		
2 "	22·5		
		137	
3 "	19·9		533
		670	
4 "	14·2		244
		914	
5 "	11·6		127
		1041	
6 "	7·0		69
		1110	
7 "	3·8		55
		1165	
8 "	2·9		47
		1212	
9 "			40
		1252	
10 "			34
		1286	
11 "			29
		1315	
12 "	1·9		25
		1340	
13 "	1·6		21
		1361	
14 "	1·3		18
		1379	
15 "	1·1		16
		1395	
16 "	0·6		14
		1409	

of gas being prevented by the gas-check D, which is flush with the bore. When the gun is fired the powder-gas presses the piston hard against the copper cylinder A, which yields and becomes shorter, expanding laterally, The plug is then removed from the gun, and the nozzle unscrewed; the cylinder is extracted and measured. Its compression is compared with those given in a table constructed from experiment, and the pressure of the gas per square inch recorded. With the chronoscope the velocities are obtained directly from the time shown by the instrument to have been taken by the shot in passing over the interval between two cutter plugs. From these velocities calculation deduces the pressures required to produce the increments of velocity. These calculated pressures are compared with and confirmed by those obtained directly from the indications of the crusher gauge. Table I. shows the nature of the information obtained from the combination of the two instruments, when used with a 38-ton gun, firing an 800-lb projectile, with 130 lb of 1·5-inch cubical powder.

Pressures and velocities inside bore.

The last velocity is calculated from that taken by a Le Boulengé instrument outside the gun. This chronograph, the invention of an officer of the Belgian artillery, is shown in figs. 9, 10, and its mode of application in fig. 11.

Le Boulengé chronograph.

The shot, after leaving the gun, cuts the wire of the first screen, and subsequently the wire of the second screen. The wire of the first screen conveys a current through an electro-

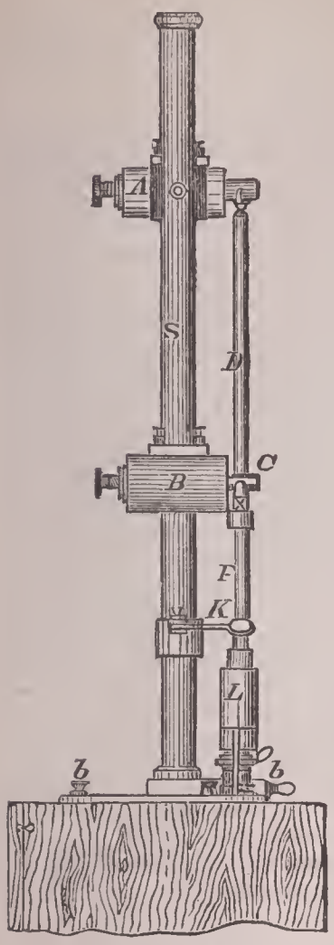


Fig. 9.—Le Boulengé Chronograph, side view.

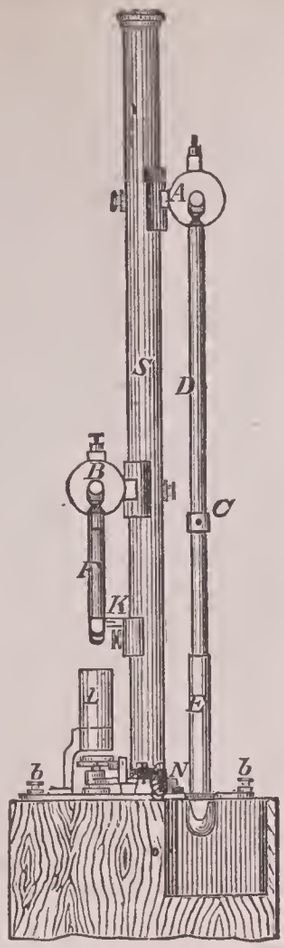


Fig. 10.—Le Boulengé Chronograph, front view.

magnet A (figs. 9, 10), which then supports a cylindrical rod C. This rod is sheathed with a zinc tube D, which is renewed from time to time as required; several short zinc tubes are slipped on, instead of one long one, if no great variation in the velocities is expected, so as to save material. Directly the first screen is cut, the rod C, which is called the *chronometer*, drops. The wire of the second screen conveys a current through another electromagnet B, which supports a much shorter rod F, called the *registrar*. The shot, in cutting the second screen, releases this short rod, which falls on a disk O, setting free a spring M. This spring carries a horizontal knife N, which flies forward and nicks the zinc tube covering the long rod. The nick made by the knife, if released while the long rod is still suspended, is the zero point. The currents from both

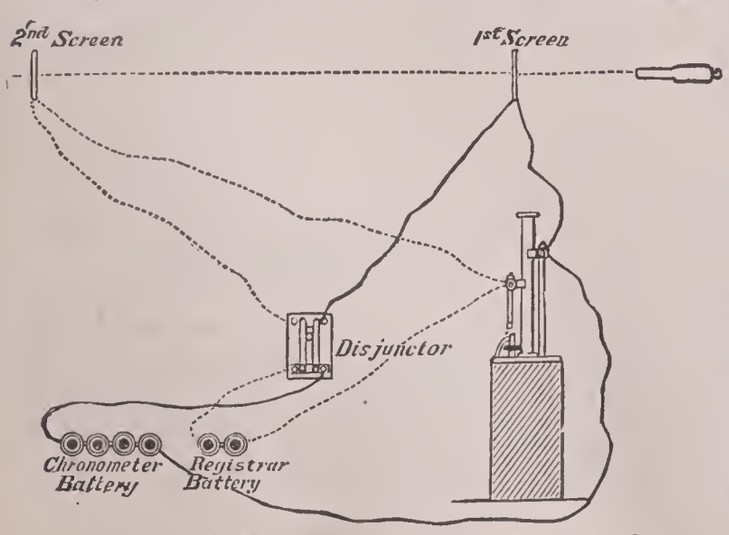


Fig. 11.—Mode of using Le Boulengé's Chronograph.

screens pass through a disjunctor by which they can be cut simultaneously. When this is done the long and the short rods fall at the same moment. A certain time is consumed by the short rod in reaching the disk, setting free the spring, and cutting a nick on the zinc. During this time the long rod is falling into a recess in the stand, deep enough to receive its full length. The instrument is so adjusted that the nick thus made

Fig. 12.—Watkin Chronograph.

is 4·435 inches above the zero point, corresponding to 0·15 sec. This is the disjunctor reading, and requires to be frequently corrected during experiments unless the weather is exceptionally favorable to the electrical conditions. Instead now of using the disjunctor to cut both currents simultaneously, suppose the shot to cut them in succession; then the long rod will be falling for a certain time, while the shot is travelling from one screen to the other, before the short rod is released. The longer the shot takes to travel this distance, the farther the long rod falls, and the higher up on it will be the nick made by the knife. A simple calculation connects the distance fallen through by the rod with the time occupied by the shot in travelling over the distance between the screens, and hence its velocity at the middle point is known. A graduated rule is generally supplied with each instrument, arranged for a certain distance between the screens; from this any velocity obtained can be read off at once.

Watkin chronograph.

The electric chronograph, invented by Captain Watkin, R. A., is shown in figs. 12, 13, 14.

Two brass cylinders A, A revolve on pivots B, B, C, C. Between them, at the top, hangs a brass weight (fig. 13), suspended freely by means of a piece of steel B, which pivots in another piece A let into the base of the weight. Two arms E enter, on falling, two V-springs on the bed of the instrument, which catch the weight. A finely-pointed brass wire, CD, enclosed through part of its length in an ebonite tube, passes through the upper end of the weight from side to side; the piece B of the weight is placed between the ends A, C of the lever arms of the holder (fig. 14).

The arm CD pivots on the pin F; AB is fixed. K, K is an electromagnet; on its keeper H is fixed a strong spring G, G. When this spring is placed between the ends B, D of

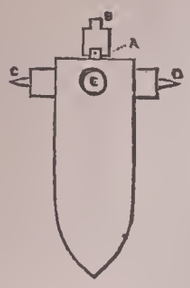


Fig. 13.—Weight.

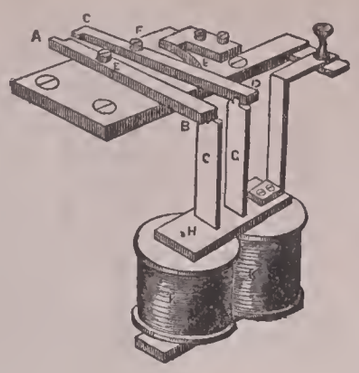


Fig. 14.—Holder.

the arms, it forces the opposite end C to press against A and to sustain the weight by gripping the piece B (fig. 13) of the weight. In this position the keeper H is at a short distance from the poles of the electromagnet. Directly the current is allowed to circulate, the keeper is attracted down to the magnet, the spring G, G is pulled away, a small spring L presses on the arm CD, the jaw AC flies open and the weight is released. The two cylinders A, A (fig. 12) form part of the circuit of a secondary induction coil. The screens are similar to those employed for the Bashforth chronograph; they are traversed successively by the shot, which momentarily interrupts the primary current, and thus causes an induced current to pass through the cylinders A, A. As these, however, are not in electrical connection, the current has to pass across through the brass wire of the weight, which is in the act of falling. The cylinders are covered with smoked paper, and the passages of the spark in and out leave minute spots showing the exact position of the weight at the moment; any number of screens may be used, and a duplicate record is obtained in one experiment of the space fallen through by the weight, while the shot is traversing each interval between the screens. As before, a simple calculation connects time and space, and an ingenious scale enables the experimenter to read off the velocities whatever be the distance between the screens.

In all these instruments slight errors exist, arising from mechanical imperfection, or from irregularity in the electric currents; still, the accuracy arrived at is sufficient for practical purposes, as is well shown by the following table:—

Comparative velocities.

Table II.—*Velocities of Martini-Henry Bullets fired with two different Charges, observed with several Instruments.*

Le Boulengé.		Bashforth.	Watkin.	
Instrument A.	Instrument B.		Right Cylinder.	Left Cylinder.
1167	1163	1163	1155	1157
1141	1140	1143	1137	1136
1140	1138	1138	1129	1132
1136	1133	1141	1138	1139
1147	1145	1142	1140	1140
Means of 5 rounds 1146	1144	1146	1140	1141
1272	1275	1269	1259	1259
1268	1264	1269	1267	1267
1270	1271	1277	1270	1268
1277	1279	1287	1272	1272
1285	1287	1290	1287	1285
1290	1294	1280	1284	1284
1264	1267	1263	1264	1264
1287	1289	1291	1285	1284
Means of 8 rounds 1277	1278	1275	1274	1273

These instruments enable the experimenter to ascertain the velocity of a projectile up to considerable distances from the gun. With rifled ordnance no difficulty is found in hitting screens of moderate size at a range of 2000 yards; and practically, the loss of velocity due to the resistance of the air can be determined for all ranges and all velocities.

It might be supposed that, having the means of acquiring this knowledge, the artillerist would find little difficulty in solving the grand problem of his art, which may be thus briefly stated:—Given a projectile of known weight and dimensions, starting, with a known velocity at a known angle of elevation in a calm atmosphere of approximately known density; to find its range and time of flight, its velocity, direction, and position at any moment,—or, in other words, to construct its trajectory. This state of perfection has, however, not yet been reached; mathematics has hitherto proved unable to furnish complete formulæ satisfying the conditions. The resistance of the air to slow movements of, say, 10 feet per second seems to vary with the first power of the velocity. Above this the ratio increases, and, as in the case of the wind, is usually reckoned to vary with the square of the velocity; beyond this it increases still farther, till at 1200 feet per second the resistance is found to vary as the cube of the velocity. The ratio of increase after this point is passed is supposed to diminish again; but thoroughly satisfactory data for its determination do not exist. From this it would appear that, as the motion of the shot increases in rapidity, the air finds continually greater difficulty in filling up the space left by the advancing projectile, but that, when once a point is reached where the vacuum in rear is complete, further increase of speed only encounters additional difficulty in displacing the air in front. The difficulty of meeting the conditions by mathematical formulæ is very great, since the velocity of the projectile changes continually, and moreover is resisted by air continually varying in density as the shot rises and falls again. It is evident that the greater the weight of a shot in proportion to the column of air displaced by it, *i. e.*, to the square of its diameter, the less effect will the resistance of the atmosphere have upon its motion; thus very heavy projectiles moving with very low velocities will be but little retarded by this cause. It is desirable, therefore, before proceeding to explain what has been done towards the complete solution of the problem above stated, to establish the limit, and investigate the trajectory when the resistance of the air is neglected.

Trajectory in vacuo.

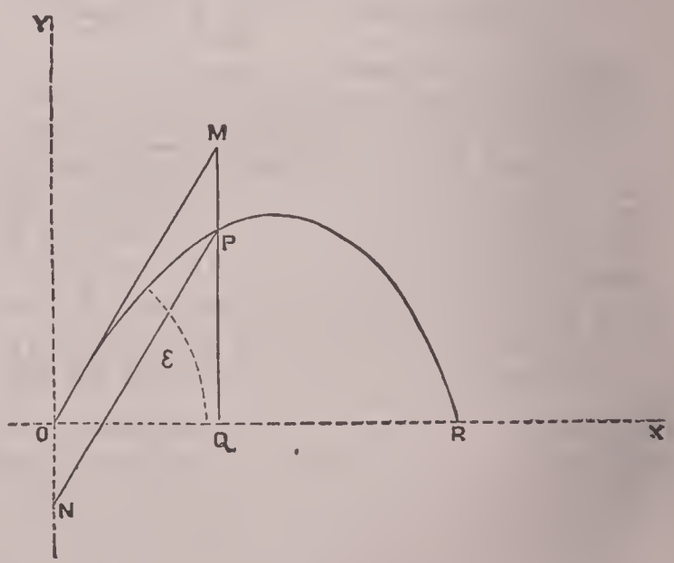


Fig. 15.

Let v = muzzle velocity of projectile;
ϵ = angle of elevation;
t = time of flight.

Let the projectile start with velocity v from the point O (fig. 15) in the direction OM, so that MOX is the angle of elevation. Let OM be the distance which would be traversed in a period of time t, if gravity did not act. Draw ON vertically downwards, equal to the distance through which the shot would fall in time t under the action of gravity only. Complete the parallelogram OMPN. Then P will be the position of the projectile at the end of the time t. We have then—

$$OM = vt, \text{ and } ON = MP = \tfrac{1}{2}gt^2.$$

$$\text{Therefore } OM^2 = \frac{2v^2}{g} MP.$$

Since OM^2 bears a constant ratio to MP, the trajectory is a parabola, having its axis vertical, and OM for a tangent.

Again, the horizontal velocity = $v \cos \epsilon$, and remains uniform;

the *initial* vertical velocity $= v \sin \epsilon$, and is acted against by gravity. Then—

$$x = OQ = vt \cos \epsilon$$
$$y = PQ = vt \sin \epsilon - \tfrac{1}{2}gt^2.$$

Eliminating t, we get—

$$y = x \tan \epsilon - \frac{gx^2}{2v^2 \cos^2 \epsilon},$$

which is the equation to the trajectory, and is a parabola. To find the range, put $y = 0$; the two resulting values of x give the position of the gun, and the end of the range, thus,

$$OR = \frac{v^2 \sin 2\epsilon}{g}.$$

In Robins' experiments in 1742 and subsequent years, it became apparent that up to a certain point the resistance of the air increased with an increasing power of the velocity. Hutton in 1790 placed this point at 1600 f. s., and considered that the ratio decreased after this velocity was passed. He proposed as a formula for the resistance $R \propto av + bv^2$. General Didion, in 1840, deduced from the experiments at Metz the formula $R \propto av^2 + bv^3$. The experiments with rifled projectiles carried on at Gavre in 1861 led Professor Hélie to the conclusion that the resistance of the air at practical velocities was more nearly proportional to the cube of the velocity than to any other working expression. He constructed a formula for the trajectory by empirically modifying the formula given above for the path of a projectile *in vacuo* thus—

Hélie's formula.

$$y = x \tan \epsilon - \frac{gx^2}{2 \cos^2 \epsilon}\left(\frac{1}{v^2} + \frac{kx}{v}\right);$$

from which he deduces an expression for the range which at low elevations for velocities between 800 f. s. and 1400 f. s. is very fairly accurate, and which furnishes the simplest method yet devised of roughly constructing a range table:—

$$r = \frac{1}{2kv}\left(\sqrt{1 + 2kv\frac{2v^2 \sin 2\epsilon}{g}} - 1\right);$$

where r = range in feet;
v = velocity in feet per second;
E = angle of elevation;
$k = 0{\cdot}0000000458\frac{d^2}{w}$;
d = diameter of projectile in inches;
w = weight of projectile in pounds;
g = acc. of gravity = 32·19.

The above value of k is given for ogival heads; with hemispherical, pointed, or flat heads a different coefficient of resistance would be required. The ogival is the form which suffers least retardation from the air. The most complete and valuable series of experiments yet carried out is that of Professor Bashforth (1865 to 1870) at Woolwich and Shoeburyness. He found that, velocities and forms being equal and similar, the resistance varies exactly as the square of the diameter of the projectile. He further arrived at the conclusion that between 900 and 1100 f. s. $R \propto v^6$, between 1100 and 1350 f. s. $R \propto v^3$, and above 1350 f. s. $R \propto v^2$. These results confirm in great measure those previously obtained, but unfortunately do not lend themselves readily to the construction of mathematical formulæ. Bashforth adopted the cubic law as his basis, as it offers the least difficulty in manipulation, and, putting $R = cv^3$, made the coefficient c a variable, the values of which he has tabulated. His method consists in building up the arc of the trajectory bit by bit, taking each portion so that a mean value of c for that portion may be used without important error. The path of the projectile may thus be constructed with almost any desired amount of accuracy, but the process is excessively laborious, and requires the use of a lengthy set of tables which cannot be reproduced here. For a complete knowledge of the subject the reader is referred to Mr. Bashforth's work. Mr. Bashforth, however, tabulated the loss of velocity due to the resistance of the air with regard to the time and distance of the shot's flight, and subsequent experiments carried out by the War Office in 1878–79 have now confirmed and extended the results he had previously obtained. As most of the problems of modern gunnery can be approximately solved by the use of these tables, we give in Table III. an abstract with explanation.

Bashforth's methods.

TABLE III.—*Loss of Velocity of a Projectile in Times and Distances.*

F.S.	Feet.	Sec'nds	F.S.	Feet.	Sec'nds	F.S.	Feet.	Sec'nds
400	5000	5·000	1100	20898	30·531	1800	24441	33·091
410	5416	6·028	1110	20974	30·600	1810	24481	33·113
420	5820	7·003	1120	21048	30·667	1820	24520	33·135
430	6213	7·928	1130	21121	30·731	1830	24560	33·157
440	6595	8·808	1140	21191	30·794	1840	24599	33·178
450	6967	9·645	1150	21261	30·855	1850	24638	33·200
460	7330	10·443	1160	21330	30·914	1860	24677	33·221
470	7684	11·206	1170	21397	30·972	1870	24716	33·242
480	8031	11·936	1180	21463	31·028	1880	24755	33·262
490	8370	12·635	1190	21528	31·083	1890	24794	33·283
500	8701	13·306	1200	21592	31·137	1900	24832	33·303
510	9026	13·951	1210	21655	31·189	1910	24871	33·323
520	9345	14·570	1220	21717	31·240	1920	24909	33·343
530	9658	15·168	1230	21778	31·290	1930	24947	33·363
540	9965	15·741	1240	21838	31·338	1940	24985	33·383
550	10267	16·295	1250	21897	31·386	1950	25022	33·402
560	10563	16·829	1260	21955	31·432	1960	25060	33·421
570	10854	17·345	1270	22012	31·477	1970	25097	33·440
580	11141	17·844	1280	22068	31·521	1980	25134	33·459
590	11423	18·327	1290	22124	31·565	1990	25171	33·477
600	11702	18·796	1300	22179	31·607	2000	25207	33·496
610	11977	19·250	1310	22233	31·649	2010	25243	33·514
620	12247	19·690	1320	22286	31·689	2020	25279	33·532
630	12514	20·118	1330	22339	31·729	2030	25315	33·549
640	12778	20·538	1340	22391	31·768	2040	25350	33·567
650	13037	20·936	1350	22443	31·807	2050	25385	33·584
660	13293	21·364	1360	22494	31·844	2060	25420	33·601
670	13545	21·706	1370	22544	31·881	2070	25455	33·617
680	13793	22·074	1380	22594	31.918	2080	25489	33·634
690	14038	22·432	1390	22644	31.953	2090	25523	33·650
700	14280	22·781	1400	22693	31·988	2100	25556	33·666
710	14519	23·120	1410	22741	32·023	2110	25590	33·682
720	14755	23·449	1420	22789	32·057	2120	25623	33·698
730	14987	23·769	1430	22837	32·090	2130	25656	33.713
740	15215	24·080	1440	22884	32·123	2140	25688	33·728
750	15440	24·383	1450	22931	32·156	2150	25720	33·743
760	15662	24·677	1460	22978	32·188	2160	25752	33·758
770	15880	24·962	1470	23025	32·220	2170	25784	33·773
780	16095	25·239	1480	23071	32·251	2180	25815	33·787
790	16306	25·508	1490	23116	32·282	2190	25847	33·802
800	16513	25·769	1500	23162	32·312	2200	25876	33·816
810	16716	26·021	1510	23207	32·342	2210	25908	33·830
820	16916	26·267	1520	23252	32·372	2220	25939	33·844
830	17112	26·504	1530	23297	32·402	2230	25969	33·857
840	17303	26·734	1540	23342	32·431	2240	25999	33·871
850	17490	26·955	1550	23387	32·460	2250	26029	33·884
860	17672	27·169	1560	23431	32·488	2260	26058	33·897
870	17851	27·375	1570	23475	32·517	2270	26088	33·910
880	18025	27·575	1580	23519	32·544	2280	26117	33·923
890	18195	27·768	1590	23563	32·572	2290	26145	33·935
900	18362	27·954	1600	23607	32·599	2300	26174	33·948
910	18524	28·135	1610	23650	32·627	2310	26202	33·960
920	18684	28·309	1620	23693	32·653	2320	26230	33·972
930	18839	28·478	1630	23736	32·680	2330	26258	33·984
940	18992	28·641	1640	23779	32·706	2340	26285	33·996
950	19141	28·799	1650	23822	32·732	2350	26313	34·007
960	19287	28·953	1660	23864	32·758	2360	26340	34·019
970	19431	29·104	1670	23907	32·783	2370	26367	34·030
980	19571	29·295	1680	23949	32·808	2380	26393	34·041
990	19701	29·385	1690	23991	32·833	2390	26420	34·053
1000	19843	29·521	1700	24033	32·858	2400	26446	34·064
1010	19975	29·652	1710	24074	32·882	2410	26472	34·074
1020	20104	29·780	1720	24116	32·907	2420	26498	34·085
1030	20230	29·902	1730	24157	32·930	2430	26523	34·096
1040	20349	30·018	1740	24198	32·954	2440	26548	34·106
1050	20459	30·123	1750	24239	32·978	2450	26574	34·116
1060	20559	30·217	1760	24280	33·001	2460	26599	34·126
1070	20651	30·303	1770	24320	33·024	2470	26623	34·136
1080	20737	30·384	1780	24361	33·047	2480	26648	34·146
1090	20819	30·459	1790	24401	33·069	2490	26672	34·156
						2500	26696	34·166

The rate of loss of velocity is here inversely recorded for an ogival projectile having a weight in pounds equal to the square of its diameter in inches. Thus a 9-pounder shell of 3-inch calibre starting with a velocity of 2500 f. s. would retain a velocity of 400 f. s. at a distance of (26,696 − 5000 =) 21,696 feet after a time of (34·166 − 5·000 =) 29·166 seconds. As the value of $\frac{d^2}{w}$ decreases the resistance of the air retards the projectile less; thus if the 3-inch shell weigh 18 lb it will overcome the resistance twice as well as the 9-pounder, since its $\frac{d^2}{w} = 0{\cdot}5$ instead of 1·0.

Example 1.—The 80-ton gun fires at a vessel in motion at a

range of 2000 yards. The muzzle velocity is 1580 f. s., the calibre 16 inches, and the weight of projectile 1700 lb. Required the velocity on impact, and the time of flight.

$$\text{Here } \frac{d^2}{w} = \frac{16^2}{1700} = 0{\cdot}1506$$

$$0{\cdot}1506 \times 6000 \text{ ft.} = 903 \text{ ft.}$$

Selecting the m. v. 1580 f. s. in the first column, the second column shows 23,519 ft. Subtracting, $23{,}519 - 903 = 22{,}616$. Running up the second column and using proportional parts, this number corresponds to a velocity of 1383 f. s., which is the velocity on impact, showing the projectile to have lost 197 f. s. of its velocity during flight. In the third column, opposite 22,616 feet, we find 31·929 seconds. Subtracting this from the time opposite 1580 feet, and dividing by $\frac{d^2}{w}$, we have

$$t = \frac{1}{0{\cdot}1506}(32{\cdot}544 - 31{\cdot}929)$$

$$= 4{\cdot}084 \text{ seconds.}$$

Example 2.—An observer in an earthwork notes the flash of a hostile gun; in 3¼ seconds the shell (blind) buries itself in the parapet, followed in half a second by the report of the gun. The shell is dug out, and found to weigh 60 lb, and to measure 15 centimetres in diameter. Required the range, the muzzle velocity, and the striking velocity.

The range is here given by the velocity of sound, which travels through air at an average rate of 1140 feet per second; so that

$$r = 3{\cdot}75 \times 1140 = 4275 \text{ ft;}$$

$$\frac{d^2}{w} = \frac{(15 \text{ cm.})^2}{60} = \frac{(5{\cdot}91 \text{ ins.})^2}{60} = 0{\cdot}5821;$$

$$r\frac{d^2}{w} = 2488 \text{ ft., and } t\frac{d^2}{w} = 1{\cdot}892 \text{ sec.}$$

We have now to consider what muzzle velocity will cause the projectile to traverse the given distance in the given time. It must move at a mean speed of 1315 f. s. Assume the muzzle velocity to be 1600 f. s.; corresponding to this are found 23,607 feet and 32·599 seconds. Subtracting from these the reduced range and time, we have 21,119 feet and 30·707 seconds; if the velocity has been correctly assumed, it is clear that the range and the time of flight should result in the same terminal velocity. In the present instance, opposite 21,119 feet stands 1130 f. s., while opposite 30·707 seconds stands 1125 f. s. Thus it appears that the velocity has diminished more rapidly in the time travelled than in the distance travelled. This shows that it is assumed too high. Trying 1584 f. s., and proceeding as before, each column indicates 1120 f. s., which therefore is the terminal velocity, showing that the projectile has lost 464 f. s. of its speed during flight.

Drift.—Projectiles fired from rifled guns do not move in a vertical plane, but deviate to the right or to the left according to the direction of their rotation. All nations have adopted the right-handed twist, probably because it happened to be selected first. If the observer stands in

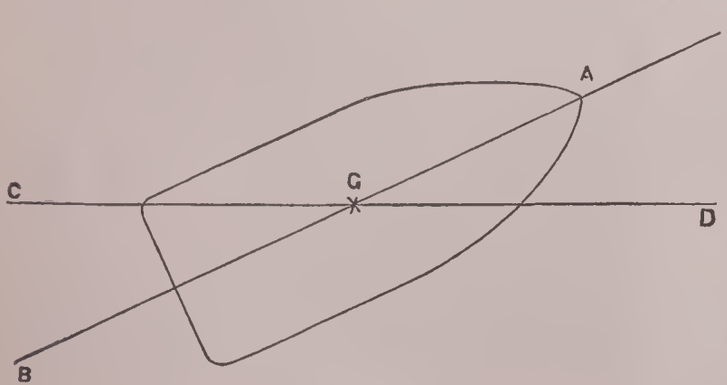


Fig. 16.

rear of the piece and looks at the gun when fired, the projectile rotates in the same direction as the hands of a watch. It then steadily bears away to the right. The reason of this is not very clearly understood; in fact, two rival theories are put forward to account for it. If there were no resistance of the air, the path of the shot would be a parabola, and the axis of an elongated projectile would remain parallel to its original direction. The resistance offered by the air causes the axis to tend to assume a position tangential to the trajectory. On leaving the gun the projectile moves in the direction of its axis, which is also the direction of the axis of the gun.

Drift or deflection.

The action of gravity soon causes the path of the shot to make a small angle with the original direction of the axis; that is, the trajectory soon deviates from a straight line; the axis of the projectile is urged by the resistance of the air to accommodate itself to the new path, but as the path is constantly changing, the axis is always too late, since the rotation tends to preserve its parallelism. Thus there is always an angle—depending in amount on the velocities of rotation and translation, weight of shot, and density of the air—between the axis of the shot GB and the trajectory CD (fig. 16). Thus far both theories agree as to the facts, but they differ as to the deductions. The first view is that the resultant resistance of the air, which has the effect of a force in the direction DC, tends to turn the shot about an axis passing through G, and perpendicular to the plane containing BGD, so that if the shot had no rotation, it would turn end over end. But as it has a right-handed twist, this motion is combined with that which the resistance of the air tends to impart to the shot, and the point A is therefore slightly deflected to the right at first. Continuing the action, the axis GA describes a cone about CD, rotating in the same direction as the shot rotates about its own axis. The resultant of the air's resistance tends to increase the angle BGD, therefore the shot will have a sinuous motion; but as the first deflection is to the right, and afterwards the point is more to the right than to the left, the deviation will on the whole be to the right. The other view is that, as the axis of the shot is always directed a little above the trajectory, the resistance of the air meets the surface on the under side, on which therefore there is more pressure than on the upper side. The consequence of this is that the friction of the air with the rotating surface is greater below than above, and therefore causes the projectile to roll bodily to the right while travelling forward. The path thus

Fig. 17.—Correction for Deflection.

curves away from the vertical plane, and the resistance of the air tends to cause the axis to lose its parallelism with that vertical plane, though it is, as before, too slow in altering its direction to become tangential to the curve described. Crucial experiments to set this point at rest are as yet wanting. The "drift" or "deflection" is usually corrected in the British service by inclining the tangent sight. The result of this is that as the range increases, the higher the sight is raised, and the farther is the eye-notch to the left of the vertical plane containing the axis of the gun. In the German service the tangent sight is placed vertically in the gun, and the deflection is allowed for by a graduated sliding leaf in the head. The same arrangement is used in those British guns, as the howitzers, which fire variable charges, as the slope of the tangent sight will accurately suit only one muzzle velocity.

To ascertain the correct slope, the actual deflection is determined for each gun on the practice ground at various ranges with a vertical sight; then, in fig. 17, AD is the line of sight when the axis of the gun is horizontal. CD is the line of sight with a vertical tangent sight set at the angle of elevation ADC required for the range DF. Since the projectile deflects to the right, it is necessary that the line CD should point to E in order to hit F. This is accomplished by inclining the tangent sight AB, so that BC shall give the requisite allowance. The relation is thus established. By similar triangles, $\frac{BC}{CD} = \frac{EF}{FD}$; then $BC = AC \tan BAC$, and $CD = AC \operatorname{cosec} ADC$, so that $\frac{BC}{CD} = \frac{\tan BAC}{\operatorname{cosec} ADC} = \frac{EF}{FD}$. Putting the angle ADC (the elevation) $= \epsilon$, the angle BAC (the slope of the tangent sight) $= \theta$, EF (the deflection) $= d$, and DE (the range) $= r$, we have $\tan \theta = \frac{d}{r} \operatorname{cosec} \epsilon$.

The action of the powder charge, the travel of the projectile along the bore, the rifling, and, speaking generally, what takes place inside a gun when fired, are matters specially connected with the designing and manufacture of ordnance, and are therefore treated under GUNMAKING.

Projectiles.—The requirements of modern artillery have necessitated many complications in the preparation and use of projectiles, which now vary greatly in their nature and in the purposes for which they are employed. A general description of the several kinds supplied to European armies will be found under AMMUNITION, and but few remarks will be required to connect them with the guns for which they are intended. Smooth-bored ordnance use solid round shot and case, common shell, and diaphragm shrapnel shell. Solid shot are used against masonry, wooden shipping, and masses of men. They were at one time fired red hot at shipping. Roughly, the cube of the diameter in inches multiplied by 0·133 gives the weight of the shot in pounds.

Smooth-bore projectiles.

Case shot consist of iron balls packed in iron or tin cylindrical cases. They are effective up to about 350 yards against troops, boats, and rigging, and are especially suitable for flanking ditches. Common shell are completely filled with powder, and are burst in flight by time fuzes, or, on striking, by percussion fuzes. They are used against men in masses, buildings, works, and material generally. Diaphragm shrapnel shell contain a small bursting charge and a number of balls. They are fitted with a time fuze which explodes the charge when they near the object, so that the released bullets fly forward. They are very destructive against troops. In addition to the above projectiles, incendiary shells, called carcasses, filled with a violently burning composition are thrown into villages and amongst shipping. Ground light balls cast among the enemy's working parties at night disclose their position. Parachute light balls contain a parachute tightly folded up, and a cup of illumining composition; they are fired with a fuze timed to burst in the air, and they then remain suspended for a time, throwing a light down on the enemy's working parties.

The great advantage of rifling was long recognized in small arms and sporting pieces before it was extended to ordnance. The first rifled arms threw bullets which, except for certain projections designed to fit the grooves of the barrel, were spherical. These guns surpassed smooth-bores in accuracy, but it was not till the introduction of elongated projectiles that a distinct gain in power was recognized.

Rifled projectiles.

The gain in accuracy is due in great measure to the superior correctness with which the ball is centred in the bore by the action of the grooves, while the rotation imparted to it annuls or greatly lessens the disturbing effect of the pressure of the air on surface inequalities, or of variations in the position of the centre of gravity. An elongated shot is also enabled to travel point first, or nearly so, and as the resistance of the air depends upon the area of the transverse section, a far greater weight can be given to the long than to the round shot without increasing this resistance. Thus, in addition to greater accuracy, rifling confers a flatter trajectory and greater penetration. The elongated form permits a head of the best shape, an increase in the contents of the shell, and the use of fuzes which explode when the point strikes an object. The projectiles used with rifled guns are case shot, common shell, shrapnel shell, and Palliser shell. The case shot differ little from those made for smooth-bore ordnance.

Common shell.

Common shell are generally from 2½ to 3 calibres in length. They are designed to contain as much powder as possible, consistently with strength of wall to resist the shock of firing. Their effect is almost entirely due to explosion; velocity has little to do with it beyond conferring range and penetration. Common shells are generally fuzed with percussion fuzes. They are effective for breaching, for setting fire to buildings, against troops if not much scattered, and especially against wooden or thinly plated vessels. The introduction of iron-clad ships is almost entirely due to the terribly destructive fire of shells.

Shrapnel.

Shrapnel shells are filled with bullets, and have a bursting charge only sufficient to open the case and release the contents, which then fly forward with the velocity possessed by the projectile before breaking up. The bullets and fragments very speedily lose this velocity after separation. It is therefore most important to judge the range correctly and to form an accurate estimate of the practice, so that the result of each round may guide the aiming and timing of the next. When the shrapnel is burst in the air by a time fuze, it is exceedingly difficult to judge its precision by the puff of smoke. The splashes or puffs of dust of the bullet striking the ground should therefore be carefully looked for. When the shrapnel is burst on striking the ground by a percussion fuze, it is much easier to estimate the accuracy of the shooting, and it is common therefore to get the range by firing a round or two with percussion fuzes before setting the time fuzes. If the ground is hard and the distance of the enemy such that the shell strikes at but a small angle of descent, percussion fuzes generally burst the shrapnel better than time-fuzes, which, in their turn, have the advantage at long ranges and over soft ground. For field service time-fuzed shrapnel should be burst at from 50 to 100 yards in front of the object, and about 10 to 15 feet above the ground. The cone of dispersion of the bullets and fragments is considered to be so proportioned that the diameter at any point of the axis is one-third of the distance of that point from the burst or apex. To get satisfactory results from time fuzes it is necessary to have a gun which shoots with great regularity, a fuze composition which burns evenly, and an accurate mode of setting the fuze. Of late years improvements in powder and design of ordnance have rendered the velocities practically uniform. The fuze composition is somewhat liable to deterioration, but is tolerably satisfactory; and a new fuze auger has just been introduced which can be set to any desired degree of accuracy. As the power of shrapnel shell is entirely due to the velocity possessed by the bullets when freed from the envelope, it is of paramount importance in long-range firing that the shell should start with a high velocity and retain as much of it as possible. It is considered that with field guns the velocity of the projectile at the moment of bursting should not fall below 800 f. s., otherwise the contents will have a much diminished effect. The bullets themselves should retain a velocity of about 500 f. s. on striking to be thoroughly effective. With the more modern field guns the effective range of shrapnel extends up to about 3000 yards; with heavy guns to 4000 or even 5000 yards.

Armor-piercing shell.

Palliser shells are made of a mixture of selected brands of iron, and are cast in moulds so constructed that the metal of the head is in contact with iron and that of the body with sand. The head is thus "chilled," as the rapid carrying off of the heat by the iron mould causes the particles of the metal to dispose themselves rigidly, and confers intense hardness, which property is essential for the penetration of iron plates. The head is of the ogival shape, that being found most effective in combining strength with sharpness (fig. 18). It is a moot point whether projectiles of hardened steel are more effective than those of chilled iron against armor. Probably the steel can get through a greater thickness, but the damage done by the fragments of the Palliser after perforation is more serious. The cost of the steel shells is about five times that of the iron ones. The bodies are cast in sand, because extreme hardness is not there required, and a sounder casting is thus obtained. No fuzes are used with these shells; they are burst by the shock of impact on armor which explodes the powder charge. It is doubtful if they would explode on striking iron vessels not armor-plated, and they would fail to burst on striking wooden ships. They are effective in destroying masonry, and have been driven through great thicknesses of stone. They hold about a quarter as much powder as common shell of the same diameter. The greatest penetration of armor yet known was obtained by the 80-ton gun at Shoeburyness in 1877. The target consisted of four 8-inch wrought-iron plates, sandwiched with three 5-inch layers of teak, the whole put together with immense strength. The projectile perforated three plates and the teak, digging its nose about half-way into the last plate, which was much cracked and bulged. The 100-ton gun has perforated with ease 22 inches of solid wrought iron plate strongly backed, but failed to drive a hole through a similar target when the plate was of steel. Very recently extraordinary penetration has been obtained by a 6-inch 70-pounder made by Sir W

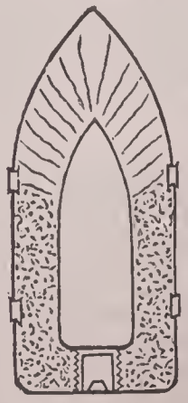


FIG. 18.—Palliser shell.

G. Armstrong & Co. Fired with a velocity of nearly 2000 f. s., this small projectile pierced about 11 inches of wrought iron. The subject of penetration is treated under GUNMAKING.

A description of some of the fuzes and firing tubes used in gunnery will be found under AMMUNITION. The general principle guiding the selection of time or percussion fuzes is that when a shell is required to burst in the air a time fuze is employed, when on striking an object a percussion fuze is chosen. In muzzle-loading guns (not using gas-checks), time fuzes are ignited by the flash of discharge; otherwise the shock is taken advantage of to light the composition by exploding a detonator. Percussion fuzes are sometimes found to act too rapidly; where it is desired that penetration to a certain depth in earth or other material shall take place before explosion, it is found necessary to *slow* the fuze by interposing a small column of composition, burning for, say, a quarter of a second between the detonator and the bursting charge. In firing a heavy shell with high velocity at a weak vessel, the resistance of the side is so slight that it may happen that the fuze either fails to act (the shell not being sufficiently retarded to set it in action), or explodes the shell after it has passed through both sides. To meet this case a specially sensitive and rapidly-acting fuze has been devised.

Fuzes.

Guns were formerly primed with loose powder and fired by a match, next by common quill tubes filled with composition and ignited by a portfire, then by detonating tubes exploded by a hammer. Now friction tubes have superseded these methods for ordinary service. When it is desired to fire a gun from a distance, or to fire a number of guns absolutely at the same moment, Abel's electric tubes are employed. In them two fine copper wires pass down through the head, insulated by gutta percha, except at the ends, which are separated by $\frac{1}{16}$th of an inch of a composition of sulphosphide and subsulphide of copper with chlorate of potash. The other ends of the wires are in contact with the copper lining of two holes in the head. The wires from the battery are placed in these holes; when the current passes, the composition is heated to ignition and explodes the tube.

Electric tubes.

Service of Ordnance.—The general principles guiding the employment and manipulation of artillery are applicable to the schemes of warfare of all civilized nations. Slight differences exist in calibres and weights; but it may be taken that the considerations which regulate the service of English guns have the same force elsewhere. The details of manufacture, the systems of loading, and the methods of rifling, are the chief points regarding which artillerists differ; these matters are treated under GUNMAKING. Of two pieces constructed with equal skill to perform the same kind of work, the heavier will always be the more powerful. Thus weight is the chief controlling element in the employment of guns, though cost and convenience of manipulation have often to be taken into account. The artillery of the present day is the outcome of a long series of improvements, and the whole system of this important arm bears traces of frequent modification and continual compromise. The first introduction of firearms appears to have taken place in England in the reign of Edward III. On the Continent it was probably somewhat earlier, but the actual date and the circumstances attending their introduction are involved in obscurity. It is said that cannon were used in the English expedition against Scotland in 1327, and at the battle of Crécy in 1346. In 1360 there were four copper guns in the Tower. For about two centuries cannon continued to be manufactured of copper, brass, or bronze, good castings of which were made long before the art of smelting iron ores was perfected. In the early part of the 16th century guns were sometimes made of wrought iron plates put together longitudinally and hooped with wrought iron. In 1545 cast iron ordnance were manufactured in England, and supplanted pieces of all other materials for a time. The growing needs of warfare, however, soon demanded guns possessed of fair mobility to accompany armies in the field, and the cast iron pieces used being found excessively cumbrous, bronze was once again resorted to for field artillery. From about the middle of the 17th century till the introduction of rifled cannon, all the heavier natures of ordnance—fortress, siege, and ship guns—were made of cast iron; and all the lighter—field and boat guns—of bronze. In 1717 the bronze foundry was established at Woolwich, and most of the smooth-bored field pieces, howitzers, and mortars used in the service were made there. The heavy cast iron guns were supplied by contractors, and proved by Government officials. The long peace which succeeded the Napoleonic wars was highly unfavorable to the progress of gunnery, but a great development took place in the arts and sciences, so that on the breaking out of the Crimean War, the latest discoveries in metallurgy and the excellence attained in machinery at once enabled inventors to make a great advance in artillery. At the transition period a few wrought iron smooth-bores, throwing spherical shot of 150 and 100 lb, were manufactured to overcome the resistance of iron-plates then recently introduced for armoring ships. These pieces were speedily discarded for rifled guns; and practically it may be said that the adoption of steel and wrought iron for guns coincided with the change from smooth-bores to rifles, both steps of progress being thoroughly established about 1860. In spite of the great superiority of the new ordnance, it cannot be said that the old pieces are yet superseded; vast numbers of them exist over all parts of the world, and often form the only defence. Even the fortifications in England are still largely armed with them on land fronts; and though they are gradually disappearing, they yet claim notice. Bronze guns are now obsolete in the British service. Figs. 19 to 24 show typical kinds of cast iron ordnance. Those denominated according to the weight of their projectile are made strong enough to fire solid shot or shell; those called by the diameter of the bore fire shell only. It must be remembered that, with spherical projectiles, the solid must be heavier than the hollow kinds, which need not be the case with rifled ord-

Early ordnance.

Smooth-bored ordnance.

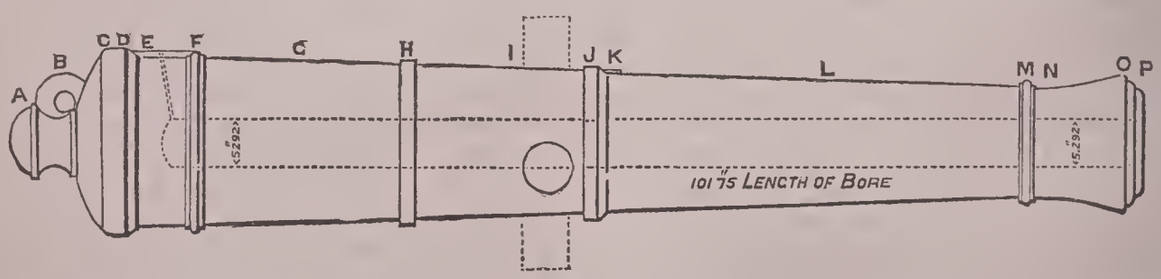


FIG. 19.—18-pounder Gun. A, button (cascable); B, breeching loop (do.); C, breech; D, base ring and ogee; E, vent-field; F, vent-field astragal and fillets; G, 1st reinforce; H, 1st reinforce ring; I, 2d reinforce; J, 2d reinforce ring and ogee; K, patch for foresight; L, chase; M, muzzle astragal and fillets; N, neck; O, swell of muzzle; P, muzzle mouldings.

nance, as the projectile may be of any length. The guns are used for direct fire, the howitzers for curved fire, the mortars for vertical fire, *i. e.*, they are set at 45° elevation, and the requisite range attained by varying the charge of powder, instead of firing at various degrees of elevation, as with guns and howitzers.

The old field smooth-bores were fairly effective up to 1000 or 1200 yards, and so established a great superiority over the smooth-bored musket; but as soon as the rifled musket was generally adopted, an advance in artillery power became necessary if the arm was to retain its position in the scale of efficiency. After the Crimean War Napoleon III. rifled his bronze field guns on Treuille de Beaulieu's system, and the new pieces exhibited great merit at Magenta and Solferino in 1859. England, and indeed every European power, was busily engaged in experimenting during this period. The early Armstrong guns in England, Broadwell's and Krupp's in Prussia, and imitations of the

French plan in other countries, speedily caused field artillery to regain its place in war. The northern kingdoms of

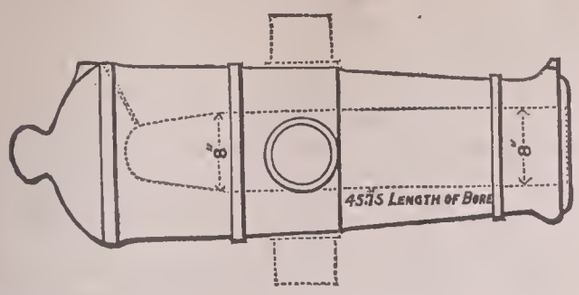


Fig. 20.—8-inch Howitzer.

Denmark and Norway and Sweden, favored by specially good iron ores, and free from the immediate alarm of war,

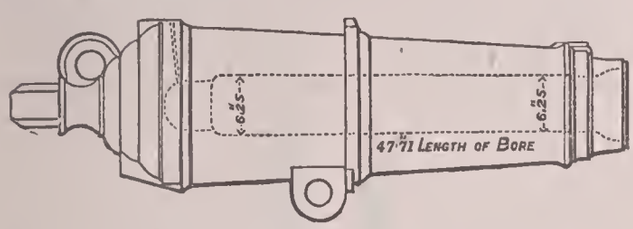


Fig. 21.—32-pounder Carronade.

retained cast iron as the material for light ordnance. Prussia had already begun to use steel for smooth-bores, and naturally adhered to it for rifled guns, while the coil system brought forward by Armstrong was found cheap and enduring in England. The new Prussian guns were breech-loaders, constructed on the double wedge system; they proved unsatisfactory, and since the Franco-Prussian war of 1870–71 have been abandoned in favor of a single-wedge system of great neatness and efficiency. The Armstrong guns were also breech-loaders, and when tested by land and sea, on actual service in China, New Zealand, and Japan, proved to be very powerful when compared with the old smooth-bores, but also exhibited many defects of construction. At this time no thoroughly successful breech-loader had been invented, and England reverted to muzzle-loading, while the Continental powers for the most part endeavored to improve their methods of breech-loading. In 1872 the British wrought iron and steel muzzle-loading 9-pounder of 8 cwt., had been introduced into the service, and the 16-pounder of 12 cwt., of similar construction, was being

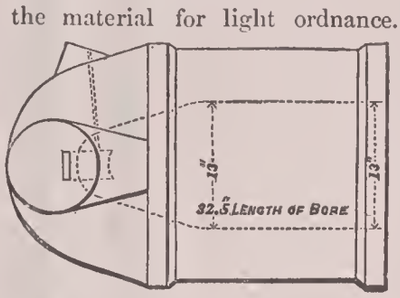


Fig. 22.—13-inch Mortar.

Rifled ordnance.

brought forward. Against these guns the Prussian 6-cwt. field breech-loader had no chance. Its lightness was almost its only merit. Throwing common shell with percussion fuzes (which were useless on soft ground), having

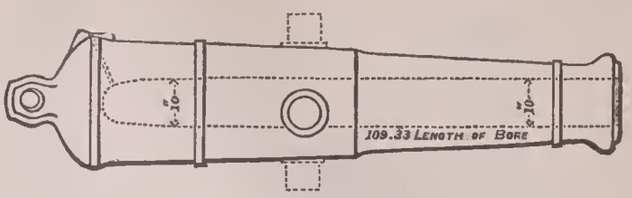


Fig. 23.—10-inch Shell Gun.

but a poor muzzle velocity, and suffering much from retardation by the air, its effect was feeble compared with that of the British 9-pounders, which threw with 200 f. s. more velocity a time-fuzed shrapnel of excellent construction, while the 16-pounder, though not equally fortunate with the 9-pounder in the arrangement of its projectile, yet by sheer power and weight of metal surpassed in deadly effect every field gun in existence. England's field artillery was undoubtedly the most powerful known at that period. No one was more alive to this fact, or more dissatisfied with it, than the Germans. Their great gunmaker, Krupp, forthwith improved his breech-closing fittings, and instituted series upon series of experiments till he produced two guns —one for horse artillery, and one for field batteries, also horsed—which were an enormous advance on the weapons previously employed against the French. The lighter gun weighs 7 cwt., and throws a shell of 11 lb weight, with a muzzle velocity of 1525 f. s.; the heavier weighs 9 cwt., and throws a shell of 17 lb weight, with a muzzle velocity of 1460 f. s. These are figures indicating power not to be attained by the English 8-cwt. gun, or even the newer pattern of 6 cwt. throwing a 9 lb shell with a muzzle velocity of 1380 f. s., and the 12-cwt. gun, throwing a 16 lb. shell with a muzzle velocity of 1360 f. s. The immediate consequence of the introduction of these improved German pieces was the instituting of a series of experiments in England which resulted in the production of a muzzle-loading field gun, weighing 8 cwt., and throwing a 13-lb. projectile with a muzzle velocity of 1560 f. s. Shrapnel shell from this gun will retain velocity over 800 f. s. (the speed below which they cease to possess high efficiency) up to 3500 yards range. In this new gun advantage is taken of all the latest improvements, such as an enlarged powder chamber, increased length of bore, polygroove rifling, rotation by gas check, and powder specially adapted to the piece. Although the introduction of this field gun once more places English light-artillery in the van, further progress is near. Sir W. G. Armstrong & Co. are now

Field guns.

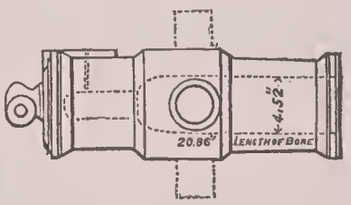


Fig. 24.—Coehorn Howitzer.

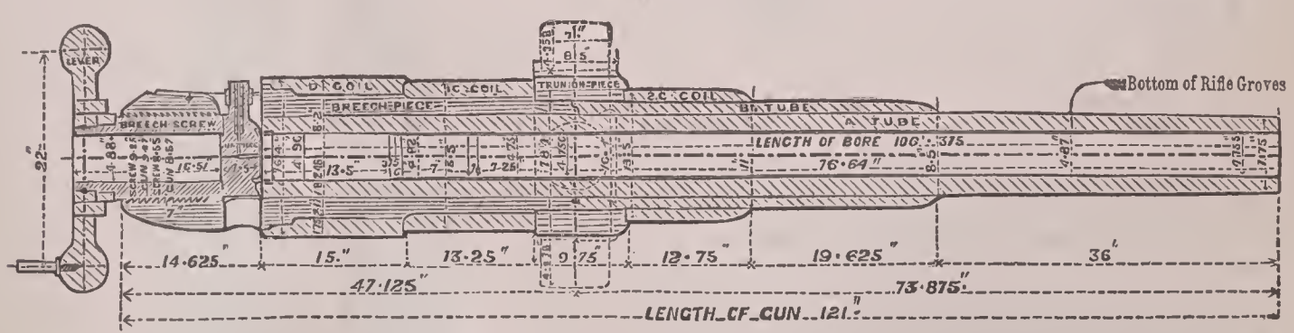


Fig. 25.—40-pounder Armstrong Rifled Breech-loader.

(1879) experimenting with field guns, both muzzle and breech-loading, yielding velocities of 2000 f. s., and no doubt a fresh development of the new principles of air-spacing and chambering (already initiated in the Royal Gun Factories) is at hand (see Gunmaking).

Siege guns.

The history of the progress of siege guns would be in a great measure a repetition of that of the field artillery. Briefly, the smooth-bored siege train of cast-iron 18-pounders and 8-inch howitzers was replaced in 1859–63 by one composed of 20-pounders, 40-pounders (figs. 25 28), and 7-inch rifled breech-loading pieces, with certain howitzers which never earned adoption. Subsequently the breech-loaders have been gradually ousted by 25-pounder, 40-pounder, and 64-pounder muzzle-loaders, with 8-inch, 6·6-inch, and 6·3-inch howitzers, new patterns of which latter pieces have just passed their early trials. The 64-pounders were introduced in 1864. For naval purposes the calibre was chosen so that 32-pounder round shot could be fired from it on emergency. The 40-pounders are stronger, and fire much heavier charges than their breech-loading congeners. The 25-pounder was introduced in 1874 to supersede the 20-pounder breech-loader for light siege trains,

and as a gun of position. Ever since 1853 experiments have been carried out by the English and other nations for the improvement of mortars and howitzers, first in a smooth-bored and then in a rifled state. These experiments are still in progress, and it cannot be said that the art of throwing heavy shell at high angles has as yet arrived at perfection. In 1872 short pieces throwing shells of 180 lb and 64 lb were adopted, but recently longer and more powerful shell guns have been tried, throwing heavier projectiles with greater accuracy. In these new pieces polygroove rifling with gas-check rotation affords a hope that the necessary precision may be attained.

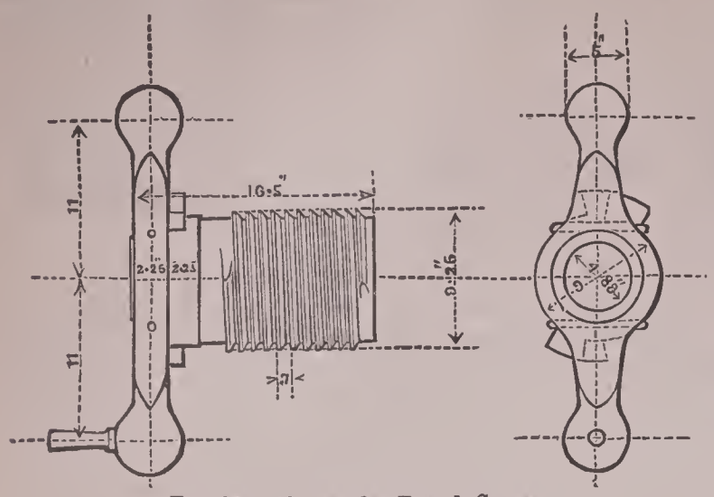


Fig. 26.—40-pounder Breech Screw.

Converted guns.

The "converted guns" must not be passed over, since they are largely employed to arm our land fronts and to provide cheap and efficient pieces for practice by the reserve forces. When first elongated rifled projectiles were introduced, a great many methods of strengthening the old cast-iron ordnance were proposed. The most satisfactory was that put forward by Palliser, and consisted of lining bored-out cast iron shells with wrought iron tubes. Some of the smaller men-of-war

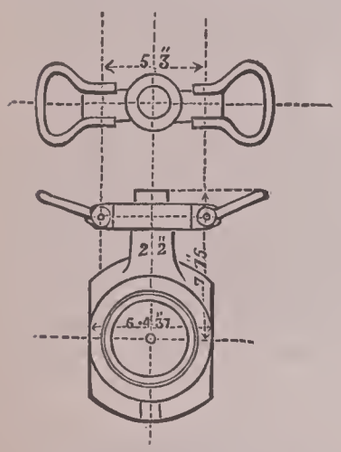


Fig. 27.—40-pounder Vent Piece.

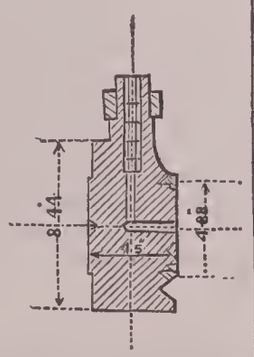


Fig. 28.—40-pounder Vent Piece (section).

carry these pieces, but the great majority are used only for the secondary purposes above mentioned. The 32-pounders of 58 cwt., and the 8-inch shell guns of 65 cwt., have thus become 64-pounders, and the 68-pounder of 95 cwt. has become an 80 pounder.

Important as are the land-service pieces of the army to England, yet, viewing her naval supremacy as one of the chief sources of her greatness, we must consider heavy ship and coast-defence ordnance to take the first place in modern gunnery. The contest between guns and armor has now continued with scarcely any intermission for upwards of twenty years, during which time the armor has increased in thickness from 4 to 24 inches, and the guns from 68-pounders to 2000-pounders; that is, from the most powerful of the old cast iron smooth-bores to the 100-ton gun.

Armor-piercing guns.

The first armor-piercing rifled guns were the 7-inch Armstrong breech-loaders, but their supremacy was of short duration. They were the heaviest made on that system, and were speedily succeeded by far more powerful muzzle-loaders. In 1867 8-inch and 9-inch guns had already been introduced. The 9-inch Woolwich rifled gun of 12 tons was tried in competition with the xv-inch American smooth-bore, which weighed nearly half as much again, against armor. The British piece gained a decisive victory. In 1868 it was decided to introduce a 10-inch gun of the same character. Since that time progress has been continual, and the latest productions of the three great gun producing establishments of the world are the 71-ton steel breech-loader, recently tested, of the German maker (Krupp), the 80-ton muzzle-loader of Woolwich, and the 100-ton muzzle-loader of the Elswick firm (Sir W. G. Armstrong & Co.).

Tables IV. and V. (p. 275) show all the principal rifled guns in the land and sea services of Great Britain. It has always been an object with the authorities to assimilate the guns of the two services as far as their respective requirements will permit, and so to avoid multiplication of stores at the numerous home and foreign stations where supplies are made; but still it will be observed that considerable differences exist, and, judging from the progress of events, it appears likely that these differences will increase, because, as the science of gunnery becomes developed, each new kind of

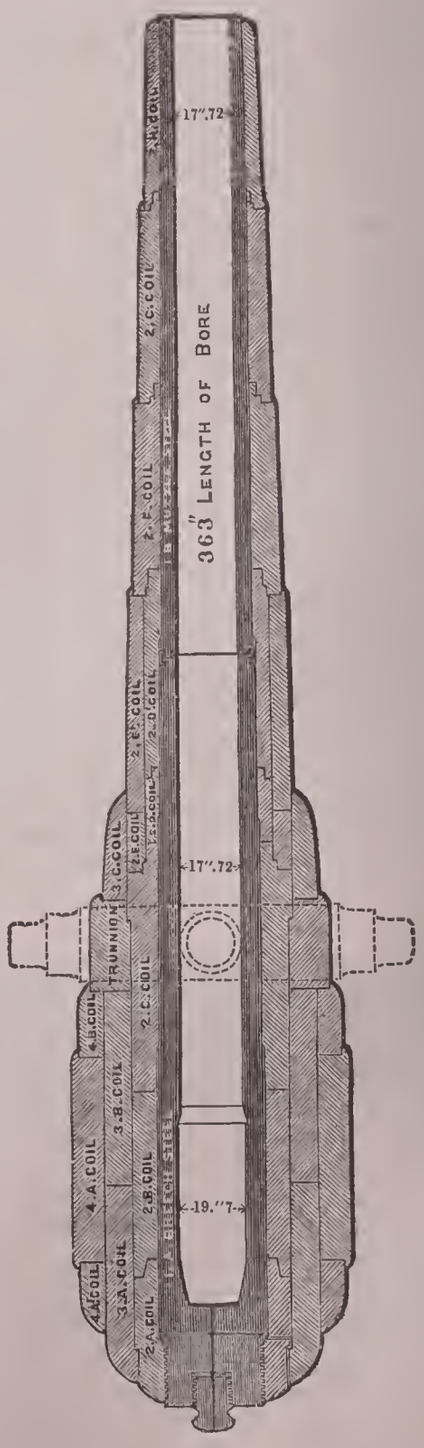


Fig. 29.—100-ton Gun (section).

gun is more exactly fitted to the performance of the special work for which it is intended, and therefore less suitable for other purposes.

Table IV. shows five distinct classes of rifled ordnance. 1. The heavy *armor-piercing guns* (figs. 29, 30) are mounted round our coasts in casemates and barbette batteries. Their

TABLE IV.—*Land Service Rifled Guns.*

Nature, Weight, Calibre, etc.	Weight of heaviest Projectile.	Max. Service Muzzle Velocity.	Class.	Perforation at 1000 yds. About	Bursting charge of com. shell. About	How Mounted.
Muzzle-loading.	lb	f. s.		ins.	lb. oz.	
17″·75 of 100 tons	2000	1600	Armor-piercing guns.	30·0	66 0	*En barbette.*
16″·0 of 80 tons	1700	1600		28·0	58 0	In turrets.
12″·5 of 38 tons	800	1420		16·0	43 0	In casemates, on sliding carriage on traversing platform on racers.
12″·0 of 35 tons	700	1340		13·7	40 0	*En barbette* on ditto, ditto.
12″·0 of 25 tons	600	1300		10·8	38 0	In casemates on do., and *en barbette.*
11″·0 of 25 tons	535	1315		11·9	30 0	Do. do. do.
10″·0 of 18 tons	400	1365		11·2	20 0	Do. do. do.
9″·0 of 12 tons	250	1420		8·8	19 0	Do. do. do.
7″·0 of 7 tons	115	1560	Land-front (fortress) guns.	Armor-piercing projectiles not supplied for these and smaller guns.	9 0	*En barbette*, sliding carriages on traversing platform. Moncrieff carr's.
7″·0 of 82 cwt., breech-loading	90	1165			6 0	Do. do.
80 pr. (6″·3) 5 tons	80	1240			9 0	Sliding carrs. on traversing platform.
64 pr. (6″·3) { 71 cwt. & 58 cwt. }	64	{ 1230 / 1245 }			7 0	Standing and Moncrieff carriages.
64 pr. (6″·3) 64 cwt.[1]	90	1365	Siege-train guns.	23 to 25 ft. from point of shaft to muzzle of gun.	7 0	Travelling carriages (siege).
40 pr. (4″·75) 35 cwt.	40	1360			3 0	Do. (siege and batteries of position).
25 pr. (4″·0) 18 cwt.	25	1320			2 0	Do. do.
8″·0 howr. 46 cwt.	180	790			14 0	Do. (siege); also on beds for siege.
8″·0 howr. 70 cwt.[1]	230	675		for bombarding.		
	170	940		for breaching.		
6″·6 howr. 36 cwt.[1]	135	610		for bombarding.		
	95	845		for breaching.		
6″·3 howr. 18 cwt.	64	830			7 0	Travelling carriages (siege).
16 pr. (3″·6) 12 cwt.	16	1355	Field guns.	About 23 ft. from point of shaft to muzzle of gun.	1 2	Field gun carriages, with limbers.
13 pr. (3″·0) 8 cwt.	13	1560			0 14	Do. do.
9 pr. (3″·0) 6 cwt.	9	1390			0 7	Do. do.
7 pr. (3″·0) 200 lb.	7	970	Mountain-train guns.	... ...	0 6	Mountain service, on travelling carriages. Siege, on beds.
7 pr. (3″·0) 150 lb.	7	675		... ...	0 6	Do. do.

TABLE V.—*Sea Service Rifled Guns.*

Nature, Weight, Calibre.	Weight of heaviest Projectile.	Max. Service Muzzle Velocity.	Perforation at 1000 yds. About	Bursting charge of com. shell. About	How Mounted.
Muzzle-loading.	lb	f. s.	ins.	lb. oz.	
16″·0 of 80 tons	1700	1600	28·0	58 0	In turrets.
12″·5 of 38 tons	800	1420	16·0	43 0	In turrets, loading by hydraulic machinery.
12″·0 of 35 tons	700	1340	13·7	40 0	In turrets, loading by hand gear.
12″·0 of 25 tons	600	1300	10·8	38 0	Do., do., and broadside.
11″·0 of 25 tons	535	1315	11·9	30 0	Broadside, revolving, and on turntable *en barbette.*
10″·0 of 18 tons	400	1363	11·2	20 0	Broadside, revolving, in turrets, and gunboats.
9″·0 of 12 tons	250	1420	8·8	19 0	Broadside and revolving.
8″·0 of 9 tons	180	1415	7·7	14 0	Broadside.
7″·0 of 6½ tons	115	1525	Armor-piercing projectiles not used for guns of less than 8″ calibre.	9 0	Broadside.
7″·0 of 90 cwt.	115	1250		9 0	Broadside.
64 pr. (6″·3) of 64 cwt.	64	1385	... ...	7 0	Broadside.
64 pr. (6″·3) of 71 cwt.	64	1230	... ...	7 0	Broadside.
9 pr. (3″·0) of 8 cwt.	9	1380	... ...	0 7	Boat.
9 pr. (3″·0) of 6 cwt.	9	1235	... ...	0 7	Boat.
7 pr. (3″·0) of 200 lb.	7	970	... ...	0 6	Boat.
Breech-loading.					
20 pr. (3″·75) of 13 cwt.	21	1000	... ...	1 2	Gun vessel and upper decks of ironclads against torpedo vessels.
12 pr. (3″·0) of 8 cwt.	12	1170	... ...	0 8	Boat, nearly obsolete.
9 pr. (3″·0) of 6 cwt.	9	1060	... ...	0 6	Do.

function is to protect the British shores from the attack of ironclad ships, wooden vessels, and boats. They are accordingly provided with Palliser projectiles, common shells, and a small proportion of shrapnel shell. In order to strike vessels steaming past at high speed, great accuracy, combined with rapidity of fire, is requisite. The guns are aimed either by eye or map, according to the nature of the coast. In the former case, the detachment commander estimates the range, gives the necessary elevation by means of the tangent sight, directs the line of fire according to his judgment, jumps down and gives the word to fire—allowing for the vessel's motion and the time of the projectile's flight.

[1] Special projectiles for penetrating masonry.

Watkin's map system.

The map system has been recently perfected by Captain Watkin, R. A. In it the whole navigable front commanded by the battery is plotted down in small squares numbered and lettered. Tables of the distances of the centres of these squares, the

degree of training on the traversing arc required to lay the gun on the desired square, together with the actual elevation

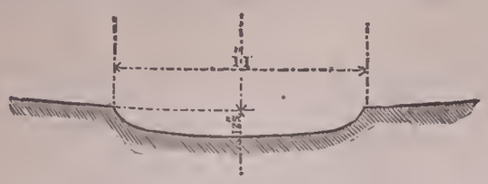


Fig. 30.—100-ton Gun (section of groove).

necessary to deposit the shot in that square, are constructed for each group of guns.

In fig. 31 F is a fort defending the channel; ABFC the line of shore; O the object to be hit, a vessel passing. A, B, and C are stations of observation. In a convenient spot the commanding officer of the artillery in the fort places the map, over which play two arms A′O′, C′O′ kept constantly parallel to the two lines of sight AO, CO, by means of mechanism actuated by currents of electricity transmitted by a cable connecting A and A′, C and C′. As A′C′ represents, on the scale of the map, the distance AC, the junction O′ represents on the same scale the position and distance of the object O. Tell-tales are distributed in the casemates, which constantly exhibit the number of the square over

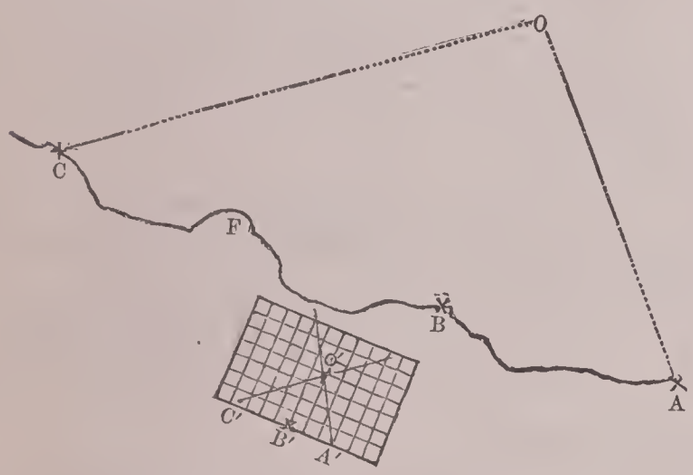


Fig. 31.—Watkin Position-finder.

which the vessel is passing, showing the position of the ship, so that when the gun, or group of guns, are loaded, they can be either laid in the ordinary way, taking the range from the tables, or, if the object is invisible from the casemate, by trailing the gun round till the number of degrees indicated by the tell-tale agrees with the reading on the traversing arc, and giving elevation to suit the range. The arcs showing the direction of the guns are so arranged that guns trailed to any given number of degrees are parallel with each other. Supposing that from smoke or other cause the object cannot be distinguished from C, an observer is placed at B, and the arm is shifted from C′ to B′. The practical working of the system is as follows. The commanding officer watches the course of a vessel as indicated to him by the arms on the map, the observers at A and C constantly following the centre of the object with their glasses. He telegraphs to the battery orders to load and lay, in accordance with the instructions given for each square of the map, and transmitted to the tell-tales. As the vessel passes over the square for which the guns are laid, the commanding officer can fire electrically the group of guns by pressing a key with his finger, or he may direct each detachment to keep up independent practice, laying in accordance with the indications sent by him through the tell-tale. The arrangements for exploding submarine mines or fixed torpedoes, where hostile vessels are passing close to them, are somewhat of the same character as those above described.

Guns of defence.

2. The *land-front guns* of fortresses shown in the table are intended to overpower and quell the fire of any pieces which can be brought against them by a besieger. They are very largely supplemented in most fortified places by a number of the old smooth-bored guns and carronades, which are well adapted for the use of case shot at close quarters, for sweeping the glacis, and for the defence of ditches. The rifled guns throw common shell into the siege works, and where possible among the enemy's material. They harass his working parties and reliefs with shrapnel, and endeavor to cut down his parapets and dismount his artillery by direct fire.

Guns of attack.

3. *Siege-train guns* accompany an army on a campaign where great mobility is not required, and where it is necessary to reduce fortified places. They should be the most powerful pieces which the means of transport will permit. In the more civilized parts of the world, where roads and climate are favorable, it is generally considered that about 70 cwt. is the heaviest weight of piece that can be carried with an army. In less favorable countries it is frequently impossible to transport more than half that weight. The early rifled siege-train guns were grouped into two classes. A unit of the heavy train comprised—

64 prs. of 64 cwt.	8
40 " of 35 "	8
8″ howitzers of 46 cwt.	14 (figs. 32, 33).

A unit of the light train comprised—

40 prs. of 35 cwt.	10
25 " of 18 "	10
6·3″ howitzers of 18 cwt.	10

Lately 8·0″ howitzers of 70 cwt. and 6·6″ howitzers of 35 cwt. have been introduced, but their allotment has not yet been settled. Siege guns are supplied with special shell, somewhat similar to Palliser projectiles, for penetrating masonry; also with common and shrapnel shell. The howitzers rarely use shrapnel shell. On first attacking a fortress at a long range, the duty of the guns is to cut down the defender's parapets, dismount his artillery, dismantle his ramparts, and subdue his fire, so as to facilitate the construction of batteries nearer the place. In the mean while the howitzers lob heavy shell into his works, and bombard the town, if necessary. As soon as practicable, breaching batteries are thrown up in such spots as may be found suitable for the attack of a weak point. It is rarely possible to breach by direct fire in the case of works of modern design. Here it is that curved fire is so effective, and here it is that the accuracy of rifled howitzers becomes so necessary. In order to make a practicable breach up which an assault can be delivered, the masonry at B (fig. 34) must be cut away, and owing to the height of the cover at A the fire must be curved to reach a point sufficiently low. Direct fire—*tir à plein fouet*, as the French express it—would strike too high up. Sometimes a work is so constructed that it is necessary to strike a point half-way down the masonry revetment to form a practicable breach. As it is desirable to strike with as much force as possible in breaching

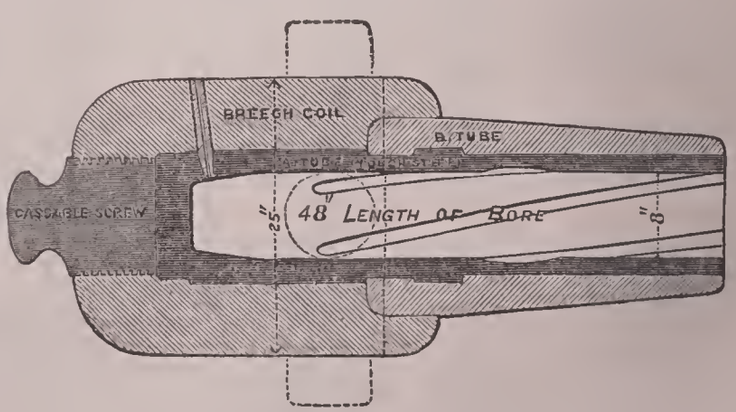


Fig. 32.—8-inch Howitzer, 46 cwt. (section).

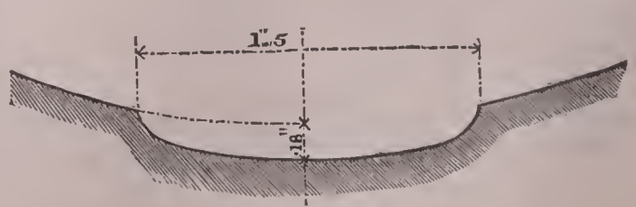


Fig. 33.—8-inch Howitzer (section of groove).

Breaching

ing, it is evident that where the profile of the work requires the angle of descent of the shell to be considerable, it is necessary to select a spot for the battery at the longest range compatible with accuracy. For, given a certain angle of descent, the longer the trajectory (*cæt. par.*)

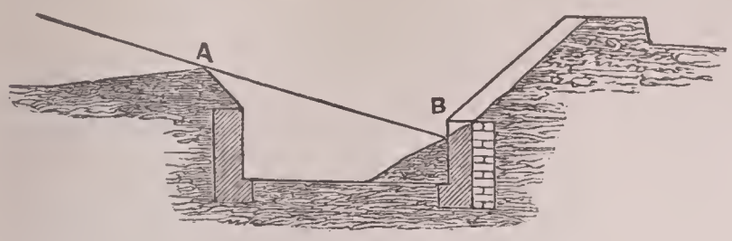


Fig. 34.—Profile of Work.

terminating in that angle, the greater will be the remaining velocity. Sometimes the guns of the siege train are employed with an army in the field to hold certain valuable ground against attack. They are then called guns of position, and are so placed as to command the approaches most effectively, and yet, if possible, to be dragged away at the last moment in case of retreat. They will usually fire shrapnel shell when thus employed.

4. The all-important qualities of *field guns* (figs. 35, 36, 37) are mobility and shrapnel-throwing power. They must be able to make long marches rapidly, to change position with celerity, to crush troops and the enemy's artillery with accurate, well-sustained fire at high velocities, and to support rough usage without detriment to their efficiency. They are supplied with shrapnel and common shell, and case shot, of which shrapnel form by far the largest proportion.

Mountain guns.

5. The *mountain-train guns* are both 7-pounders; they fire the same shell, but the heavier one uses a 12-oz. cartridge, while 6 ounces is as much as can be fired from the lighter one. Both guns are intended for mule transport, one mule taking the gun, another the carriage, and a third the wheels, etc.; but at the Cape of Good Hope the heavier 7-pounder is mounted on a light high field-carriage for transport as well as for firing, while in Ashantee the lighter 7-pounders were dragged on a kind of sleigh. The lighter gun is tolerably effective for nearly a mile, and the heavier for about a mile and a half. Some jointed guns, proposed by an artillery officer, are now under

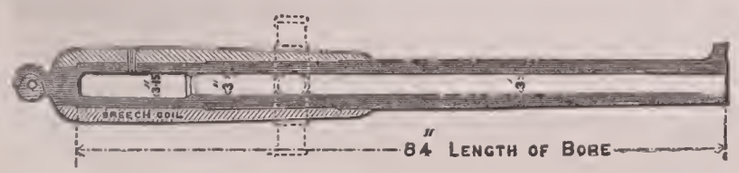


Fig. 35.—13-pounder of 8 cwt. (section).

trial. They are composed of two pieces screwed together, and, being carried separately, form a gun of about twice the weight of the ordinary mountain gun. Great increase of power is expected from this method of construction. Mountain guns are principally employed to throw time-fuzed shrapnel at troops, and percussion-fuzed common shell into hill works and woods occupied by the enemy.

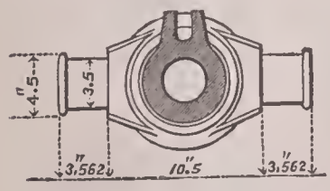


Fig. 36.—13-pounder of 8 cwt. (front view).

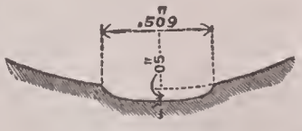


Fig. 37.—13-pounder of 8 cwt. (section of groove).

Naval guns.

In Table V. the principal sea-service rifled guns are shown. Three kinds of work are performed by them, viz., to pierce ironclads and armored forts, to attack unarmored vessels, and to keep up a fire on troops on shore or on approaching boats. The heavy armor-piercing guns are well provided with common shell, as well as with chilled projectiles, so as to perform the first and second duties, but they have a very small proportion of shrapnel shell, which is intended to be used by them against troops or boats only on emergency. The 7-inch and 64-pounder guns are supposed to be quite sufficient in ordinary cases for the second and third duties, assisted in the third case by the smaller boat guns. All these are well furnished with common shell and shrapnel.

Carriages.

Gun Carriages.—The development which has taken place of late years in the power of artillery has necessitated corresponding changes in gun carriages. Formerly, every carriage was capable of travelling to some extent; even the heaviest guns were mounted on carriages fitted with trucks, which permitted motion on the ramparts or about a deck. Later on, sloping traversing platforms were introduced, up which the gun carriage recoiled on firing. Extra means of checking recoil became necessary as the power of the guns grew; compressors, or friction plates, were introduced, and are now only partially superseded by the hydraulic buffer. Mobility of carriage has almost entirely been given up, except for field and mountain artillery. The heavier siege guns travel on platform wagons, not on their firing carriages; and it is possible that the traversing platform and slide principle will extend yet further.

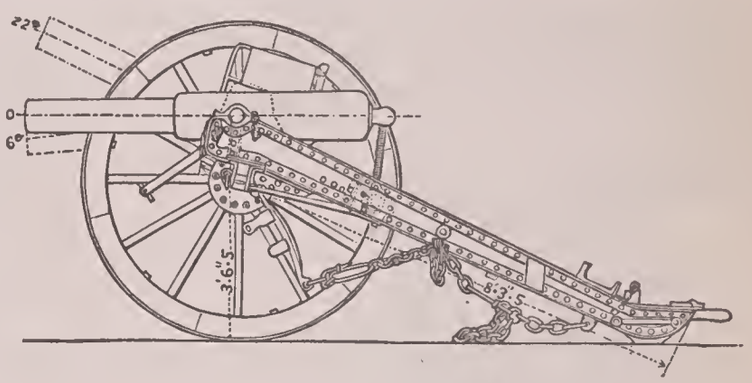


Fig. 38.—9-pounder Field Gun Carriage (elevation).

Tables IV. and V. show how the various pieces in the British service are mounted. Differences of detail exist, but the general system is the same for all European countries. Wrought iron is rapidly supplanting wood in the construction of carriages, and there are signs that it will in its turn be in great measure superseded by a mild steel. The subject of gun carriages is too long and too complicated to be treated in detail here, but, as guns are of no use without carriages from which to fire them, it is necessary to give some idea of the chief modes of mounting modern artillery. Figs. 38, 39 show the details of the 9-pounder rifled muzzle-loader carriage. It consists of three parts, the wheels, the axle, and the trail. The wheels have oaken spokes and ash felloes, the tire is of wrought iron, the nave and pipe box (which holds the end of the axletree arm) of a mixture of copper, tin, and zinc. The dish is considerable, amounting to 2 inches in the 5-foot wheel. There is little strut, so that the lowest spoke is nearly vertical, and the tire forms a frustum of a cone, instead of being a cylinder. The object of this form is to obtain lateral strength, especially in travelling on uneven ground. The axletree bed is of wrought-iron, constituting, with the axle, a beam

Field gun carriages.

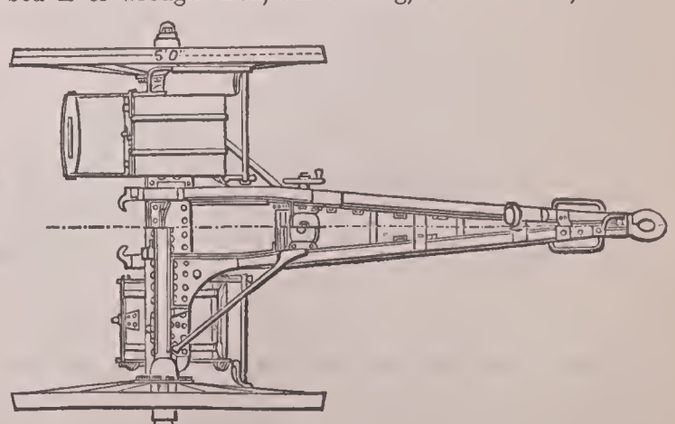


Fig. 39.—9-pounder Field Gun Carriage (plan).

of box-girder section, the axletree forming the bottom. The trail consists of two side brackets fixed by two tran-

soms, two bolts, and the trail piece carrying the trail eye. The brackets are made of plate iron, riveted to a frame of angle iron. The axle carries two seats for gunners; into the trail are fitted the elevating screw and wheel, and the drag shoe with chain hangs below. Fig. 38 shows the gun and carriage in the firing position; when it is desired to move it to any distance exceeding a few yards, the point of

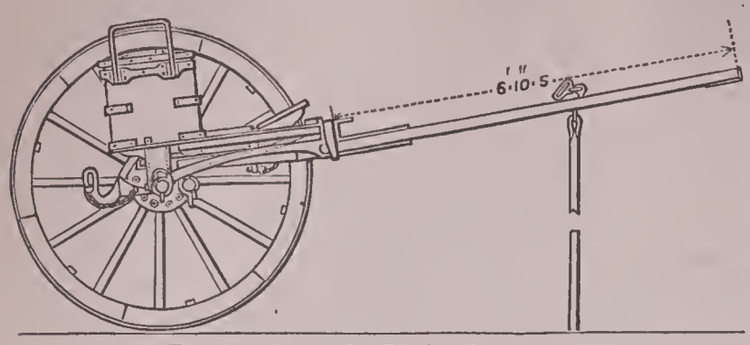


Fig. 40.—9-pounder Limber (elevation).

the trail is raised, the limber is brought up, the trail eye is passed over the limber hook and keyed fast. The gun carriage and limber then form a four-wheeled vehicle, and travel as such. Figs. 40, 41 show the limber, which consists of wheels and axletree similar to those of the gun car-

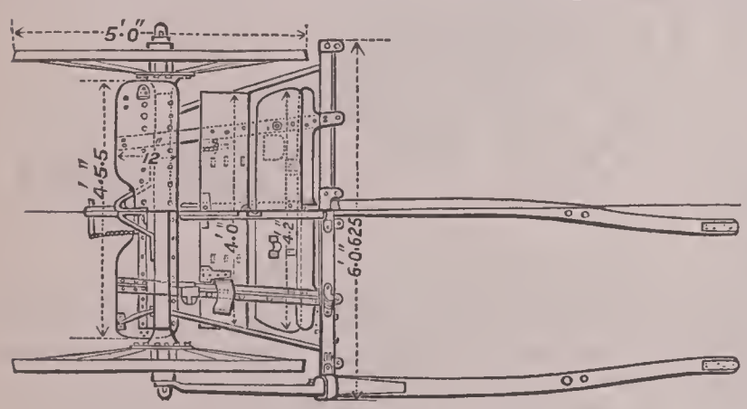


Fig. 41.—9-pounder Limber (plan).

riage, ammunition boxes, platform, and a pair of shafts. In the British service each gun carriage and limber are drawn by three or four pairs of horses, according to the nature of the piece. The driver of each pair mounts the near horse, the off wheel horse is between the shafts. In some countries pole draught is preferred.

Traversing slides.

Fig. 42 shows a 9-inch gun mounted on a wrought iron carriage and dwarf platform. This arrangement may be considered typical of all sliding carriages on traversing platforms. The direction of the gun is changed as required by training the platform to the right or left, the trucks working on the racers, front and rear, which are usually of wrought iron, laid concentrically on a bed of stone. The level of the traversing platform rises towards the rear, so as to assist in absorbing the work of recoil on firing, and to facilitate running forward again after loading. The recoil is also checked either by a system of friction plates, called a compressor, or by an hydraulic buffer, placed parallel to and between the sides of the traversing platform, so that the carriage on recoil forces a piston into a cylinder containing oil, which escapes, through holes cut through the piston head, into the space round the piston rod; the size of the holes and the amount of the oil regulate the resistance offered to recoil, and enable the gunner to stop the piece at the proper place.

Disappearing carriages.

Several kinds of carriages on the "disappearing" principle have from time to time been put forward. In these the gun is exposed to the fire of the enemy only while being aimed and discharged; loading is performed under cover. The Moncrieff carriages are the most successful of this class. In them the force of recoil is stored up and employed to raise the gun from the loading to the firing position. Colonel Moncrieff applies his principle in two ways: the recoil either raises a counter-weight or forces a piston into a cylinder, compressing, by the aid of a fluid, air already much compressed. The counter-weight carriages are used to some extent in coast defence, and the hydro-pneumatic carriages are under trial for siege-train guns. Plate V. gives the details of the former. On a level traversing platform rolls a carriage or "elevator," which places the gun in the required position either for loading or firing. The end of the elevator opposite to that which carries the gun is weighted, so that the recoil causes the elevator to roll to the rear and the gun to descend, at the same time raising the weight, which is retained in the upward position till released after loading, when its descent again raises the gun. Thus the elevator

Moncrieff's system.

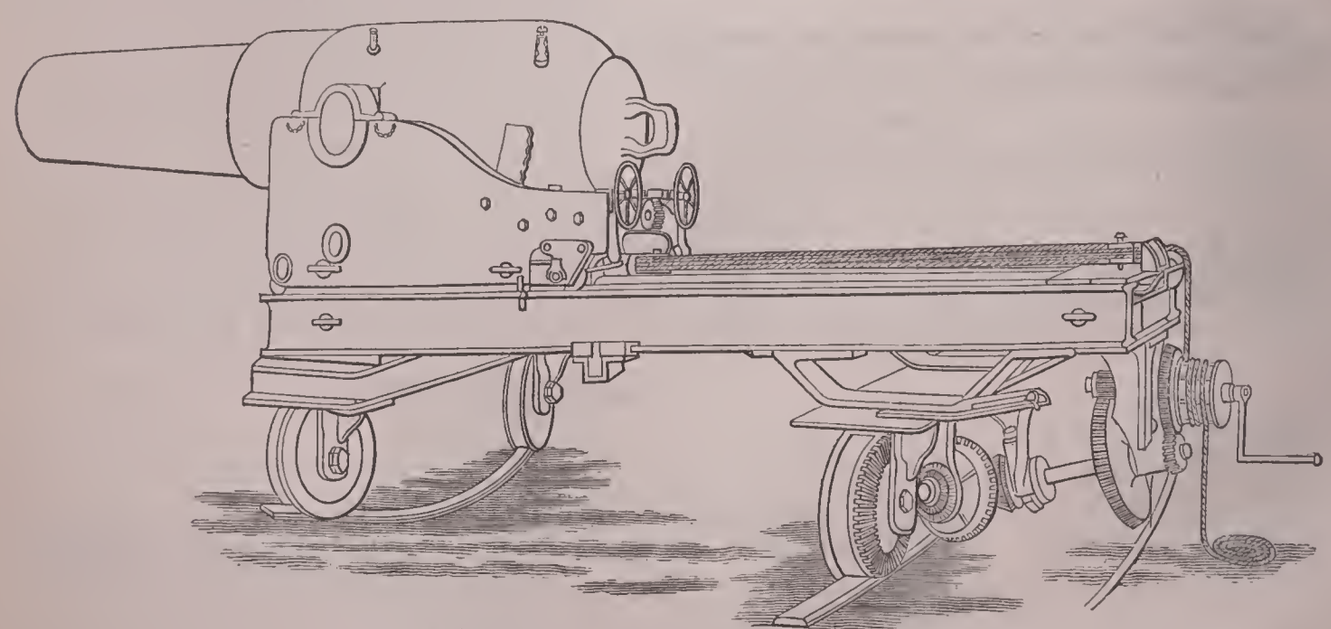


Fig. 42.—9-inch Gun Wrought Iron Carriage and Dwarf Platform.

is a lever of the first order working on a shifting fulcrum, the curve (an involute) of the rolling surface being so adjusted that the resistance of the weight gradually increases as the gun recoils, and finally stops it smoothly and without violence. Conversely, by this form the gun is raised to the firing position gradually and without being jolted.

Hydraulic Gear for Guns.—As soon as the weights of ordnance increased so greatly that their service exceeded the power of manual labor, it became necessary to find some substitute. Steam power is always at hand in steam vessels, and it was quickly seen that it was best applied through the medium of water pressure. The simplicity and compactness of hydraulic machinery, the circumstance of

its direct action rendering toothed gear unnecessary, and the perfect control it gives over the motion of heavy weights, especially adapt it for the purpose.

Rendel's hydraulic systems.

Plate VI. represents the mode in which the system is applied to the working of the 80-ton guns on board H.M.S. "Inflexible." A circular turret contains two guns placed side by side, and strictly parallel as to line. The hydraulic pressure is conveyed through the trunk A by pipes to the presses in the turret. At B is a press for elevating the gun; this press also absorbs the force vertically given off during recoil on the elevating beam C. D is the gun-slide which carries the recoil press G for checking the recoil. This press is supplied with a tank F, up into which the water from the press G must escape through valves V loaded to the required pressure by springs. E is the gun run forward in the firing position; its trunnion S is fixed to the end of a piston rod, the head of which enters the press G; when the gun E is fired it recoils into the position F, shown by the dotted outline. The trunnion S forces the piston home into the cylinder G, driving the water up into the tank; the trunnion fittings run along the gun-slide horizontally, and the attachment or saddle below the gun runs up the elevating beam C, which is pivoted at the fixed point T, so as to depress the muzzle outside the port P of the turret PR. The gun is then in the loading position. In the mean while the turret has been caused to revolve on the conical rollers H, H by hydraulic pressure till the muzzle of the gun is brought opposite the loading apparatus, which is securely housed below deck. The water power is taken down the ammunition hoist K, which raises a truck L, carrying a shell, on the top of which is laid a cartridge, to the loading position M. The sponge N, similarly worked by hydraulic pressure, serves as a rammer also. To perform the operation of loading, the sponge is forced home through the bore of the gun against the bottom, by contact with which a button on the head is pressed, setting free a rush of water; this thoroughly and visibly drenches the bore, and prevents the remotest possibility of a burning fragment remaining from the previous round; the sponge is then withdrawn, and the ammunition raised to M; the sponge now becomes a rammer, thrusts the cartridge into the muzzle of the gun, and is drawn back; the truck is raised still higher, the rammer then pushes the projectile into the muzzle, and rams home both cartridge and shell together; a wad previously placed on the head of the rammer is left behind, fast in the bore in front of the projectile, which is thus prevented from moving forward. An indicator on the rammer shows whether the charge is home. The press B is then put in action to lower the breech, raising the muzzle to the elevation required to suit the range of the object to be fired at; the gun is run forward to the firing position E, and the turret is revolved till the guns point at the object. The sighting is not on the guns, but on the turret; the captain of the battery looks through a hole in the roof R, behind the guns, and arrests the movement of the turret at the correct place, when the line between the sights, which is parallel to the axes of the guns, is directed to the object. The firing may be performed either in the usual way, or by electric tubes and wires from a distance.

Plate V., fig. 2, shows a 100-ton rifled muzzle-loading gun, mounted *en barbette* for coast defence, and adjusted for hydraulic loading. After being fired the gun is traversed round to the position A, where its muzzle is brought opposite the loading apparatus G, which is contained in a recess in the parapet D. An hydraulic hoist E raises the ammunition on a truck F to the muzzle; a similar apparatus is constructed on the right of the gun, which is traversed to either at pleasure. The carriage B slides on the platform C, which pivots on P, a trunk through which is introduced the hydraulic power for running the gun back and absorbing the recoil.

Many other applications of hydraulic power to gunnery besides those just described are due to Mr. G. Rendel of the great Elswick firm. One of the most novel is that adopted in H.M.S. "Témeraire," in which 25-ton guns are mounted on the disappearing principle in a turret having no roof and no ports; inside the turret is a turn-table carrying the gun by the trunnions on two arms, which are raised by hydraulic power, enabling the gun to fire *en barbette* over the wall of the turret. The recoil brings it down again, and it is placed opposite the loading gear by revolving the turn-table. The general principles are the same as those on which the previously described systems are constructed.

Muzzle-loading *versus* breech-loading.

Loading.—This article would be scarcely complete without a reference to the comparative advantages of the muzzle, and breech-loading systems. Many have been much impressed with the great superiority of breech-loaders as small arms, whether for sporting or military purposes, and have concluded that the same superiority must extend to ordnance constructed on this plan. Others, having seen the difficulty of avoiding complication and accident to the parts in the early breech-loaders, have hastily condemned the whole system. The truth, as is often the case, lies between the two views, as will be seen from the following considerations. The chief points of excellence to be attained by a field gun are—(*a*) high ratio of power to weight; (*b*) immunity from injury by its own fire; (*c*) immunity from injury by the enemy's fire; (*d*) capability of supporting the accidents of service; (*e*) rapidity and facility of manipulation; (*f*) efficiency of projectile. (*a.*) The power of a gun is most conveniently measured by the energy (in foot tons) communicated to the projectile on leaving the muzzle. The following table shows how the latest English and German field guns compare together in this respect. The English guns are muzzle-loaders, the German ones breech-loaders.

TABLE VI.

Gun.	Nation.	Weight.	Muzzle Velocity.	Energy.	$\frac{E}{w}$	Remarks.
pr.		cwt.	f. s.	ft.		
9	English.	6	1380	119	397	Service guns.
16	"	12¼	1365	213	348	
13	"	8	1560	220	550	Under manufacture.
11	German.	7¾	1525	131	467	Service guns.
15	"	9	1460	222	493	

For field use.

The English 9 and 16-pounders at the time of their introduction were the most powerful field guns known, but were after a time beaten by the new German guns, which will in their turn be beaten by the new English piece, the first supply of which was lately issued. Recently a trial was carried out of two field guns made by Sir W. Armstrong & Co. They were precisely similar in all respects, except that one was a breech-, the other a muzzle-loader. No difference in their excellence could be detected. Thus it may be considered as certain that the power of a gun is in no way affected by the mere fact of its being a muzzle-loader or a breech-loader. Should, however, the adoption of one system favor an improved construction, or lend itself more readily than the other to the use of improved ammunition, this equality would disappear, and whichever system should gain a decided advantage in power, which cannot be obtained by its rival, must certainly prevail. It is almost impossible to overrate the importance of high velocity, combined, of course, with efficiency of projectile. In the field it enables the gunner to place the enemy under fire at long ranges, and so to force him to change his formations, and show his hand. It intensifies both the moral and physical effect of shell upon troops. It permits the guns to occupy good positions without the necessity of constant moving to get within range. In entrenchment firing it is, if possible, of still greater importance. Low velocity projectiles fired from field guns are almost harmless against earthworks. They have not sufficient bursting charge to do damage to the work by mere explosion, nor impetus enough to cut down the parapets; while the defenders hear the gun and crouch under cover as the shell comes. Thus it is not surprising that all our recent advances have been towards high velocities. Nothing has tended more to this end than the enlargement of the diameter of the powder chamber, which facilitates the profitable consumption of increased charges. This improvement is found to act differently on the two systems of loading A chambered muzzle-loader requires an expanding cartridge (in field guns); a chambered breech-loader requires a breech-closing apparatus of increased size and weight. Supposing a satisfactory expanding cartridge to be devised, the muzzle-loader gains in ratio of power to weight. If this be found impracticable, the breech-loader secures an important advantage in this respect. Experiments are still in progress, and it would be premature to pronounce definitely in favor of either at present, especially as some fresh discovery or new explosive may at any moment confer preponderance on either system. (*b.*) In the Franco-German War of 1870, a large number of old pattern double-wedge breech-loaders became unserviceable by their own fire. This difficulty appears to have been quite overcome in the newer patterns of Krupp field guns by the adoption

of the cylindro-prismatic wedge, with Broadwell ring and steel facing-plate. It would probably be incorrect to affirm that a breech-loader has *quite* as great immunity from injury by its own fire as a muzzle-loader, since no joint, however well contrived, can be as strong as the solid-ended steel tube forming the breech of the latter. But, putting mathematical certainty of security out of the question, it may now be accepted that practically field guns can be made as safe and enduring on one system as on the other. (*c.*) As regards immunity from injury by the enemy's fire, the muzzle-loader has a decided advantage. It is difficult to estimate the real value of this advantage, depending as it does partly on the manner in which artillery is employed, and partly on the doctrine of chances. During the Russo-Turkish War of 1877–78 but few guns were placed *hors de combat* by the enemy's fire. In such cases as did occur, the injuries were nearly always such as would not have affected muzzle-loaders. The wedge handles were usually bent up by the action of percussion fuze shell jamming the wedges. The Russian field guns were generally of a feeble class; the proportion of entrenchment fighting was unusually large; and in the field the Turkish artillery habitually fired at long ranges. It may therefore be fairly concluded that the number of guns injured by the enemy's fire was not so great as to render the superior invulnerability of muzzle-loaders of much importance. These conditions will probably be reversed in any great war in which England may take part; and hence the advantage gained by muzzle-loaders in immunity from damage by hostile fire must be carefully borne in mind in comparing the two systems of loading. (*d.*) In capability of supporting the accidents of service, there is not much to choose between the two rivals. The breech-loader is more liable to injury from being upset, and exposes more parts and finer fittings to the action of the weather. On the other hand, it is easier to clean, and the officer can better see that it *is* clean. The jamming of projectiles in the bore when ramming home, which sometimes occurs with muzzle-loaders, is impossible with breech-loaders. This defect, it is hoped, has been overcome in the new English field gun. The preservation of breech-loaders, especially in mountainous countries, necessitates a profuse expenditure of oil and grease. (*e.*) In comparing the rapidity and facility of manipulation of the two methods of loading, it is necessary to consider the circumstances under which the guns are employed. Suppose a horsed battery of guns to gallop to an open spot whence they command a body of hostile troops in motion. Coming into action, the gunners load and fire as rapidly as accuracy will permit, unhampered by parapets. It is evidently of great importance to throw as many projectiles as possible among the enemy. Here the muzzle-loader will have some advantage. With full detachments in the open it takes rather less time to load, aim, and fire a muzzle-loading field gun than a breech-loading one. The reason of this is that with the former the man laying the piece can manipulate the sight and usually take aim while the loading is being performed, while, when the projectile and cartridge are thrust in from behind, he has to wait till the loading is done before he can get to the sight. There is no practical difference in the time occupied by the actual loading. In one case, the cartridge and shell are rammed down a long distance together; in the other, first the shell is put in a short distance, and afterwards the cartridge, and the wedge has also to be withdrawn and replaced. Next, suppose a commanding position to have been selected for a battery, and a light entrenchment to have been thrown up, over which the guns fire. Here the muzzle-loader will lose the advantage gained when firing in the open, as it must be loaded before being run up to the parapet, and aimed afterwards. Both natures of gun recoil, and it makes no difference in time whether the ammunition be thrust home when the gun is back at the recoil position, or after it is run up. Here the breech-loader and the muzzle-loader stand upon equal terms. Thirdly, suppose—a rare case with field guns—that firing with reduced charges is required, that shell are being lobbed from behind a parapet at high angles into a work. Here we shall have little recoil, probably not enough to permit loading at the muzzle without the gun being run back by hand. Loading at the breech will, however, be perfectly simple. In this case the breech-loader gains a very decided advantage over the muzzle-loader, since not only does it not require to be run back, but it has to be run up merely a very short distance. To this the advocate of muzzle-loading will probably reply that shells are lobbed with low velocities into works only at considerable intervals of time, that rapidity is therefore of no use, and that the advantage claimed is worthless. No doubt there is truth in this argument, but suppose the action of reduced charges on the gun to be imitated by the introduction of a brake which shall check the recoil within a short space, even when the gun is firing rapidly with high velocity, then the breech-loader behind entrenchments gains a distinct advantage. The German guns are supplied with powerful but clumsy brakes, more for travelling purposes than for firing, and it is doubtful how far they answer for the latter object. In the British service it has not been thought important to check recoil, since a certain amount of it has been necessary for loading behind parapets; but trials have been made of brakes, etc., for the purpose of preventing guns from running backwards down a reverse slope when fired from the crest of a hill, or, more generally, for checking excessive recoil. Up to the present time (1879) no great success has attended these efforts, nor does it appear feasible to abolish recoil altogether by sinking the wheels in a ditch, since the strain on the carriage would then be much increased. There is no doubt the question offers grave difficulties, especially as lightness is such an important feature in the construction of field gun carriages. As yet, then, the reduction or checking of recoil behind a parapet confers but a problematical superiority on breech-loaders, and cannot be held to counterbalance the advantage gained by muzzle-loaders in the open. (*f.*) In the older pattern guns of both systems, where studs and windage were pitted against lead coating and no windage, the muzzle-loading projectile was able to take a better time-fuze than could be used in the breech-loader, but it did not possess the same accuracy of shooting. Since the introduction of the polygroove system, in which rotation is given and windage sealed by a copper-flanged ring or disc at the base of the shell, the muzzle-loading projectile has lost the advantage of being able to use the simpler time-fuze, but has gained in several important respects. The breech-loading shell has also been improved by the substitution of two copper wires for the lead coating, but is probably inferior to the new muzzle-loading projectile, which, however, can be used equally well for breech-loaders. It may be said therefore that the systems are equal in respect to efficiency of projectile.

Thus then, taking the six qualities named as chief excellences to be sought for in field artillery, it appears that in four of them there is practically little or no advantage gained by either system over the other, while, in the two remaining qualities, the muzzle-loader has slightly the best of it. On the whole it seems therefore that, at the present moment, the balance of evidence is in favor of muzzle-loading for field guns.

For siege purposes.

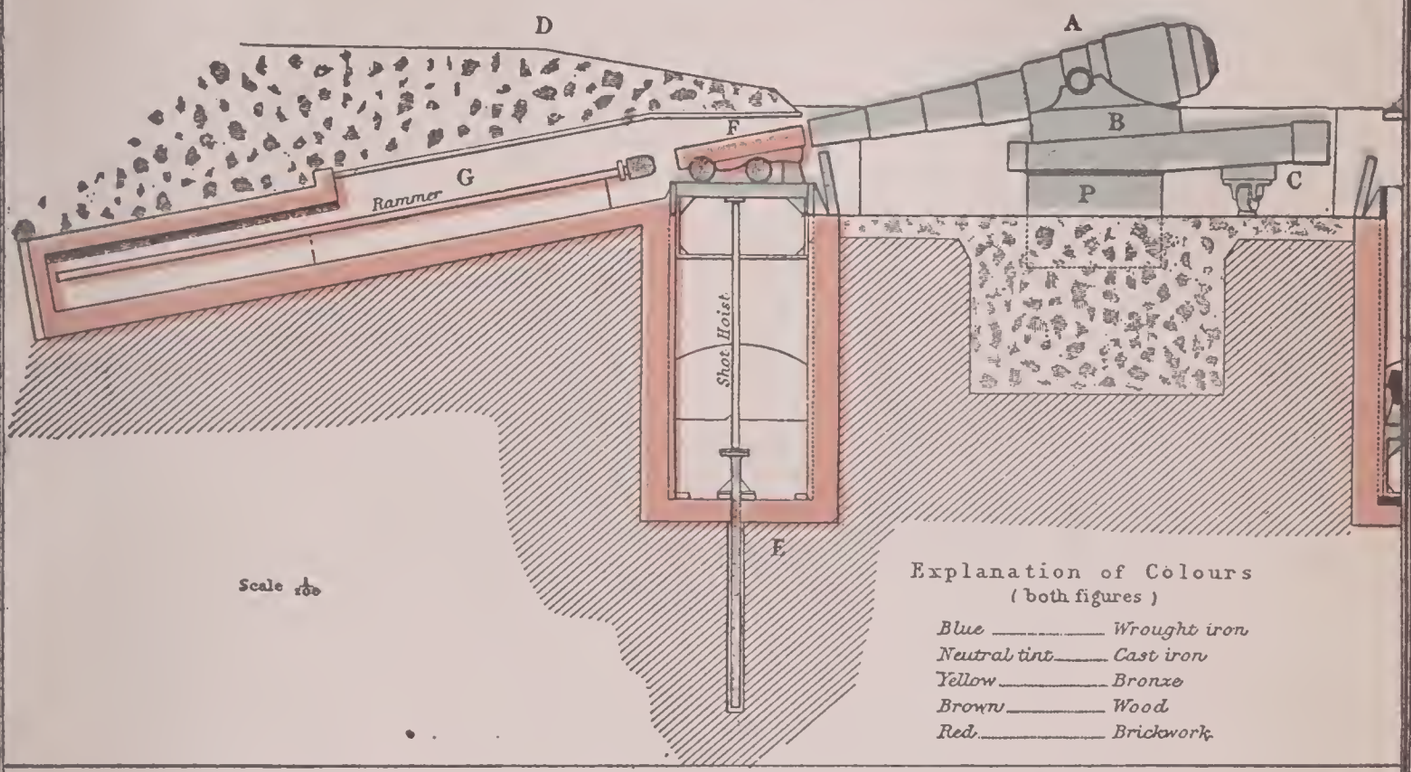
In comparing the advantages of the rival methods of loading siege guns, the entirely different character of the two classes of pieces composing a train at once forces itself on the attention. One class consists of long guns, projecting far over a parapet, and usually fired at low elevations with heavy charges; the other of short guns, usually fired at high elevations with low charges, the muzzles on recoil coming well within the emplacement. The Germans use long and short 15-centimetre guns, both breech-loaders, and both throwing shell of the same weight. The long gun, fired with heavy charges, weighs three times as much as the short gun, which is fired with light charges. Supposing the dimensions of the short gun were increased, the proportions remaining unchanged, till its weight equalled that of the long gun, then it would be able to fire shell of three times the weight. This is what is actually being done in the British service. Now all these heavy pieces, firing either heavy powder charges or heavy shell, require very strong and consequently very heavy carriages to bear the recoil, and it is found convenient to transport the guns on comparatively light platform wagons apart from their firing carriages. Hence there is no longer any necessity for constructing firing carriages with a view to travelling purposes; and it is probable that traversing slides will be introduced for all heavy siege pieces. It is not requisite to institute at length a comparison of the various qualities desired for siege guns. Rapidity is very rarely of importance with them; they are always fired under cover, and it may be at once assumed that, as far as power and endurance go, the two systems are practi-

Fig. 2.

100 TON M.L. GUN EN BARBETTE

UNDER COVER LOADING

ELSWICK SYSTEM



Scale $\frac{1}{100}$

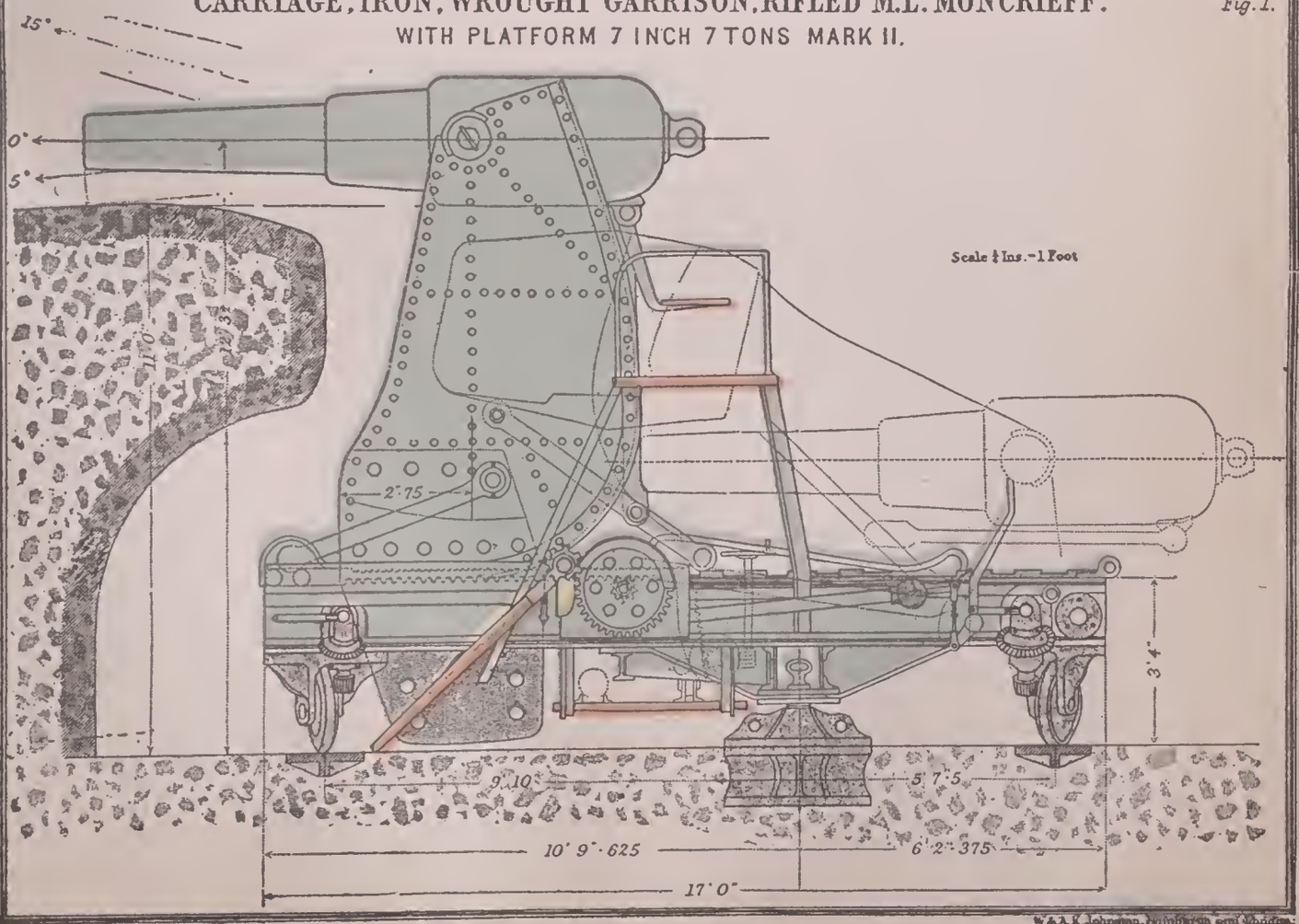
Explanation of Colours
(both figures)

Blue	Wrought iron
Neutral tint	Cast iron
Yellow	Bronze
Brown	Wood
Red	Brickwork

CARRIAGE, IRON, WROUGHT GARRISON, RIFLED M.L. MONCRIEFF.

WITH PLATFORM 7 INCH 7 TONS MARK II.

Fig. 1.



W. & A.K. Johnston, Edinburgh and London.

SECTION THROUGH TURRET SHOWING HYDRAULIC GEAR

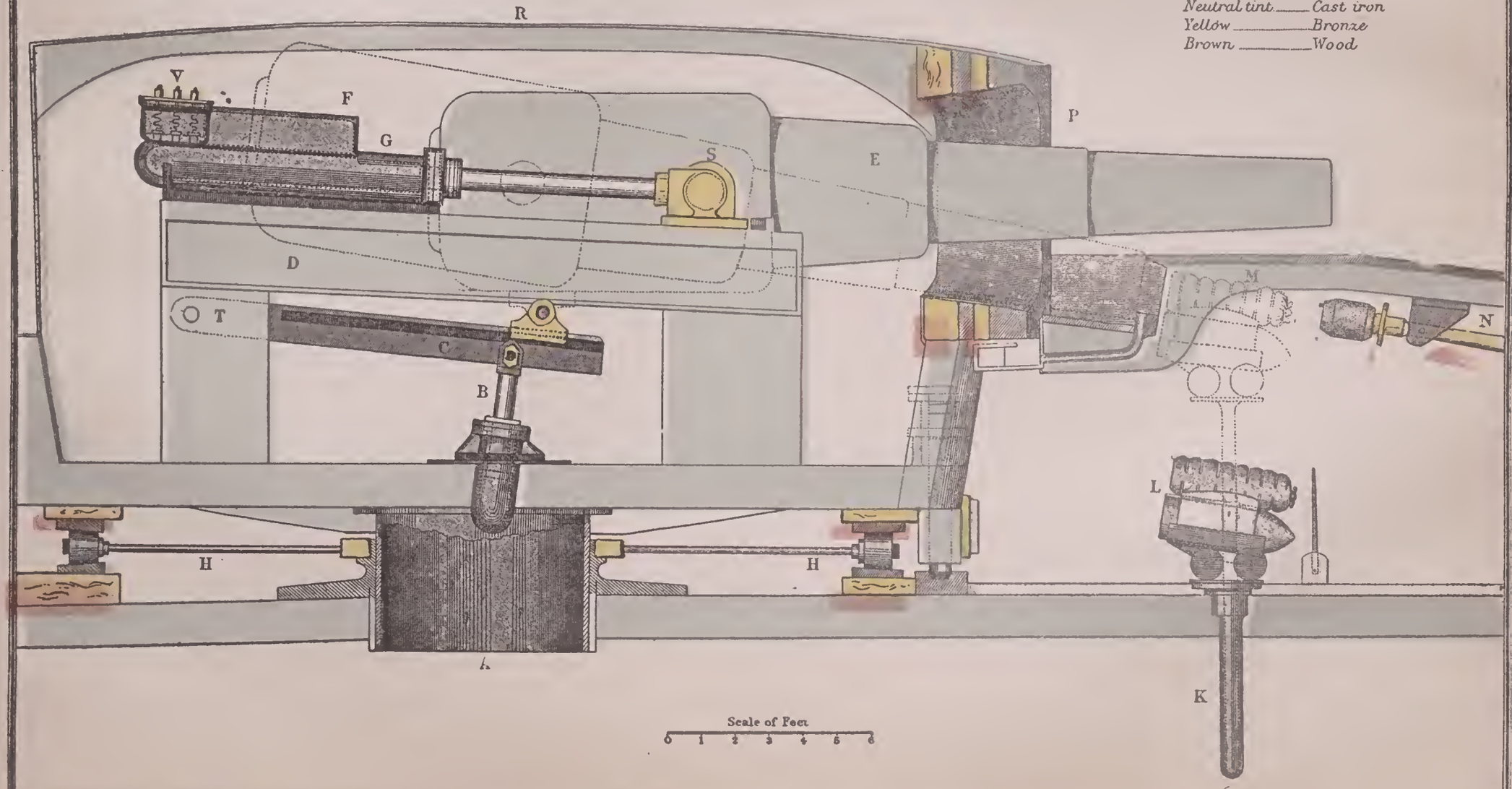
"INFLEXIBLE" TYPE

Gun shown in firing position ——
Gun dotted in loading position .....

80 ton Guns

Explanation of Colours

Blue	*Wrought iron*
Neutral tint	*Cast iron*
Yellow	*Bronze*
Brown	*Wood*



W. & A. K. Johnston, Edinburgh and London

cally equal. A fresh set of conditions comes into play: the projectiles are heavy; and convenience of loading, combined with safety to the gunners from the enemy's fire, should now be considered. As these points are connected with the form of carriage employed, it was necessary to call to mind in comparing breech with muzzle loading, that slides are likely to take the place of travelling carriages. When long guns are fired, in order to permit loading at the muzzle, it is requisite that the recoil should be great, and the emplacement deep. Many devices, such as flexible rope rammers, jointed staves, etc., have been tried, but have not proved perfectly successful in overcoming this difficulty. Breech-loading here has a considerable advantage. Long guns are fired at low angles of elevation, and no difficulty therefore is experienced in thrusting the projectile home from behind in a nearly horizontal bore. High velocity is required, and the breech-loading system lends itself readily to enlargement of the powder chamber, without necessitating the complications of an expanding cartridge. If slides are used the hydraulic buffer checks the recoil at once; on the other hand, the parapet affords rather better protection to men standing close to it at the muzzle than to men standing a little way off at the breech. These conditions are reversed with the short pieces. The rammer is short, and no great recoil is necessary to permit loading at the muzzle. The elevation is high, and it is much easier to drop a shell in from the front than to thrust it up from behind. Indeed this cannot usually be done, and a breech-loader has to be brought nearly horizontal for loading. High velocity is never required, and enlargement of powder chamber is not wanted. The men are in the most sheltered position at the muzzle. If these views be admitted as correct, it seems clear that the long pieces of a siege train should be breech-loaders, and the short ones muzzle-loaders. To this it may be objected that uniformity would be sacrificed by such a combination. There is not much in this objection. The mere fact of two guns being loaded in different ways is surely of little consequence, and can easily be grasped by the dullest gunner. It is done every practice day on board ship, where the old pattern Armstrong vent-piece breech-loaders are combined with modern muzzle-loaders. As regards the stores, a long and a short gun of the same weight would not under any circumstances fire the same ammunition, and even in cases where a heavy long gun is associated with a light short one having the same diameter of bore, as in the case of the German 15-centimetre pieces, there is no reason why the same projectile should not be used for both if desired; that is, the new smooth muzzle-loading shell, with a gas-check on the base, would answer for both.

For heavy guns.

The question of breech-loading or muzzle-loading is obviously not only complicated, but is liable to alteration in its conditions with every advance made in the science of gunnery. To decide that an army or a navy should have nothing but breech-loaders, or nothing but muzzle-loaders, would be to make a fetich of uniformity, there is plenty of room for both systems. With regard to heavy fortress and ship guns, it is easy to suggest positions where it will probably be found that one system has a decided advantage over the other. Thus, taking the sea service first, in turrets the muzzle-loader is preferable. The loading can be performed with great facility outside the ports, and a turret of a given diameter will house a pair of bigger guns than when the loading has to be done inside at the breech, unless some method of exterior loading can be devised for the breech-loaders also. For broadside guns, on the other hand, it seems equally clear that breech-loading has the advantage, as muzzle-loaders have to be run in so far to permit loading that they must be too short for ballistic excellence. For a small gun placed on a slide in the bow of a boat, it appears far more convenient to load at the breech. For those gunboats in which the vessel is simply the gun carriage and the line of fire is given by the helm, loading at the muzzle from below deck offers great advantages. Land service heavy guns, mounted on sea fronts for the protection of harbors, etc., present a great variety of conditions. In some cases the rocks or ground on which the battery is erected have such a form that a heavy gun loaded at the breech could be used where only a comparatively small one could be loaded at the muzzle. Sometimes a turret can be erected with loading gear outside, and then the conditions are reversed. In the case of very heavy guns, which once *in situ* are not intended ever to be moved, the argument from uniformity loses much of its cogency; and the circumstances of every gun position could therefore be separately considered. The guns and howitzers arming land fronts of fortresses should follow the same rule as given for the siege train, the conditions of service in battery being very similar. The long pieces should be breech-loaders, the short ones muzzle-loaders. Wherever the comparative advantages of breech-loading and muzzle-loading are nearly equal, the decision should be in favor of the muzzle-loaders as possessing the inherent advantages of simplicity, solidity, and cheapness.

Conclusion.—The science of gunnery has received so many developments of late years, and is even now progressing so rapidly, that it is impossible to do justice to the subject within the limits of an article. The reader who wishes for more minute details, and who would study any part of the science thoroughly, is recommended to consult the following list of works:—

Bibliography.

ENGLISH.—Robins, *New Principles of Gunnery;* Gen. Boxer, R. A., *Treatise on Artillery;* Col. Owen, R. A., *Modern Artillery;* Majors Griffiths and Duncan, R. A., *Artillerist's Manual;* Major Sladen, R. A., *Principles of Gunnery;* Rev. F. Bashforth, *Motion of Projectiles;* W. D. Niven, *On the Calculation of the Trajectories of Shot;* Capt. Noble and Prof. Abel, *Researches on Explosives;* W. W. Greener, *Modern Breech-Loaders* and *Chokebore Guns; Proceedings of Royal Artillery Institution* (quarterly); Lt.-Col. Strange, R. A., *Manual of Field Artillery for Canada; Reports of Committee on Explosives; Reports of Committee on High-Angle Fire; Changes in Artillery Matériel and Stores;* and the War Office publications—*Proceedings of Ordnance Select Committee; Text-Book on Ordnance; Text-Book on Ammunition; Text-Book on Carriages.*

FRENCH.—Gen. Didion, *Traité de Balistique;* Id., *Lois de la Resistance de l'Air;* Prof. Hélie, *Traité de Balistique Expérimentale;* G. Piobert, *Traité d'Artillerie Théorique et Expérimentale Revue d'Artillerie* (monthly).

ITALIAN.—*Rivista Marittima* (quarterly).

AMERICAN.—Holley, *Ordnance and Armor; Annual Reports of Chief of Ordnance.*

GERMAN.—*Handbuch für die Offiziere der Königlichen Preussischen Artillerie,* Berlin, 1877; *Mittheilungen über Gegenstände des Artillerie und Genie-Wesens,* Vienna (monthly); *Handbuch für die K.K. Artillerie,* Vienna (published in sections, 1871-77); Maj.-Gen. Count Bylandt-Rheidt, *Der indirecte Schuss mit Hohlgeschossen,* Vienna, 1874; Prof. Georg Kaiser, *Theorie der Elasticität und Festigkeit röhrenförmiger Körper,* Vienna, 1876; Id., *Ueber Laffeten-Construction,* 1877; *Militär-Wochenblatt,* Berlin. (E. M.)

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GUNNY. This name is applied to cloth or bags made of jute, and is supposed to be derived from *ganga* or *gania* of Rumphius, or from *gonia*, a vernacular name of the *Crotolaria juncea*—a plant common in Madras. One of the first notices of the term itself is to be found in Knox's *Ceylon*, in which he says: "The filaments at the bottom of the stem [coir from the cocoa-nut husk (*Cocos nucifera*)] may be made into a coarse cloth called gunny, which is used for bags and similar purposes." JUTE (*q. v.*) is the fibre of two species of *Corchorus, C. capsularis* and *C. olitorius*, one species of which, probably the latter, has long been known as the Jew's mallow, from the fact that the leaves have long been used in Palestine, Egypt, and Arabia as a potherb.

The seeds of the jute plant are sown in April or May, and the plant is cut down close to the roots just before flowering. The tops are then clipped off and the stems made into bundles, which are placed in tanks or ditches and covered with turf or other heavy substances to keep the bundles under water. Here they are watched anxiously day by day till the fibre separates easily from the central woody portion. The period of retching or soaking takes from eight to ten days; if allowed to remain too long, the fibre rapidly decays. In drying also the fibre generally becomes of a deeper color. When the fibre is ready for manipulation, the operator descends into the tank or ditch, and taking 10 to 15 bundles, strips off the barky fibre and washes thoroughly, and by a dexterous movement of the wrist spreads and separates the fibres over the surface of the water. The fibre soon becomes clean and is hung over bamboo framework to dry. The fibre thus obtained is fine, long, and silky, but the short staple and the portion near the root held in the hand of the operator during washing, which frequently has

bark attached, are the portions generally selected to make gunny bags or cloth of.

The kind of cloth known as gunny, tat, choti, etc., is woven in various lengths and widths for use as bedding, bags, etc., and formerly, more than at present, every man, woman, and child, boatmen, husbandmen, and others, in their spare moments, distaff in hand, wove gunny cloth. Even the Hindu widow, saved from death and despised by all, made her life less miserable by making gunny cloth, and thus rendering herself to an extent independent of her family. On the eastern frontier women are clothed in it, and the poor cover themselves with it at night. In the Malayan Archipelago it is no unusual sight to see a poor Chinese coolie with a dress made of gunny cloth. The great and most important use, however, to which gunny cloth is applied is in making bags wherein to pack rice, linseed, sugar, cotton, and other products for shipment.

As soon as this cheap, strong, and serviceable material became known, the manufacture speedily assumed enormous proportions, and vast quantities of jute were imported into Dundee for the manufacture of gunny bags and cloth alone. The Dundee mills, in the early period of this trade, had only Indian hand-woven gunnies to compete with. The introduction of the latest machinery of the most approved patterns into Bengal, the chief seat of this industry in India, has, however, had the effect of giving India the opportunity of competing with the Dundee mills on advantageous terms, and now India supplies vast quantities of gunnies to Europe, Egypt, Ceylon, the Malayan Archipelago, China, and the United States. In America alone it is computed that the annual average outturn of cotton is 3,500,000 bales, each bale requiring 6 yards of wrapping material, and of this one-third at least is supplied in gunny cloth. In 1872–73, 6,105,275 gunnies and 64,347 pieces were exported from India, whilst in 1876–77, during a period of eleven months, 30,110,616 gunny bags and 5,262,835 yards of gunny cloth were exported to foreign countries. These figures do not include what is sent coastwise or what is used for packing exported Indian produce.

Bombay too has machinery for weaving jute, but has not as yet done much to compete with Bengal, and indeed there appears little hope for Bombay unless large quantities of jute can be made to grow on the spot, since, apart from the cost of carriage, the juices in the jute plant, as in many other plants, become resinified by drying, and therefore require operating upon whilst perfectly fresh, being attended after treatment with more difficulty in manipulation and a less outturn of fibre.

The excellent gunny bags sent to England are often used for repacking for exportation, and large quantities find their way to paper mills.

GUNPOWDER. Upon the great importance of the invention of gunpowder it is needless to dwell. Not only has it revolutionized the art of war, and given the forces of civilization a vast advantage over mere numbers and savage valor, but we may even urge, paradoxical though it appears, that the very improvements by which modern science has rendered military machines more deadly tend to make war far more expensive, and therefore to prevent its being so frequently or so rashly undertaken as of old. Besides such indirect services to civilization, gunpowder has been, and is of great use in the arts of peace, although of late years to a certain extent superseded by more potent explosive agents.

Historical sketch.

Such being the case, it is not a little remarkable that the discovery of gunpowder should be veiled in uncertainty, although this very obscurity seems proof of its great antiquity. It is, however, certain that it was *not* invented, as has been often stated, by the German monk Bertholdus Schwartz, about 1320, although Wilkinson, in his *Engines of War*, considers Schwartz may have suggested the use of a mortar, since the form as also the name of this piece of ordnance may well have been due to some accident in the laboratory. Roger Bacon, who was born in 1214, refers, *circa* 1267, to an explosive mixture of the nature of gunpowder as known before his time, as being employed for purposes of diversion, and as producing a noise like thunder, and flashes like lightning; he even suggests its application to military purposes, and indulges in the supposition that some such composition might have been employed by Gideon to destroy the Midianites (Judges vii.). He elsewhere writes—"Ex hoc ludicro puerili quod fit in multis mundi partibus, scilicet, ut instrumento facto ad quantitatem pollicis humani, ex hoc violentia salis, qui salpetræ vocatur, tam horribilis sonus nascitur in ruptura tam modicæ pergamenæ, quod fortis tonitru rugitum et coruscationem maximam sui luminis jubar excedit" (see preface to Jebb's edition of Bacon's *Opus Majus*). In the above passage saltpetre is alone referred to as the violently explosive substance, but Bacon was well aware of the fact that saltpetre of itself will not *explode*, for in his previously written treatise, *De Secretis Operibus Artis et Naturæ et de Nullitate Magiæ*, he says "that from saltpetre *and other ingredients* we are able to make a fire that shall burn at any distance we please." In chap. xi. of the same work these other ingredients are veiled in the disguise of an anagram: "Sed tamen salis petræ *lura nope cum ubre* et sulphuris, et sic facies tonitrum et coruscationem, si scias artificium;" the unmeaning words in italics have been translated as *carbonum pulvere*. Robins, in his work on gunnery (1742), and Dutens (*Enquiry into the Origin of Discoveries attributed to the Moderns*), suggest that Bacon may have derived his knowledge from the MS. of Marcus Græcus, preserved in the National Library in Paris, entitled "Incipit *Liber Ignium* a Marco Græco prescriptus, cujus virtus et efficacia est ad comburendum hostes, tam in mari quam in terra." Marcus Græcus, who lived about the end of the 8th century, was therefore not ignorant of the military uses to which the composition might be put; among other modes of launching fire upon an enemy he gives one to the following effect:—one pound of live sulphur, two of charcoal of willow, and six of saltpetre, reduced to a fine powder in a marble mortar and mixed together; a certain quantity is to be put into a long, narrow, and well compacted cover, and then discharged into the air. This is evidently the description of a rocket. It has also been suggested that Bacon may have learnt the secret in Spain, in which country he is known to have travelled, and whose Moorish masters were then far in advance of the rest of Europe in science and literature. Albertus Magnus, in his treatise *De Mirabilibus Mundi*, repeats almost word for word several receipts in the work of Marcus Græcus; also, an epistle by Ferrarius, a Spanish monk, and a contemporary of Bacon, which is preserved in the Bodleian Library at Oxford, gives receipts for Greek fire, rockets, and "thunder." There is a treatise on gunpowder in the library of the Escorial, written about 1250, which appears to describe both rockets and shells; the Arabians are, from this and other authorities, supposed to have enclosed combustible or explosive compositions in hollow globes of iron, which were discharged upon the foe either by hand, like the modern grenade, or from the warlike machines then in use; it has also been stated that towards the close of the 13th century they projected small balls from tubes carried in the hand, or attached to the end of a lance, and only used at close quarters, being in fact hand-guns. Rockets were employed during the reign of the Greek emperor Leo, about 880, and indeed seem to have been known in India from time immemorial, some of them having been made of great size.

The gloom of the dark ages precludes further attempt to trace back the history of gunpowder with any certainty, but Mr. Dutens, in the work before quoted, adduces many passages from classical authors in support of his view that a composition of the nature of gunpowder was not unknown to the ancients, as, for example, the story of Salmoneus, king of Elis, who, according to Virgil (*Æneid*, vi. 585), for his audacity in attempting to imitate thunder and lightning was slain by Jupiter; Mr. Dutens considers he may have fallen a victim to his own experiments. Eustathius, a commentator on Homer, speaks of him as being so skilled in mechanics that he constructed machines to imitate thunder (Eustathius ad *Odyss.*, λ 234, p. 1682, l. 1; see also Hyginus, *Fabul.*, 61, 650; Valerius Flaccus, lib. i. 662). It is also narrated of Caligula by Dion Cassius (*Hist. Rom.*, "Caligula," p. 662) that he had machines which imitated thunder and lightning, and emitted stones. See also Johannes Antiochinus, *Chronica apud Peiresciana Valesii*, Paris, 1604, p. 804.

According to Themistius (*Orat.*, xxvii. p. 337) the Brahmins had similar machines. Philostratus, in his life of Apollonius Tyanæus (lib. ii. cap. 14), written about 200 A.D., relates of a people of India, dwelling between the Hyphasis and the Ganges, whose country Alexander never entered: "Their cities he could never have taken, though he had led a thousand as brave as Achilles, or three thousand such as Ajax, to the assault; for they come not out to the field to fight those who attack them, but these holy

men, beloved by the gods, overthrow their enemies with tempests and thunderbolts shot from their walls."

From the mention by Vitruvius, and in Plutarch's life of Marcellus, that one of his machines threw large stones with great noise, it has been thought that Archimedes used some explosive composition in the defence of Syracuse.

The most ancient reference of all is in the Gentoo code of laws (Halhed's translation), supposed by some authorities to be coeval with Moses. It runs thus: "The magistrate shall not make war with any deceitful machine, or with poisoned weapons, or with cannon and guns, or any kind of firearms." The translator remarks that this passage may "serve to renew the suspicion, long since deemed absurd, that Alexander the Great did absolutely meet with some weapons of that kind in India, as a passage from Quintus Curtius seems to ascertain." The word translated firearms is literally a weapon of fire, and one species of it has been described as a dart or arrow tipped with fire and discharged from a bamboo, so that the reference may not be to any *propelling* agent, but merely to some combustible or incendiary composition, of the nature of the so-called Greek fire.

Greek fire.

It is almost certain that those authors who assert that the Arabians used gunpowder at the siege of Mecca, 690 A.D., having derived their knowledge of it from India or China, confound gunpowder with this Greek fire, which seems to have been the generic name given to several different combustible mixtures, although Arabian writers speak of them as Chinese fires. Greek fire was introduced into Constantinople from the East about the year 673; it was discharged upon the enemy by means of various engines of war, or in smaller quantities attached to arrows or darts. The Saracens used it against the Crusaders. Maimbourg, in his *History of the Crusades*, describes its effects; and Joinville, who was an eye-witness, says "it was thrown from a petrary, and came forward as large as a barrel of verjuice, with a tail of fire as big as a great sword, making a noise like thunder, and seeming like a dragon flying in the air; the light it gave out from the great quantity of fire rendered the camp as bright as day, and such was the terror it occasioned among the commanders in the army of St. Louis that Gautier de Cariel, an experienced and valiant knight, advised that, as often as it was thrown, they should prostrate themselves upon their elbows and knees, and beseech the Lord to deliver them from that danger against which he alone could protect them." However, its actual destructive effect seems to have been very inadequate to the terror it occasioned. From the account of Geoffrey de Vinesauf, sand and earth, but especially vinegar, appear to have been considered the best extinguishers; water would not put it out. One description of this wildfire was composed of resin, sulphur, naphtha, and probably saltpetre. Bacon states that religious scruples hindered European nations from adopting Greek fire; but if so, they seem to have been gradually overcome, for its use is mentioned by various writers, Anna Comnena, Père Daniel, and Froissart among them. Similar scruples no doubt considerably retarded the introduction of gunpowder; and the fear that its adoption would prove fatal to all knightly gallantry also caused it to be regarded with aversion. Firdousi, the famous Persian poet, describes in his writings what were doubtless the effects of rockets and wildfire discharged upon the enemy, but he ascribes the whole to magic.

Eastern origin of gunpowder.

The researches of all authorities seem to point to the Far East as the birthplace of an explosive mixture of the nature of gunpowder; it was used there from time immemorial, although doubtless its application as a propelling agent is of far later date. In all probability, the germ of the science of explosives lay in the accidental discovery of the peculiar properties of the nitre so plentifully found mixed with the soil upon the vast plains of India and China. By means of the charred embers of wood-fires, used for cooking, the two most active ingredients of gunpowder might easily be brought into contact, and, under the action of heat, more or less deflagration would ensue; in fact, the accidental dropping of some of the crude saltpetre into the coals would show its remarkable power of supporting and accelerating combustion. The combination of saltpetre and charcoal in a more or less powerful mixture can therefore be easily conceived, the sulphur being an after addition, and not necessary to cause explosion. Our present gunpowder is only the improvement and perfection of such a mixture. Saltpetre was early known as "Chinese snow," and some have supposed the use of gunpowder in cannon to have been known in China very soon after, if not before, the Christian era. But this seems to be an error, for Colonel Anderson, C.B., in his book on gunpowder (London, 1862), quotes a conversation held by John Bell of Antermony, who visited Peking in 1721, with the emperor's general of artillery, to the effect that from their records it had been used in fireworks, etc., for about 2000 years, but that its application to the propulsion of shot was a late introduction. Some of their compositions had such names as "devouring fire," "earth thunder," etc. The *Institutes of Timur*, written about the middle of the 14th century, contain no mention of cannon or gunpowder, although full particulars are given of the equipment of his troops; it is, however, related that when Timur engaged the army of Mahmud under the walls of Delhi, men scattered wildfire and flung rockets in every direction. In this connection it may be noted that, while the use of rockets was of very old date in India, the names given to pieces of artillery under the rule of Baber and the Mogul conquerors of Hindustan almost invariably point to a European, or at least to a Turkish origin. It is also well authenticated that Akbar and Aurungzebe had Englishmen and other Europeans in their service to teach the art of gunnery. The analysis of the gunpowder made by the Chinese in the present day shows a composition almost identical with that employed in Europe, which has only been arrived at after centuries of experience, so that, in all probability, they have corrected their earlier formula from Western sources.

Its introduction into Europe.

Whatever obscurity may hang over the early history of gunpowder, it seems most probable that its employment as a propelling agent originated among the Moors or Saracens,—whose civilization for several centuries contrasted forcibly with the intellectual darkness of Christendom,—and from them spread eastward, as well as northward into Europe. Condé (*Hist. Dom. Arabs in Spain*) states that Ismail Ben Feraz, king of Grenada, who in 1325 besieged Baza, had among his machines "some that cast globes of fire with resounding thunders and lightnings resembling those of the resistless tempest; all these missiles caused fearful injuries to the walls and towers of the city." The first reliable contemporary document relative to the use of gunpowder in Europe, a document still in existence, bears date 11th February, 1326; it gives authority to the priors, the gonfalonier, and council of twelve of Florence to appoint persons to superintend the manufacture of cannons of brass, and iron balls, for the defence of the commune, camps, and territory of the republic.

First use in England.

If the testimony of John Barbour, archdeacon of Aberdeen, who wrote in 1375, is to be believed, cannon, which he calls "crakys of war," were employed during the invasion of Scotland by Edward III. in 1327; but they are not mentioned in the accounts of the expenses of this war preserved in the record office. An indenture, first published by Sir N. H. Nicolas in his *Hist. Royal Navy* (London, 1847), and since by Lieut.-Colonel H. Brackenbury (*Proceedings R. A. Institution*, 1865), stated to be of 12 Edward III., 1338, contains several references to small cannon as among the stores of the Tower, and also mentions "un petit barrell de gonpouder le quart'plein." If authentic, this is certainly the first distinct mention of gunpowder in Great Britain we now possess, but doubts have since been thrown upon the date of this MS. It, however, seems certain, from a contemporary document in the National Library in Paris, that, in this same year 1338, there existed in the marine arsenal at Rouen, an iron weapon, called "pot de fer," for propelling bolts, together with some saltpetre and sulphur to make powder for the same; at this period the ingredients were usually kept separate, and mixed when required. From the year 1345, 19 Edward III., we have, preserved in the Record Office, reliable accounts of the purchase of ingredients needed for the fabrication of gunpowder, and of the shipping of cannon for France. In 1346 Edward III. ordered all the saltpetre and sulphur that could be found to be bought up for him, but the quantities obtained were very small. Whether it be true or not that cannon were used by the English at Crécy in that year belongs rather to the question of the employment of artillery in the field; it has been maintained that such was

the case by Napoleon III. (*Études sur le passé et l'avenir de l'Artillerie*). It may be noted that Petrarch, about the year 1344, in his dialogues *De remediis utriusque fortunæ*, speaks of "brazen globes cast forth by the force of flame with a horrible sound of thunder" as having become as common as any other kind of weapon.

In the year 1377, being the first of Richard II., Thomas Norbury was ordered to buy, amongst other munitions, sulphur, saltpetre, and charcoal to be sent to the castle of Brest. In 1414 Henry V. ordered that no gunpowder should be taken out of the kingdom without special license; in the same year this monarch also ordered twenty pipes of powder made of willow charcoal, and various other articles for the use of the guns.

It was not, however, until the reign of Elizabeth that the manufacture of gunpowder can be said to have been established in England. The greater portion required had been previously imported from abroad, and the trade had been an open one; but the threatening attitude of Spain compelled the Government to provide more efficient means of defence, and patents were issued by the crown for the manufacture of gunpowder, constituting it a monopoly. Early in this reign also, saltpetre began to be artificially produced in England, but the quantity so obtained formed a very small proportion of the supply needed, the remainder being brought from various parts of the Continent, and from Barbary. Again, in 1623, nominally in order to prevent the sale of weak or defective powder, a proclamation was issued by James I., prohibiting its manufacture, as well as that of saltpetre, except under the king's commission, and directing that all gunpowder should be proved and marked by the sworn proof-master. A little later, in 1626, the East India Company had commenced the importation of saltpetre, and had also erected powder works in Surrey. Their renewed charter in 1693 contained a clause providing that 500 tons of saltpetre were to be furnished to the ordnance annually, and from this time forward we hear of no difficulty, at least in England, of obtaining the chief ingredient of gunpowder, although on the Continent great attention has been paid to its artificial production; this was especially the case in France during the reign of Napoleon I., when the supremacy of Great Britain at sea for many years prevented the importation of saltpetre by her enemies.

About the year 1590, George Evelyn, grandfather of the celebrated John Evelyn of Wooton, received the royal license to set up powder mills at Long Ditton and Godstone; the Evelyns are said to have brought the art from Holland. The works at Faversham, afterwards for so many years the Government gunpowder factory, date from Elizabeth's reign, but were then of secondary importance to those at Godstone. There seems reason, however, to suppose that powder mills existed at Waltham Abbey so far back as 1561, for in that year we find John Thomworth of Waltham in treaty, on behalf of Queen Elizabeth, for the purchase of saltpetre, sulphur, and staves for barrels. Fuller also refers (*English Worthies*, i. 338) to the powder mills at Waltham Abbey, of which place he was appointed vicar in 1641. In 1787 they were sold to the crown by John Walton, and reorganized under the superintendence of the famous Sir William Congreve. The old royal factory at Faversham was given up after the peace of 1815, being first let and afterwards sold to the well-known firm of Messrs. John Hall & Son; a third Government factory at Ballincollig was disposed of a few years later. The Waltham Abbey works have been greatly enlarged of recent years, and no expense has been spared to render them, by the introduction of new and improved machinery, the most complete as well as the safest in the world. It is impossible to describe in detail the various improvements which have been made in the manufacture of gunpowder, but the most important will be briefly stated when describing the successive processes to which the ingredients are subjected.

The Ingredients and their Action.

Objects to be attained.

The objects to be attained in the production of an explosive agent for artillery and small arms are—(*a*) the maximum of propelling force; (*b*) the minimum of *initial* pressure in the bore of gun; (*c*) uniformity of action; (*d*) freedom from fouling, especially in small-arm powders; (*e*) durability, *i. e.*, power to bear transport and keep well in store. Of all explosive substances at present known, gunpowder alone can be said to fulfil the first three conditions. Its advantages may be summed up as follows:—(*a*) the rate of combustion of gunpowder is gradual compared with that of most other explosives; and, both by adjusting the proportions of the ingredients and varying the mechanical processes of manufacture, its explosiveness can be modified so as to suit every description of weapon; (*b*) the ingredients are easily procured, and are comparatively cheap; (*c*) with proper precautions, it is comparatively safe in manufacture, in store, and in transport; it also keeps well in a moderately dry atmosphere.

Advantages of gunpowder.

The earliest gunpowder used in cannon in Europe consisted of equal parts of saltpetre, charcoal, and sulphur, ground up and mixed together as required, and must have proved a mixture far inferior in strength to that given in the MS. of Marcus Græcus. To account for the use of such a very weak composition long after better proportions had been ascertained, it must be remembered that the earliest cannon were composed of iron staves roughly hooped together; and tubes of thin iron, or even of wood or leather, with rope coiled round them, were sometimes used. Indeed the effective application of gunpowder as a propelling agent involves a whole series of inventions, and it was doubtless chiefly owing to the backward state of mechanical science during the Middle Ages that such weak powders were employed. The slow growth of artillery science in Europe for five centuries, and its rapid development in very recent years, are facts which support this presumption. Even about 1410 the proportions were still but 3 saltpetre, 2 sulphur, and 2 charcoal. The relative amount of saltpetre was gradually increased, and Tartaglia (*Quesiti e Inventioni diversi*, Venice, 1546) mentions twenty-three various compositions as having been used at different times; the gunpowders of his days were—

Composition.

	Saltpetre.	Charcoal.	Sulphur.
Cannon powder.....	4	1	1
Musket "	48	8	7
or	18	3	2

It is remarkable that Robins states the above proportions to have been very nearly those of his own day (1742), for there is a great deficiency of saltpetre in the cannon powder, and a considerable excess in that for muskets, compared with the relative quantities now employed in England. For a long period of time it was the custom for the fine grain or musket powder to contain a larger proportion of saltpetre than that for cannon; and, again, the amount of nitre was relatively reduced as the piece of ordnance became heavier, doubtless with the view of obtaining a slower burning powder for large charges. However, we find that by the latter part of the last century, what was called "common war powder" was almost universally composed of 6 saltpetre, 1 charcoal, and 1 sulphur, and these are the proportions still in use by many Continental nations (D'Antoni *On Gunpowder*, translated by Capt. Thompson, R. A., London, 1787).

So far back as the 16th century, Baptista Porta is said to have arrived at the proportions now used in France, which, however, were certainly not adopted until a comparatively recent period. Exhaustive experiments have also been carried out in that country by Beaumé, the Committee of Public Safety, Chaptal, and Proust, who fixed upon percentages of saltpetre varying from 76 to 80, of charcoal from 13 to 16, and sulphur from 5 to 9. These may seem to give rather a wide margin, but this will surprise no one who is acquainted with the great differences in results given by comparatively slight variations in the conditions of experiment, with powder of the same composition. In the British Government service but one scale of proportions has been employed for many years, and the very extensive trials of the "Committee on explosives" have shown that there is no good reason to depart from that scale; for they have conclusively demonstrated that the variations in the mechanical and physical properties of gunpowder, produced by the processes of manufacture, exert even more influence upon its action than a comparatively considerable difference in composition, this does not, however, apply to the small charges used in firearms. It will be seen, moreover, that one of the three ingredients—charcoal—can be so varied in *quality* as very materially to affect the results.

The following table gives the percentage composition of gunpowder as now made in different countries for military purposes :—

	Saltpetre.	Charcoal.	Sulphur.
England, Royal Gunpowder Factory	75	15	10
France	75	12·5	12·5
Germany	76	14	10
Austria	76	14	10
Russia	75	15	10
Belgium	75	12·5	12·5
Spain (Cannon powder)	75	15	10
Spain (Rifle ")	75	12·5	12·5
United States	75	12·5	12·5

Trade powders.

The proportions of the ingredients in English commercial gunpowders vary considerably according to the market for which they are intended. The best sporting powders have about the same composition as those made by Government. Wherever cheapness is the chief object in view, the quantity of nitre is diminished, and the other two components relatively increased. Some of the powder for the African trade, commonly called "nigger powder," does not contain much more than 50 per cent. of saltpetre, while other kinds are nearly as bad. Blasting powder contains a low proportion of saltpetre, from 60 to 62 per cent.; but, although this reduction may originally have been made in order to manufacture a cheaper article, yet it is also the most effective for the object desired in many cases, which is to remove large masses of earth or soft rock, and this can best be done by using a comparatively weak or slow-burning powder. The element of time is here of great importance; a very quick-burning or violent explosive would not displace such large masses of a soft material, although the local effect would be more destructive (see BLASTING and EXPLOSIVES).

Before proceeding further, it will be as well briefly to consider the properties of the three ingredients of which gunpowder is composed, and the part played by each.

Saltpetre.

Saltpetre, or nitrate of potash (KNO_3), occurs as a natural production on or near the surface of the earth in several warm climates, especially the plains of India and China. When it arrives in England, it has only been partially separated from the earthy and foreign saline matters with which it was combined when found, and is quite unfit for the manufacture of gunpowder, the salts of sodium especially, from their property of absorbing moisture, are most injurious. In this state the saltpetre is known as "grough" nitre, the impurities commonly present being the chlorides of potassium and sodium, and the sulphates of potash, soda, and lime, together with sand and organic matter; they do not usually exceed 5 lb per cwt., the exact proportion of impurities in any sample being termed the "refraction" of the saltpetre, and allowed for in the price. The nitrate of soda, called "cubical nitre" or Chili saltpetre, which is found abundantly in South America, although chemically adapted to supply the place of potassium nitrate, cannot be employed in the manufacture of gunpowder, owing to its very deliquescent properties. This salt is, however, largely converted into saltpetre by the action of chloride of potassium. In France and Germany, also, nitre is produced artificially (see SALTPETRE).

Saltpetre, which is a compound of 54 parts of nitric acid and 46 of potash, acts as a magazine of oxygen in a solid form, one volume of saltpetre containing as much oxygen as about 3000 volumes of atmospheric air. This oxygen, with which it readily parts when raised to a certain temperature, combines violently with the carbon to form carbonic acid and a proportion of carbonic oxide; these with free nitrogen constitute the chief gaseous products of combustion. The potassium is found combined in the solid residue.

Charcoal.

Wood charcoal is the charred woody fibre or residue which remains after the liquid and more volatile parts have been driven off by destructive distillation. The object of charring wood is the removal of moisture, and, which is of great importance, the expulsion of those matters which become volatile before they are burned, and which would absorb a large amount of heat. It may be charred in the ordinary way in pits; but the usual mode of preparing charcoal for gunpowder is by heating it in large iron cylinders or retorts, as hereafter described. By this latter method, the operation is performed with more uniformity and economy, and the charcoal kept more free from particles of grit or earthy matter. Charcoal is best fitted for the manufacture of gunpowder when prepared from light spongy wood, containing a very small proportion of mineral substances; it should be sound, and of not much more than ten years' growth. The quality of the charcoal exercises the greatest influence upon the rate of combustion, so that both the description of wood used and the mode of burning are of the utmost importance.

By a series of experiments first made by Proust, and since repeated by English chemists, it has been found that 12 grains of various charcoals, mixed with 60 grains of saltpetre, give the following average volumes of gas :—

	Cubic inches.
Dogwood (*Rhamnus Frangula*)	82
Willow (*Salix alba*)	77
Alder	74
Filbert	72
Fir, chestnut, hazel	66
Overheated willow charcoal	63

The production of the strongest powder does not depend alone upon the evolution of the largest volume of gas, but the above table is of interest since the three descriptions of wood which head the list have long been considered by universal consent as the best adapted for the manufacture of charcoal for gunpowder. Dogwood (so-called, but in reality it is alder-buckthorn, *Rhamnus Frangula*, the French *bourdaine*) is an underwood of slow growth, usually obtained from Sussex, Belgium, or Prussia; it is cut about an inch in diameter, and packed in bundles 6 feet long. This wood is now used, both in England and on the Continent, for all military small-arm powders, as well as the best descriptions of sporting gunpowder. It has been found, moreover, that cannon powders made from dogwood charcoal are, other things being equal, much more violent in action than those manufactured with willow or alder charcoal. Accidents with powder made from dogwood charcoal have usually proved more destructive than those made with any other description. Alder and willow charcoal is used for making gunpowders for field and heavy ordnance, as well as for the commoner kinds of commercial powders; these woods are obtained from various parts of England, and should measure about 4 inches in diameter. The willow used is the *Salix alba*, one of the softest and lightest of English woods, white in color, and of very rapid growth; the pith is circular, and tolerably large. Alder is considerably harder and denser in texture, and of slower growth; its color is reddish-yellow, and the small pith triangular or bayonet-shaped in section. Dogwood has a very large pith in proportion to its size, circular, and of a red color, which is preserved even after the wood is converted into charcoal.

The temperature at which the wood is charred exercises the most powerful influence upon the inflammability of the charcoal, and consequently upon the "explosiveness," or rate of combustion, of the gunpowder made from it. The higher the temperature the larger the proportion of hydrogen and oxygen expelled, and the nearer the approach of the charcoal to pure carbon; at the same time, it becomes more dense and incombustible, and the gunpowder made from it is comparatively slow in action, and gives a low initial velocity. Charcoal prepared at a low temperature is softer and more inflammable, and contains more volatile constituents; it makes a quicker burning powder, giving a higher velocity to the projectile, but also producing more strain or pressure upon the metal of the gun. The chief defect, however, of this "slack-burnt" charcoal, or *charbon roux*, as it is called from its reddish-brown color, is its property of absorbing moisture more readily than denser charcoal; the powder manufactured from it is consequently more hygroscopic, and therefore more liable to deteriorate in strength from the effects of damp than that made with a more highly burnt charcoal. To show the great difference in inflammability caused by burning at low and high temperatures respectively, it may be stated that charcoal prepared at 500° Fahr readily ignites at about 640°, while, if burnt at 1800° Fahr., nearly double the heat previously mentioned is required to inflame it. The following table exhibits concisely the practical effects of different modes of preparing charcoal for gunpowder, the same kind of wood being used in each case; it shows (*a*) the analysis of the charcoals, and (*b*) the comparative initial velocities and

pressures given by powders made in a precisely similar manner from those charcoals.

		No. 1. Burnt 7 hours at a low heat.	No. 2. Burnt 4 hours at a greater heat.	No. 3. Burnt 3 hours at very high heat.
Charcoal.	Carbon ..... per cent.	78·23	81·23	87·55
	Oxygen, and trace of nitrogen ..... "	16·96	13·19	8·29
	Hydrogen ..... "	3·67	3·31	2·91
	Ash ..... "	1·41	1·27	1·25
Initial velocity (feet per second)		1417	1399	1353
Mean pressure in powder chamber (tons per square inch)		16·83	13·54	8·85

Sulphur. For the manufacture of gunpowder, only the crystalline electro-negative variety of sulphur soluble in bisulphide of carbon (see CHEMISTRY, vol. v. p. 432) is used. Sublimed sulphur, commonly called "flowers of sulphur," which consists of minute granules of insoluble sulphur enclosing the soluble variety, is considered unfit for gunpowder; the reason assigned has usually been that, from the mode of manufacture, it is impregnated with sulphurous and sulphuric acids, but Professor Bloxam points out that in all probability it is the fact of the sublimed sulphur consisting of the electro-positive insoluble variety, which exerts an injurious influence upon the gunpowder made from it. Sulphur performs the part of a second "combustible" in gunpowder; but there is no doubt that its chief value as an ingredient thereof arises from its great inflammability, owing to its tendency to combine with oxygen at a moderate temperature; it inflames at about 560° Fahr., thus facilitating the ignition of the powder. Its oxidation by saltpetre appears also to produce a higher temperature than is obtained with charcoal, thus accelerating combustion, and increasing by expansion the volume of gas generated. An excess of sulphur would, however, be injurious by increasing the solid residue, in which the sulphur is found combined in various forms after the explosion. Some authorities have considered that, from its non-absorbent properties, sulphur renders gunpowder less hygroscopic, and more compact and durable.

Explosiveness. Powders made from exactly the same materials, mixed in the same proportions, yet differ greatly in "explosiveness," which has been defined as the rate at which the powder burns or is converted into gas. This quality will depend chiefly upon the following properties:—(*a*) extent of incorporation; (*b*) the density of the powder; (*c*) its hardness; (*d*) size of the grains or pieces; (*e*) shape of the grains; (*f*) amount of glaze. Although not altogether synonymous with strength, we may consider "explosiveness" as the quality upon which the value of gunpowder for any particular purpose chiefly depends.

Extent of incorporation. Next to the selection of the precise description of charcoal to be used, no point in the manufacture of gunpowder requires such care and attention as the thorough intermixture of the ingredients,—the object being in fact to form out of the three components a new substance as nearly homogeneous as possible. It is usually considered that there is a limit of time beyond which no advantage is gained by continuing the "milling" or incorporating process; but it is certain that nothing that can be done to the powder afterwards will add to its strength, although we may modify its explosiveness, and that the very best powders, especially for small-arms, are milled the longest time. This question will be further treated under the head of manufacture.

Density and hardness. No physical property affects the explosiveness of gunpowder as much as its density. By density we mean the quantity of matter actually present in a certain bulk of the powder. Thus, if different quantities of meal powder, containing the same proportion of moisture, be compressed into equal bulks, say, for example, into cylinders of equal size, that which contains the most meal will be the densest. Hardness has not necessarily a relation to density, for a substance may be hard, and yet possess little density. Increase of density can only be given by compressing the meal into a smaller bulk, while increase of hardness can be arrived at by pressing the meal in a moister condition.

Other things being equal, increasing the density decreases the initial velocity, and, *vice versa*, a less dense powder gives a higher velocity, but also a greater strain to the metal of the gun. This is due to the less dense powder burning more rapidly than that with a dense close texture. If two grains, or pieces of powder, of equal size and similar shape but very unequal density, be burnt upon a glass plate, the less dense one will be entirely consumed before the denser one has finished burning.

Freedom from fouling is a very important property in small-arm powders. From the experience gained in selecting a powder for the Martini-Henry rifle, it was found that, with the same description of charcoal, the slower the action of the charge the less fouling took place; this modification of action was easily obtained by raising the density, at, however, a corresponding sacrifice of velocity in the bullet. The reason assigned was that the quicker-burning powder caused a rush of gas past the lubricating wad before the latter had time to act properly. A dense hard powder which will take a high polish or glaze will evidently keep better, and bear transport better, than a more porous and therefore more friable grain, which would easily form dust. It will thus be seen that many considerations enter into this question of density.

Size of grains. The size of grain is one of the most important points to be considered as modifying the explosiveness of powder. Although a charge of powder appears to explode instantaneously, yet both ignition and combustion are comparatively gradual; the flame is communicated from one grain to another, and each burns in concentric layers until it is consumed, so that the combustion of the grains is not *simultaneous*. Meal-powder burns more slowly in air than when the powder is granulated, in consequence of the minuteness of the interstices; dust, especially in fine-grain powder, retards ignition by filling up the interstices. To go to the other extreme, as showing the advantage gained by granulating the press-cake, we may quote an experiment made some years ago. A small piece weighing 1·06 oz. was placed in a mortar, and a light ball placed upon it; when it was fired, the ball was not thrown out. An equal quantity broken into 15 pieces, projected the ball 3·3 yards; broken into 50 pieces, the ball ranged 10·77 yards; when the same weight of ordinary grained powder was used, the range was 56·86 yards. It is most unsafe to attempt to apply to the action of gunpowder, when fired under enormous pressure, and especially when employed in large charges, the conclusions arrived at from its combustion in air. We may, however, assert that the weight of charge, the density, and all other conditions being equal, a charge made up of large grains or pieces of gunpowder will burn more slowly, and exert a lesser *initial* strain upon the gun than one composed of small grains, owing to the total surface of combustion being diminished by increasing the size of the pieces; this has been abundantly verified by the results of experiments with heavy rifled ordnance. On the other hand, the larger grains afford larger interstices between them for the passage of the flame, thus facilitating the ignition of large charges. Hence, a gunpowder may possess a low rate of combustion and yet a high rate of ignition, and *vice versa*. For each gun, or charge of gunpowder, there is doubtless a size of grain which would produce a maximum velocity with a minimum initial strain, but as each kind of cannon powder has to be employed in more than one piece of ordnance, it is necessary to select that size which will best suit all of them.

Shape of grains. The same quantity of powder meal made into two grains of equal density, but different shapes, will take different times to burn; the larger the surface exposed the quicker will be the combustion of the grain. A sphere being the smallest form in which a given quantity of matter can be placed, it follows that a certain amount of meal powder compressed into a spherical form will take longer to burn than the same quantity made into the shape of a flat scale, exposing a large surface. The rounded form of grain is the most favorable for the transmission of the flame, the interstices being larger and more regular than in the case of elongated or flat grains fitting into one another. Hence we may conclude that, to secure *uniformity*, it is better to have the constituent grains as nearly as possible of the same shape, and the nearer this shape approaches a sphere the better.

Glazing. The glazing process is one of considerable importance, both with reference to the explosive-

ness, and also the keeping qualities of the gunpowder. As regards the former point, it undoubtedly modifies the violence of the combustion, and this it probably does by slightly retarding the ignition, a powder with a rough porous surface affording a better hold to the flame than one possessing a highly polished exterior. With the large "cubical" powder, used for heavy rifled ordnance, there is little or no appearance of what is commonly understood as *glaze*, or polish, from this process, but the corners and edges of the cubes are rubbed off, and the shape approximates more nearly to that of a sphere than is the case with the much lighter fine-grain powder; there seems to be also a certain hardening of the surface of the grains or pieces, partly the effects of friction, but probably due in part to the *sweating* the powder undergoes, a considerable amount of heat being generated in the glazing barrels. It is evident that, by taking away the sharp angles which would otherwise easily be converted into dust, and also by giving the grains a harder exterior, this process renders gunpowder the better able to bear transport, and to resist the deteriorating effect of a damp atmosphere. The addition of a thin coating of the purest graphite to cannon powders, although originally intended merely to modify the explosiveness, also renders the surface of the grains less absorbent. Military small-arm powders are never dressed with graphite; good fine-grain gunpowder will take a high finish without it, but, by its aid, a very inferior article can be polished up to a silvery brightness.

Effect of moisture.

Moisture in gunpowder reduces the explosiveness by using up a portion of the heat generated by the combustion, to get rid of the water; therefore the property of withstanding the absorption of moisture is a very important one for gunpowder to possess. All powder will take up from a normally dry atmosphere a certain amount of moisture, which will depend to some extent upon its density, but to a much greater degree upon the description of charcoal from which it is made. Slack-burnt or red charcoal is greatly more hygroscopic than black charcoal, or that burnt at a high temperature; and the absorbent properties of gunpowder made from the former are but little reduced by raising the density. Large cannon powder contains a greater percentage of water than the fine grain, and the actual amount present in any given sample will be affected by the prevailing state of the atmosphere, especially if kept in wooden barrels. To show the considerable effect upon the initial velocity of projectile, and pressure in bore of gun caused by comparatively slight variations in the amount of moisture, the following results may be quoted from the experiments of Noble and Abel. The samples of "pebble" powder used were specially prepared for the Committee on explosives, differing only in the amount of moisture contained in them.

Percentage of Moisture.	Muzzle Velocity. Feet per second.	Maximum pressure. Tons per sq. inch.
0·7	1545	22·02
0·8	1537	21·38
0·9	1530	20·77
1·0	1523	20·18
1·1	1517	19·63
1·2	1512	19·12
1·3	1507	18·63
1·4	1502	18·18
1·5	1497	17·76

Keeping gunpowder in a very damp atmosphere will tend to separate the ingredients by dissolving a portion of the saltpetre, which crystallizes upon the surface of the grains or pieces.

Fired Gunpowder.

Products of explosion.

In the explosion of gunpowder, the products of combustion are very materially affected by the conditions under which it is fired,—whether burnt in the open air, exploded under very great pressure in a tightly closed vessel, or the products allowed to expand in the bore of a gun. It may, however, be stated generally that the oxygen of the saltpetre converts nearly all the carbon of the charcoal into carbonic acid (CO_2), a portion of which combines with the potash of the nitre to form carbonate of potash ($K_2O.CO_2$), the remainder existing in the state of gas. The sulphur is for the most part converted into sulphuric acid (SO_3), and forms sulphate of potash, a large proportion of which, probably by secondary reactions, becomes hyposulphite and sulphide. The nitrogen of the saltpetre is almost entirely evolved in the free state, and the carbon not having been wholly burnt into carbonic acid, there is always a proportion of carbonic oxide (CO) present.

The decomposition is so complicated, and varies so considerably under different conditions of experiment, that it is impossible to represent the transformation by any single equation, but the following expression may give some idea of the primary reaction:

$$4KNO_3 + C_4 + S = K_2O.CO_2 + K_2O.SO_3 + N_4 + 2CO_2 + CO.$$

There is a very large proportion of residue, which, on cooling, assumes the *solid* form. The experiments of Noble and Abel prove that it is *liquid* very shortly after the explosion; indeed, it is probable that at the moment of maximum temperature, the ultimately solid products are more or less in a state of vapor, being deposited in a very finely divided state as the temperature falls.

Mechanical effects.

When a charge of gunpowder is exploded in the chamber of a gun, a large quantity of gaseous matter is evolved in a highly condensed state;—its tension, or expansive power, is, moreover, greatly increased by the heat generated during the transformation. The pressure being equal in all directions, the work done upon the projectile is due to the expansion of the permanent gases in the bore of the gun, which force is also considerably sustained—or the reduction of temperature due to the expansion in great measure compensated for—by the heat stored up in the ultimately solid residue. Any calculation which does not take this latter point into consideration will give far too low an estimate of the actual force of fired gunpowder (see Explosives).

With our present state of knowledge, it may be stated in round numbers that the gases evolved by gunpowder, *if it entirely fills the close vessel* in which it is exploded, will occupy at a temperature of 0° C. and 760 mm. barometric pressure, about 280 times the volume of the original powder, and will give a pressure of about 6000 atmospheres, or 40 tons per square inch.

Researches relative to fired gunpowder.

In view of the very different results which have been arrived at by various eminent authorities who have experimented upon fired gunpowder, the following brief account of their researches may be useful:—

Robins.

Robins, the father of scientific gunnery, in 1743 read before the Royal Society a paper describing experiments which showed that gunpowder, when fired, generated permanent gases, which, at the ordinary temperature and atmospheric pressure, occupied a volume 244 times greater than that of the unexploded powder. He further considered that the heat evolved was such that the tension of the permanent gases would be increased fourfold, and hence deduced the maximum pressure to be about 1000 atmospheres. In 1778 Dr. Hutton communicated in the same manner an account of his celebrated researches on the combustion of powder; he deduced the maximum pressure to be about twice that given by Robins, or a little over 2000 atmospheres, differing from the latter chiefly as to the temperature, for he considered that the volume of gases generated would occupy, under ordinary conditions, 250 times that of the powder. He also deduced formulæ for giving the pressure of the gas and velocity of the projectile at any point of the bore, but no allowance is made for the loss of heat in proportion to the work done, that fundamental principle of thermodynamics being then unknown; the error thus occasioned is, however, in part compensated for by the heat stored up in the non-gaseous products. In 1797 Count Rumford sent to the Royal Society his experimental determinations of the pressures given by fired gunpowder, which are remarkable as being the first attempt to do this by direct observation. The closed vessel he used was, however, very small, being able to hold but 28 grains when filled, and he only succeeded in measuring the results up to a charge of 18 grains. His plan of operation was to ascertain by repeated trial the least weight which would just confine the products of explosion, and thence to calculate the pressure; this he deduced from two series of experiments, which, however, gave some very anomalous results, to be as high as 100,000 atmospheres for gunpowder exploded in its own space. In 1823 Gay-Lussac, the celebrated French chemist, estimated the volume of the permanent gases evolved at 450 times that of the powder fired. but General Piobert assigns very probable reasons for supposing the quantity of gas determined to have been doubled in error. Gay-Lussac found the percentage com-

Hutton.

Rumford.

Gay-Lussac.

position of the gaseous products to be 52·6 carbonic acid, 5 of carbonic oxide, and 42·4 nitrogen. In 1857 Bunsen and Schiskoff published (*Poggendorff's Annalen*, vol. cii. p. 325) the results of their very important experiments; their determinations were—(1) that the permanent gases represented only about 32 per cent. of the weight of the charge, and occupied at the standard temperature and pressure about 193 times the volume of the original powder; (2) that the heat generated by exploding gunpowder in a close chamber is about 3340° C.; and (3) that hence the pressure would be about 4374 atmospheres, or 29 tons per square inch.

Bunsen and Schiskoff.

Major Rodman (Boston, 1861) published the results of extensive experiments carried on for the United States Government, in order to ascertain the pressures given by different powders in the bores of heavy guns. He employed a pressure gauge, which bears his name, and consists mainly of a piston to which is attached a knife edge acting upon a piece of soft copper, contained in a small cylinder at right angles to, and communicating with, the bore of the gun, this apparatus he also used to ascertain the pressure given by powder exploded in a closed vessel. The chief value of his experiments consists in their having established the fact that the size of the grain should be proportionate to the length and diameter of the bore of the gun.

Rodman.

Von Karolyi (*Poggendorff's Annalen*, April, 1863) carried out experiments from which he estimated that, for small-arm powder, the gases evolved occupied about 226 times the original volume, while cannon powder produced about 200 volumes.

Von Karolyi.

Captain Andrew Noble, F R.S., of Elswick, and Professor Abel, C. B., F.R.S., chemist to the British War Department, carried out a most extensive series of experiments on "Fired Gunpowder" (*Phil. Trans. Royal Soc.*, 1875), probably the most complete ever made, and undertaken collaterally with the Government "Committee on Explosives;" their mean results may be summed up as follows:—

Noble and Abel.

(A.) *When Fired in a Confined Space.*—(1) The products of combustion are about 57 per cent. by weight of *ultimately* solid matter, and 43 per cent. of permanent gases. (2) The latter occupy at 0° C. and 760 mm. barometric pressure about 280 times the volume of the original powder. (3) The tension of the products of combustion, when the powder entirely fills the space in which it is fired, is about 6400 atmospheres, or 42 tons per square inch. (4) The temperature of explosion is about 2200° C. (5) The chief gaseous products are carbonic acid, nitrogen, and carbonic oxide, with a little sulphydric acid and hydrogen. (6) The solid residue is mainly composed of potassium carbonate, sulphate, hyposulphate, and sulphide.

(B.) *When Fired in the Bore of a Gun.*—(1) The products of combustion, at all events so far as regards the proportions of solid and gaseous matters, are the same as in the case of powder fired in a close vessel. (2) The work on the projectile is effected by the elastic force due to the permanent gases. (3) The reduction of temperature due to the expansion of the permanent gases is in a great measure compensated by the heat stored up in the liquid (afterwards solid) residue. (4) An expression is obtained showing the law connecting the tension of the products of combustion with the volume they occupy. (5) Equations are also deduced for the work that gunpowder is capable of performing in expanding in a vessel impervious to heat, and for the temperature during expansion. Thence the experimenters give a table showing the total work gunpowder is capable of performing in the bore of a gun, in terms of the density of the products of combustion, or the number of volumes of expansion. (6) The total theoretic work of gunpowder when indefinitely expanded (for example, in a gun of infinite length) is about 486 foot-tons per pound of powder.

They further ascertained that—(*a*) the fine-grain powders furnish decidedly smaller portions of gaseous products than large grain or cannon gunpowders; (*b*) the variations in the composition of the products of explosion, in a close vessel, furnished by one and the same powder under different conditions as regards pressure, and by two powders of similar composition under the same conditions of pressure, are so considerable that no chemical expression can be given for the metamorphosis of a gunpowder of normal composition; and (*c*) the proportions of the several constituents of the solid residue are quite as much affected by slight accidental conditions of explosion of one and the same powder in different experiments as by decided differences in the composition, as well as in the size of grain of different powders. It may, however, be remarked here that, while the pressures given in the bore of a gun are very seriously affected by the size of the grains or pieces of the powder, it was clearly demonstrated by these experiments that the *force exerted by fired gunpowder* is not affected by the apparent accidental variations in the nature of the secondary chemical changes resulting from the explosions; this fact renders the exact composition of the products of combustion of less practical importance.

The following table gives concisely the chief results arrived at.—

Authority.	Volumes of Permanent Gas Generated.	Heat Evolved by Combustion	Tension of the Gases.	Pressure in Tons.
		Cent.	Atmospheres.	Per sq. in.
Robins	244	...	1000	6·75
Hutton	250	...	2000	13·5
Gay-Lussac	450[1]	1850°	2137	14·3
Bunsen and Schiskoff	193	3340°	4374	29
Noble and Abel	280	2200°	6400	42

[1] As before stated, Piobert gives reasons for halving these figures.

M. de Saint Robert determined experimentally the amount of work lost by the heat communicated to the gun to be about 250 gramme-units per gramme of powder *in the case of a rifled musket*. From the experiments of Noble and Abel this loss becomes reduced to as little as 25 gramme-units per gramme of powder in a 10-inch gun. They have also calculated the energy in foot-tons from the initial velocity obtained, and hence deduced the percentage of the possible theoretic work which is actually realized for every rifled gun in the British service. This percentage, which they term the "factor of effect," is found to be greatest, viz., 93 per cent., in the case of the 38-ton gun, and least, 50·5 per cent., in the 7-pounder mountain gun, weighing 150 lb.

To determine the pressures, Noble and Abel employed two methods:—(1) *directly*, by means of "crusher gauges," inserted at various points of the bore; this is an improvement on the Rodman piston-gauge, the pressure being estimated by the amount of compression given to a small cylinder of pure soft copper, (2) *indirectly*, by means of the chronoscope invented by Captain A. Noble, which measures the velocity of the projectile at given points in the bore, whence the pressure can be calculated (see GUNNERY). These pressures will vary greatly, other conditions being the same, according to the "explosiveness" of the powder, the great object is to obtain a powder suited to the particular arm with which it is to be used.

Determination of pressure in bore.

Many foreign physicists are of opinion that the phenomenon of *dissociation* comes into play at the moment of maximum temperature, causing the carbonic acid gas (CO_2) to be decomposed into carbonic oxide (CO) and oxygen. However, Noble and Abel show that, if such be supposed to occur, the loss of heat absorbed by the decomposition would more than compensate for the increase of volume.

Dissociation improbable.

PREPARATION AND PURIFICATION OF THE INGREDIENTS.

The three ingredients of gunpowder may be purchased in the market in a prepared or refined state, and this is done to a greater or less extent by many powder makers. However, the royal gunpowder factory, as well as some of the great private firms, prepare and purify the materials required from the commencement, with the double object of insuring uniformity in the qualities of the powders made, and of avoiding, so far as practicable, the introduction of the least particle of grit or other foreign matters, which might cause serious accidents.

The rationale of the refining process is based upon the fact that saltpetre is far more soluble in hot than in cold water, while the chief saline impurities found in grough nitre are almost equally soluble in either. Water at 212° Fahr. holds about *seven* times as much nitrate of potash in solution as water at 70° Fahr.; if, therefore, a saturated solution of saltpetre be made at a temperature of 212° Fahr., and the chlorides of sodium and potassium are contained in the liquor, as the solution cools to 70° Fahr., six-sevenths of the nitre will be deposited in the form of crystals, which can easily be removed, whereas the foreign salts will still remain in solution. The following is a brief account of the improved mode of refining saltpetre, introduced some years back at Waltham Abbey, and now adopted at the chief private factories in England. The refining coppers are capable of holding about 500 gallons each, and are fitted with false iron bottoms, which are perforated with holes to allow sand and other mechanical impurities to fall through. Being each charged with 280 gallons of water,—usually the "washings" of saltpetre previously refined,—and 40 cwt. of grough nitre, a fire is lighted beneath. In about two hours the greater part of the saltpetre is dissolved, and the solution begins to boil, the thick scum formed on the surface is carefully taken off, and cold water from time to time thrown in to induce it to rise, the boiling being continued until there is no more scum; the coppers are then filled up with cold water, and the solution again made to boil briskly for a few minutes, after which the fires are allowed to go down In about two hours more the solution will have fallen to the proper temperature, 220° Fahr. (sp. gr. 1·53) for pumping out, it is then filtered through dowlas bags suspended on a frame, and conducted by troughs to the "coolers" or crystallizing cisterns at about 180° Fahr. These latter are large shallow pans of copper, in which the liquid is kept agitated either by long-handled wooden hoes, or

Refining saltpetre.

by machinery; as it cools, fine crystals fall to the bottom, and are from time to time thrown upon inclined draining frames by means of perforated copper shovels. When the temperature falls below 70° Fahr., the agitation is ceased, and any large crystals which may afterwards form are left in the mother liquor. After being thus allowed to get rid of some of the liquor, the crystallized saltpetre, having almost the appearance of snow, and technically called "flour," is raked into the "washing-cistern;" it is there subjected to three separate washings with pure water, distilled being preferable, which is allowed to drain off through a plug hole at the bottom of the cistern. These "washings" are carefully conducted to an underground tank, and kept either for using in the refining coppers, or boiled down in "evaporating pots" holding about 300 gallons, until the liquid is sufficiently concentrated for the saltpetre to crystallize, when it is run into small copper pans, and set aside to cool; this course is also pursued with the mother liquor from the large cooling cisterns, and the resulting crystals treated as grough nitre, for these large crystals always enclose liquid containing impurities. After draining for a night the refined saltpetre is removed to store bins, and is ready for use without any further pulverization; the amount of moisture remaining in it, from 3 to 5 per cent., is then carefully ascertained, and allowed for in the mixing house. Neither the solid residue from the pots and coppers nor the mother liquor from crystallizing pans is thrown away, but by repeated boilings and evaporations every ascertainable portion of saltpetre is extracted, and the residue sold; it chiefly consists of chlorides of sodium and potassium, with some sulphates. The jute bags in which the saltpetre is imported are also boiled down.

The large percentage of saltpetre contained in damaged powder makes it worth while to extract the nitre by boiling in large coppers, filtering and crystallizing in small pans as before; the residuum is again boiled, and then thrown away. The sweepings from the powdor houses, in various stages of manufacture, are "extracted" in the same manner.

Refined saltpetre for making gunpowder is tested as follows:—(1) with blue and red litmus paper, for acids or alkalies; (2) for the presence of chlorides, with solution of nitrate of silver; (3) for sulphates, with chloride of barium, forming the insoluble sulphate of baryta.

By the old method of refining the solution was left to crystallize in coolers, and the drained crystals fused or melted in iron pots at a heat of about 500° Fahr.; the molten saltpetre was then poured into moulds, broken up when cold, and ground under edge runners.

Charcoal burning.

The wood for charcoal is cut in spring, so that the bark may strip off easily, and is stacked for about three years to season it, but a considerably shorter time will suffice. Being cut in lengths of 3 feet, the wood is packed in iron cylindrical cases termed "slips," which are then inserted in the "cylinders" or retorts, the latter being built into the wall in sets of three with a furnace underneath, arranged so as to allow of the complete regulation of the heat; the flames surround the retorts as nearly as possible. An opening is left in the rear end or lid of the slip, corresponding with a similar opening in the retort, through which, by means of pipes, the inflammable gases resulting from the charring of the wood are conducted into the furnace and there burnt; this saves a considerable amount of fuel. There are also pipes which receive and carry off the tar and pyroligneous acid produced. In the powder works of Messrs. Hall & Son, of Faversham, the retorts are disposed three on each side of the furnace, and the connecting pipes and dampers are so arranged that the gases from either set, or from any single cylinder, can be utilized for the charring of the wood contained in any of the others; by this means it is claimed that little fuel is required beyond the quantity needed to warm the furnace and partially char the first set of retorts.

That the wood is sufficiently charred is shown by the blue color of the gas flame, which indicates the formation of carbonic oxide; the door of the retort is then opened, and the slip is withdrawn by means of tackling, and placed in a large iron cooler having a close-fitting lid, where it is left a few hours till cool enough to be turned out and put into store. The charcoal is carefully picked over by hand, to insure its being of uniform quality, and is kept from ten days to a fortnight before being ground, to obviate the danger of spontaneous combustion, to which it is liable if ground too soon after burning; this arises from the heat generated by the very rapid absorption and condensation of oxygen from the air by the finely-powdered charcoal.

Characteristics of good charcoal.

Properly-made charcoal for gunpowder should be jet black in color, and its fracture should show a clear velvet-like surface; it should be light and sonorous when dropped on a hard substance, and so soft as not to scratch polished copper. Slack-burnt charcoal, or that prepared at a very low temperature, is at once known by its reddish-brown color, especially when ground, and this peculiarity can be recognized in the powder made from it, when reduced to a fine state of division. Charcoal burnt at a very high temperature is known by its hardness, metallic ring, and greater density.

In France, charcoal is prepared by injecting superheated steam into the retorts for a certain period.

Grinding the charcoal.

The charcoal mill in shape resembles an enlarged coffee mill; a cone works within a cylinder, both being provided with diagonal teeth and ribs, wide apart at top, but gradually approaching one another below. The pulverized charcoal is thence conducted by a simple mechanical arrangement direct into a cylindrical frame or "reel," about 8 feet by 3 feet, set at a slope and covered with copper wire cloth of about 32 meshes to the inch; all that is fine enough to pass through the reel-covering falls into a bin which encases the reel, and the coarser particles pass on to a tub at the further end, in order that they may be ground over again. The ground charcoal store should always stand by itself, in case of spontaneous combustion taking place.

Sulphur refining.

The sulphur from Sicily known as "Licata firsts" is employed for the best gunpowder; it undergoes a rough purification before importation, leaving from 3 to 4 per cent. of earthy impurities. Formerly these were removed by simply melting the "grough" sulphur in an iron pot, and then ladling it into large wooden moulds or tubs, saturated with water to keep the sulphur out of the cracks; when cool enough, these tubs were unhooped, and the top and bottom of each mould of sulphur cut off. In the present day, however, the sulphur is refined by distillation in a simple apparatus. A large iron "melting pot," or retort, is set in brickwork, about 3 feet above the floor, with a furnace underneath; this retort has a heavy movable lid, which is luted into the pot with clay, and in the lid is also an opening, closed by an iron conical plug. From the melting pot lead two pipes at right angles to one another, one to a large circular "dome," or subliming chamber, and a smaller pipe to an iron "receiving pot" placed on a lower level than the retort; the latter pipe has an iron casing or "jacket" round it, through which cold water is allowed to circulate. The communication of these pipes with the retort can be shut off or opened as occasion may require by means of valves worked from without.

A charge of about 5½ cwt. of grough sulphur in small pieces being placed in the retort and the furnace lighted, the pipe leading to the dome is left open, as well as the plug-hole in the lid, but that leading to the receiving pot is closed; after about two hours, a pale yellow vapor rises, when the plug in the lid is put in and the vapor allowed to pass into the dome, where it "sublimes" or condenses on the sides and floor in the form of a fine powder, known as "flowers of sulphur." In about three hours from the commencement, the vapor becomes of a deep iodino color, when the pipe leading into the dome is closed, and that into the receiving pot opened, at the same time cold water from a tank overhead being allowed to circulate through the jacket; the vapor is then condensed in the pipe, and runs into the receiving pot below in the form of a clear orange-colored fluid. When the jacket commences to get cold, the receiving pipe is closed, and the communication with the dome is reopened, so that the rest of the vapor may pass into it, the furnace doors being at the same time thrown back; the impurities remain at the bottom of the melting pot, and are thrown away. The flowers of sulphur thus obtained, being unfit for the manufacturo of gunpowder, are placed in the melting pot as grough sulphur. A leaden pipe passes from the lid of the receiving pot into a small wooden chamber lined with lead, in which any vapor still remaining uncondensed may be deposited, as in the domo. The distilled sulphur is allowed to cool down to about 220° Fahr., when it is ladled into wooden moulds, as above described, and set aside to cool. The tests for refined sulphur are the following:—(1) burn a small quantity on porcelain, when the amount of residuum should not exceed 0·25 per cent.; (2) boil a little with water, and test with blue litmus paper, which it should only very feebly redden.

Pulverizing the sulphur.

The sulphur from the moulds, being broken into pieces, is ground under a pair of iron edge-runners, similar to those of the incorporating mills, but of less size; after this, it is passed through a reel similar to that used for sifting the charcoal, but covered with even finer copper wire-cloth, having 44 meshes to the inch.

Manufacture of Gunpowder.

Processes of manufacture.

The following list will give a general idea of the chief processes of manufacture, properly so called, through which gunpowder passes, although it will be understood that more or less variation takes place in some of the very different descriptions of powder now made:—(1) mixing the ingredients; (2) incorporation, or "milling;" (3) breaking down the mill-cake; (4) pressing; (5) granulating, or cutting the press-cake; (6) dusting; (7) glazing; (8) second dusting, (9) stoving, or drying; (10) finishing.

Mixing. The following is the most approved method of mixing. The ingredients are carefully weighed out in the proper proportions for a 50 lb mill-charge, with an extra amount of saltpetre according to the moisture found to be contained in it; they are then placed in the mixing machine, which consists of a cylindrical gun-metal or copper drum, with an axle passing through its centre, upon which are disposed several rows of gun-metal fork-shaped arms, called "flyers," the machinery being so arranged that the flyers and drum revolve in opposite directions, and at different rates of speed. After being mixed in this machine for about five minutes, the composition is passed through a hand-sieve over a hopper, falls into a bag placed below, and is tied up ready for the incorporating mill; it is now called a "green" charge.

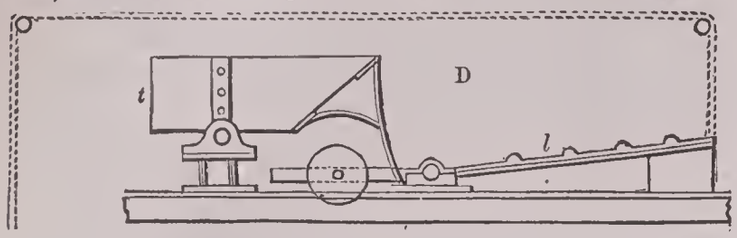


Fig. 1.

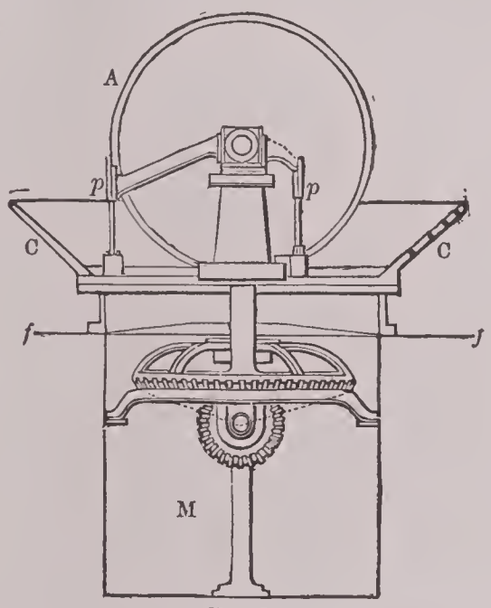


Fig. 2.

Figs. 1 and 2.—A, sectional elevation of incorporating mill, showing one runner and ploughs (*p*, *p*); C, curb of bed; M, machinery in tank, underground; D, drenching apparatus; *l*, lever-board, or shutter; *t*, tank; *f*, *f*, floor line.

Incorporation. The incorporating mill (see figs. 2 and 3) consists of a circular iron or stone bed, about 7 feet in diameter, firmly fixed in the floor of the building, whereon a pair of iron or stone cylindrical edge-runners revolve; formerly, both were made of a dark gray lime-stone which took a high polish, but the newer mills have cast-iron beds and runners, the edges of the latter being now usually surface-chilled. The average diameter of the runners is 6 feet, and their width about 15 inches; they have a common axle, which rests in gun-metal bouches in a solid cross-head attached to a vertical shaft; this shaft passes through a bearing in the centre of the bed, and is in gear with the driving machinery, which is placed above the runners in the old water mills, and beneath the bed in cast-iron tanks in the new steam mills. Each runner weighs about 4 tons, and the speed averages 8 revolutions per minute. The bed has a sloping rim on the outside, called the "curb," and on the inside an edge formed by the "cheese," or bearing, through which the vertical shaft passes. The runners are not equidistant from the centre of the bed, one working the part of the charge near the centre, and the other the outer portion, but their paths overlap. Two "ploughs" of wood, shod with leather, are attached to the cross-head by arms and brackets; one working next the vertical shaft, and the other close to the curb, the ploughs throw the composition under the runners as it works away from the latter.

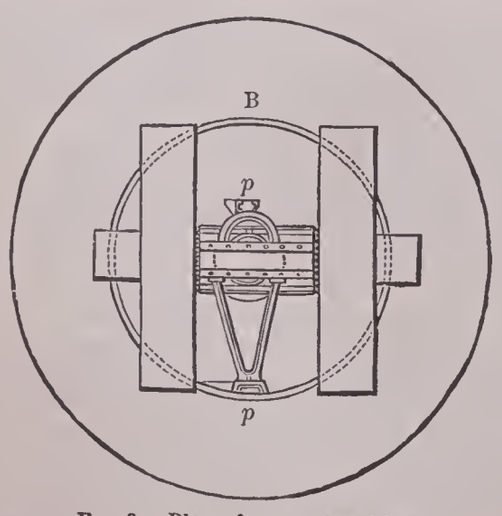


Fig. 3.—Plan of runners and bed.

The charge, when spread evenly on the bed by means of a wooden rake, contains about 2 pints of water (the moisture of the saltpetre) and a further quantity of from 2 to 6 pints is added from time to time, according to the state of the atmosphere, for the threefold purpose of preventing powder dust from flying about, facilitating the incorporation, and reducing the effect of an explosion; if too wet, the runners would lick up the composition from the bed. During the time of working, the millman enters the mill occasionally, takes a wooden "shover," and pushes the outside of the charge into the middle of the path of the runners, so that every portion may be equally incorporated.

The action of the runners is a combination of rolling and twisting, and has, on a large scale, somewhat the effect of a pestle and mortar, crushing, rubbing, and mixing the ingredients, so as to effect an intimate union.

The time of milling depends upon the nature of the powder. For good fine-grain powders it varies from four to eight hours, but the very best sporting gunpowder is said to be as long as twelve hours under the runners; blasting and cannon powders are incorporated from two to four hours, the period being rather longer where the lighter stone runners are used. It is of the greatest importance that the mills should be carefully attended to by experienced men, as the whole goodness and uniformity of the powder depends upon this process, and no after treatment can remedy defective incorporation.

When the composition, which has now become "mill-cake," is ready for removal from the bed, it should be homogeneous in appearance, without any visible specks of sulphur or saltpetre, and of a dark grayish or brownish color, according to the charcoal used The mill-cake is carefully tested to ascertain whether it contains the proper amount of moisture; this should be from 2 to 3 per cent. for fine-grain powders, and 3 to 5 per cent. for the larger descriptions. Sometimes a small portion is roughly granulated, and "flashed" on plates of glass or porcelain, a good powder should flash off, leaving nothing but some smoke marks, but, if badly incorporated, the plate will be coated with specks or beads of solid residue.

In former days the ingredients were incorporated in "stamp-mills," which were simply large mortars and pestles, the latter merely raised up by some cam arrangement and allowed to drop by their own weight, the charge being about 12 lb, and the weight of the stamp 50 lb or thereabout. The stamp or *pilon* mills are still used in France and Germany, as well as the *moulins-à-tonneaux*, in which the composition is put, with about an equal weight of brass or lignum vitæ balls, into large barrels, which are made to revolve for a certain time on their axes, this method of incorporation is sometimes employed in conjunction with edge-runners.

There is more danger of an explosion during the milling than in any other process of manufacture; but, owing to the limitation by law of the weight of charge permitted to be under the runners at one time to 50 lb, as well as to the great precautions taken, there is seldom any fatal result. The millmen only enter the mill occasionally to "liquor"

the charge or give it a shove over, and at Waltham Abbey they wear incombustible clothing with a cap fitting over the ears, and gauntlets of the same material. The roof, and front and rear sides of the mills are usually constructed of very light boards, or even of canvas on a wood frame, while the partitions between each pair of runners are of solid masonry. The force of the explosion of a mill charge materially depends upon the length of time the incorporation has been in progress.

Directly over the bed of each mill is a flat lever-board or "shutter" (see fig. 1) in gear with a tank of water, so arranged that, when the shutter is raised on its pivot by an explosion, the water is upset into the bed; a horizontal shaft connects all the shutters in a group of mills, so that the explosion of one mill at once drowns all the remaining charges. The set of tanks can also be pulled over by hand.

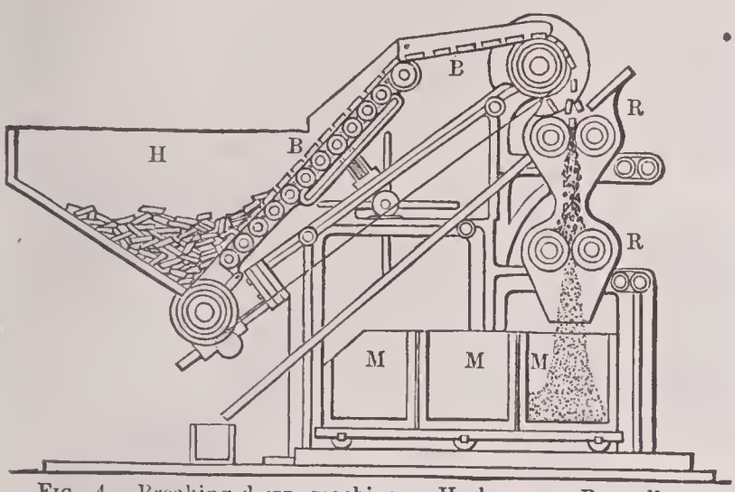


FIG. 4.—Breaking-down machine. H, hopper; B, endless band; R, rollers; M, boxes to receive meal.

Breaking down.

The process of breaking down, although a subsidiary one, is strictly necessary in order to reduce the mill-cake to a fine meal, so that it may be conveniently loaded into the press box, and receive as uniform a pressure as possible. The breaking-down machine (see fig. 4) consists mainly of two pairs of gun-metal rollers, set in a strong frame of the same material; one roller of each pair works in sliding bearings connected with a weighted lever, so that any hard substance may pass through without dangerous friction. An endless canvas band, having strips of leather sewn across it, conveys the pieces of mill-cake from a hopper, capable of holding 500 lb to the top of the machine, where it falls between the first pair of rollers; after passing through the second pair, which are directly below, the meal is received in wooden boxes, placed upon a carriage, and is ready for the press.

Pressing.

The press-box is usually of oak, with a strong gun-metal frame, and so constructed that three of the sides can turn back on hinges, or be screwed firmly together. Being laid sideways, the top temporarily closed by a board, and the uppermost *side* alone open, a number of copper plates are placed vertically in the box, and kept apart (at a distance depending upon the description of gunpowder required) by two racks, which are afterwards removed; the box is then loaded with some 800 lb of meal, which is rammed evenly down between the plates with wooden laths, and the racks withdrawn, so that the plates are only separated by the meal between them. The *present* upper side of the box being firmly screwed down, the box is turned over, and placed on the table of the hydraulic ram, under the fixed press-block, the plates being now horizontal (see fig. 5). The pumps which work the press (in a separate house) are then set in motion, and the press-block allowed to enter the box a certain distance, when the edge of the latter releases a spring catch and rings a bell as a signal to stop the pumps; the powder is kept under pressure a few minutes, after which the ram is lowered, and the box removed and unloaded. For all granulated powders the press-cake is broken up into pieces and put into tubs, but for the cubical cannon powders the slabs are pressed to the exact thickness required, and are carefully kept whole.

The above mode of regulating the pressure is found to give more reliable results than trusting to the indicator gauge of the hydraulic press, for the reason that the elasticity, or resistance to pressure, of the meal varies with the amount of moisture present in it, and the state of the atmosphere. To get uniform density, equal quantities of meal, containing equal amounts of moisture, must be pressed at the same rate into the same space. In practice, however, the moisture in the meal will slightly vary, whatever care be taken with the mill-cake, owing to the hygrometric state of the air causing a difference by the time it comes to the press. It is therefore necessary to alter the exact distance the press-block is allowed to enter the box, not only with the nature of the powder, but with the season of the year, and even according to the prevailing state of the weather.

On the Continent, the operation of pressing is sometimes altogether omitted, and the requisite density given merely by the weight of the runners revolving very slowly, the charges being worked with a considerable amount of moisture in them, and the less dense edges of the cake rejected; by this plan it is, however, almost impossible to ensure *uniformity* in the powder produced. The meal is also sometimes pressed by passing it, on an endless band, between large rollers revolving at a slow speed, the less dense edges of the cake being cut off by fixed knives.

Granulating.

For some centuries, gunpowder remained in the form of dust or "meal," being, in fact, simply the ingredients ground up together. Granulating or "corning" the powder was a great step in advance, but it is doubtful whether this operation was intended to increase its strength, or merely to render it more convenient for charging small arms, for which alone corned powder was used for many years, whilst meal powder was still employed for heavy guns; the latter was called "serpentine" powder in the time of Edward VI., probably in allusion to the name of one of the pieces of ordnance then in use. However, during the reign of Elizabeth, the experience of the great additional strength imparted by the corning process, for the reasons already explained, led to the universal introduction of corned powder, except for priming, —both in cannon and small arms,—for which purpose meal powder remained in use as late as the reign of Charles I.

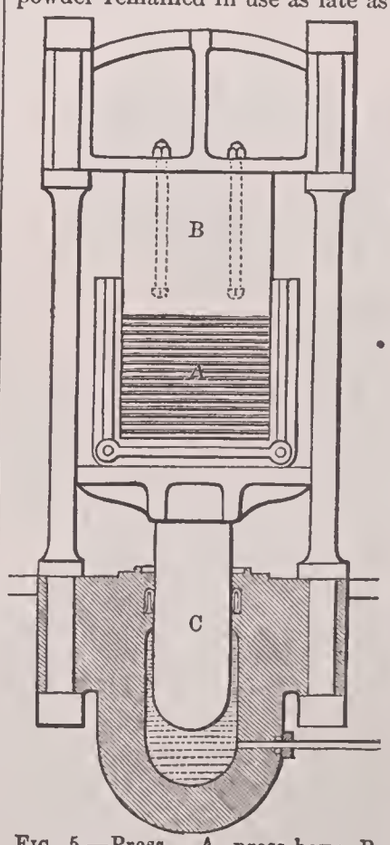


FIG. 5.—Press. A, press-box; B, press-block; C, hydraulic ram.

The old method of granulating was to place the press-cake in sieves, provided with two bottoms of thick parchment prepared from bullock's hides, and perforated with holes, those in the lower bottom being much the smaller; a large number of these sieves were attached to a wooden frame, hung by ropes from the ceiling, which received a violent shaking motion by means of a crank underneath. Into each sieve was put a disc of lignum vitæ, to break up the cake, and force it through the larger apertures; the grain produced was retained between the bottoms of the sieves, the dust passing through the fine holes in the lower ones, and falling on the floor of the house. The grain was afterwards separated into sizes by being passed through wire sieves. These machines were clumsy and dangerous; and the accidents which happened with them have caused them to be generally supplanted by better apparatus, although some of the old frames are still in use.

The granulating machines used in the royal factories in England and in India, as well as in the best private works, are constructed upon a principle introduced by Sir William Congreve, but since improved upon. Three or four pairs of gun-metal rollers with pyramidal-shaped teeth, are fixed

obliquely one above the other in a strong framework (see fig. 6); the sizes of the teeth vary according to the kind of grain required, but decrease from the top pair, and for fine-grain powders, the lowest pair would be smooth; one roller of each pair works in a sliding bearing, having a counterweight attached to prevent undue friction. Each pair of rollers is connected with that next below, by a short rectangular screen of copper wire; while, underneath all the rollers, are placed, at the same slope, two or more long wire-screens fixed in a frame having a wooden bottom; both the frame and the short connecting screens are hung to the machine by strips of lance wood, and, when at work, a

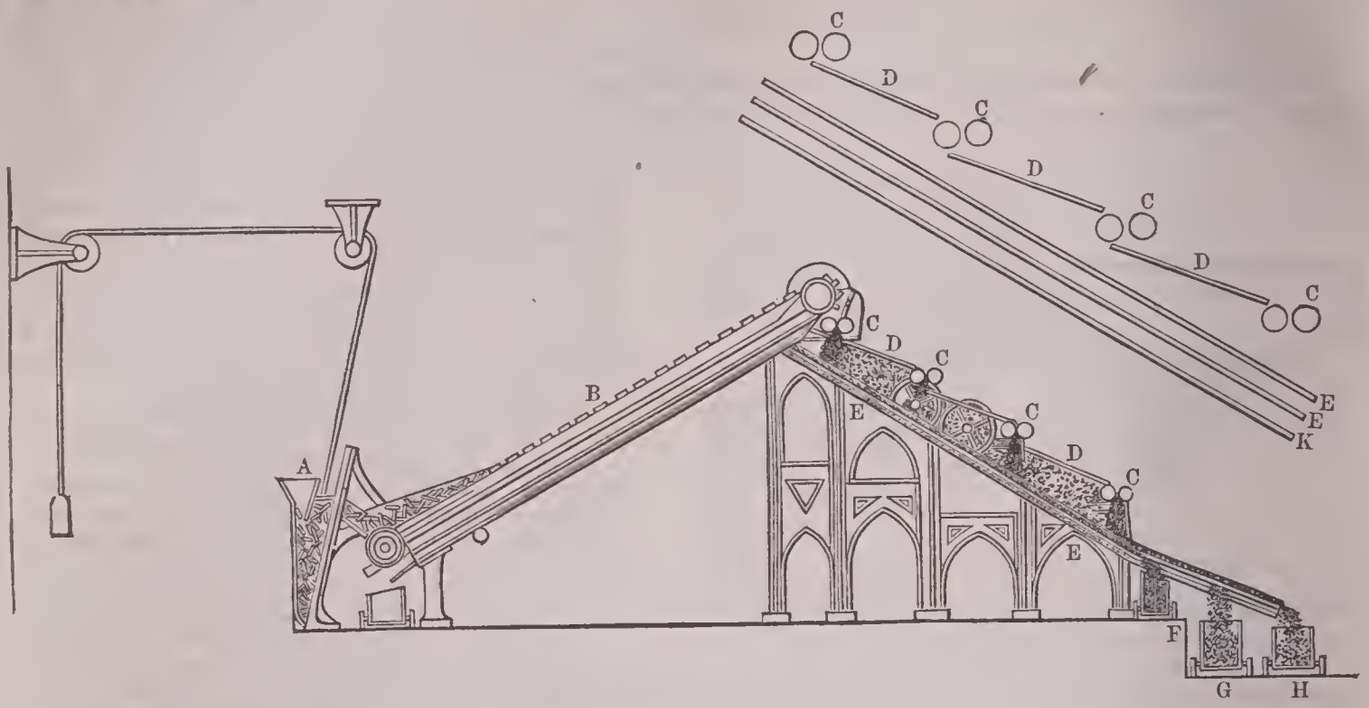


Fig. 6.—Granulating machine. A, hopper, with raising arrangement; B, endless band; C,C,C,C, four pairs of rollers; D,D,D, short screens; E,E, long screens; F, box for dust; G, box for grain; H, box for chucks; K, bottom board.

quick vibratory motion is given to all the screens by means of a polygonal wheel upon the main frame working against

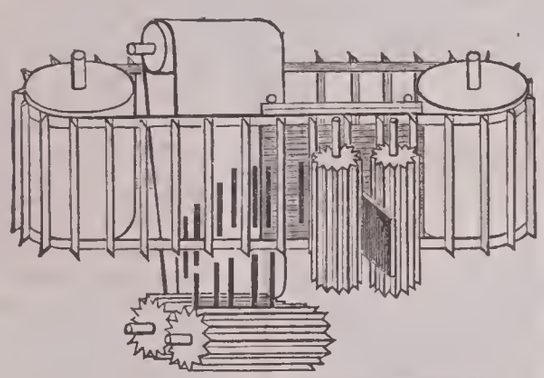


Fig. 7.—Rollers of cube-cutting machine.

a loose smooth wheel attached to the screen-frame. A large hopper, which rises by the action of the machine, feeds the press-cake upon an endless canvas band, as in the breaking-down machine, and carries it to the top pair of rollers, whence it falls upon the first short screen; all that is fine enough to pass through is sifted out by the shaking action of the long screens below, and travels down upon whichever screen has meshes fine enough to retain it; the pieces too large to pass through the short top screen are carried to the next pair of rollers, and so on. At the lower end of the long screens are placed boxes to receive the different sizes of grain; the "chucks," or pieces too large for any grain, are again passed through the machine, while the dust which falls upon the wooden bottom, and is received in the innermost box, goes to the mills to be worked up for forty minutes as a dust charge. Formerly at Waltham Abbey both musket (F.G.) and cannon powder (L.G.) were granulated in the same machine at the same time, but dogwood charcoal being now used for small-arm powders, one description only is usually made, so that but two long screens are required to define the higher and lower limits as to size of grain; for example, all that will pass through a 12-mesh and be retained upon a 20-mesh screen would be "rifle-fine-grain" (R.F.G.) powder, suited as to size for the Snider and Martini rifles. Modifications of this machine are used by private makers, the grain being usually separated into various sizes by hand-sieves.

Cube-cutting machine.

Pebble or cubical powders for heavy ordnance are granulated, or "cut," in special machines which divide the press-cake first into strips, and then again cross-ways, into cubes of $\frac{5}{8}$ inch and $1\frac{1}{2}$ inch length of edge respectively. This is effected by two pairs of gun-metal or phosphor-bronze rollers, which have straight cutting edges arranged at suitable intervals *along* their surfaces, the slabs of press-cake being fed vertically between the first pair of rollers. The resulting strips are carried along upon a board, by means of a skeleton band, which receives each strip of cake between two laths of wood; they then drop from the board upon an endless canvas band a little below, travelling in a direction at right angles to their previous motion, and are conveyed *endways* to the second pair of rollers. To prevent the strips of cake from fouling one another, the board upon which they first fall has a reciprocating motion given to it by means of an endless chain, one link of which is studded to a bracket underneath the board; consequently, as the board travels backwards, the strips are deposited at intervals, *in echellon*, upon the canvas band. The diagram (fig. 7) shows a portion of the machine. The cubes, etc., fall into a small reel fixed at a slope beneath the machine, which allows the dust and fragments to pass between its wires while the properly

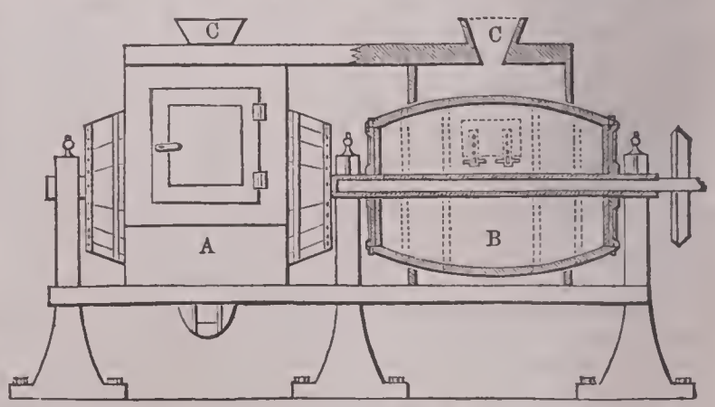


Fig. 8.—Glazing barrels. A, elevation, showing door of case; C, hoppers for loading; B, section through barrel (showing opening in dotted lines).

sized pebbles or cubes are delivered into boxes. The large 1½-inch powder has, however, afterwards to be picked over by hand.

Dusting. All grain from the granulating machine is called "foul grain," and has to be deprived of its dust in reels, consisting of a cylindrical frame-work about 8 feet long by some 2 feet in diameter, covered with a dusting cloth or canvas of from 18 to 56 meshes to the linear inch, according to the size of grain. These reels are either "horizontal" or "slope," according to the position in which they are fixed and the object in view. Slope-reels are open at both ends, fixed at an angle of about 4°, and are used for fine-grain powders as they come from the machine, when they contain more dust than the larger grain, especially if made from dogwood charcoal; the powder is poured in at the higher end, and received in barrels at the other end. The larger grained powders are dusted for about half an hour in a horizontal reel, with closed ends, the charge being from 250 to 300 lb; one end of the reel is made to lower for the purpose of unloading. Both kinds of reel are enclosed in cases to receive the dust, which, as before, is sent back to the incorporating mills for 40 minutes or so.

Glazing. The theory of glazing gunpowder has already been discussed. All descriptions are glazed, for varying periods in glazing barrels or "churns" (fig. 8), which are usually about 5 feet long by 2 to 3 feet in diameter, and revolve some 34 times in a minute; however, barrels of much greater diameter and less length are occasionally employed, revolving at a slower rate. The charge for each barrel is ordinarily 400 lb, and the fine-grain powders are mixed with a proportion of the "chucks" or larger pieces, which are afterwards sifted out. The glazing process causes a great alteration in the appearance of the grain, especially in that made from dogwood; the dull brownish hue is replaced after a few hours by a fine black color with more or less polish. Some powders are glazed from 10 to 12 hours, a considerable amount of heat being generated by the friction. Fine-grain powders are again passed through the slope reel after glazing.

Stoving. All kinds of gunpowder are dried in the same manner. The "stove," or drying room, is fitted with open framework shelves or racks, the heat being produced by steam pipes underneath. The powder is spread upon either copper trays or wooden frames with canvas bottoms, each capable of holding about 12 lb, which are then placed upon the racks. Not more than 50 cwt. may be dried at one time. The length of time required for stoving depends upon the nature of the powder, and the proportion of moisture it contains; it varies from about twelve hours for fine-grain up to three or four days for the very large cannon powders; the heat ranges from 120° to 145° Fahr., the temperature being gradually raised or lowered. It is most important that a stove should be well ventilated, so that a constant current of hot dry air may be supplied, and the air charged with vapor carried off; if this be not done effectually, the moisture would be recondensed upon the powder as the temperature was lowered.

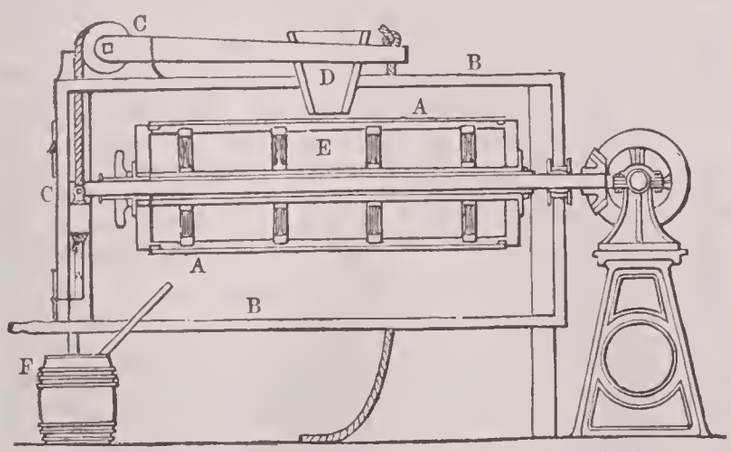


Fig. 9.—Horizontal Dusting Reel (longitudinal section). A, cylindrical reel; B, reel case; C, apparatus for lowering one end for unloading; D, hopper for loading; E, opening in reel for loading; F, barrel for unloading into.

Finishing. The drying process produces a small portion of dust which it is necessary to remove; but the finishing process has, especially upon the fine-grain powder, a much more considerable effect than the mere removal of dust. It is usually finished by being run from two to three hours in a horizontal reel (see fig. 9), the charge being 300 lb, and acquires a very glossy appearance, if the quality be good, even without the addition of graphite, which is very commonly added to sporting gunpowder. Large cannon powder, such as "pebble" and "cubical," is finished in large skeleton wooden reels, shaped like barrels, and enclosed in cases; after being run for about three-quarters of an hour, a small portion of the purest graphite (2 oz. to 400 lb of powder) is introduced in muslin bags, and the powder is run for a short time longer. This skeleton reel will hold a whole "glazing," as the contents of four glazing barrels is termed, being about 16 barrels of 100 lb each, and advantage is taken of this finishing process to mix together a number of glazings, so as to get a batch of 50 or 100 barrels giving uniform results at proof. These batches are afterwards "blended" together in four-way hoppers, with others of opposite character, should they not in all respects be up to specification, and any quantity of gunpowder so finished or blended as to give identical results at proof is termed a *brand*, and receives a distinctive number.

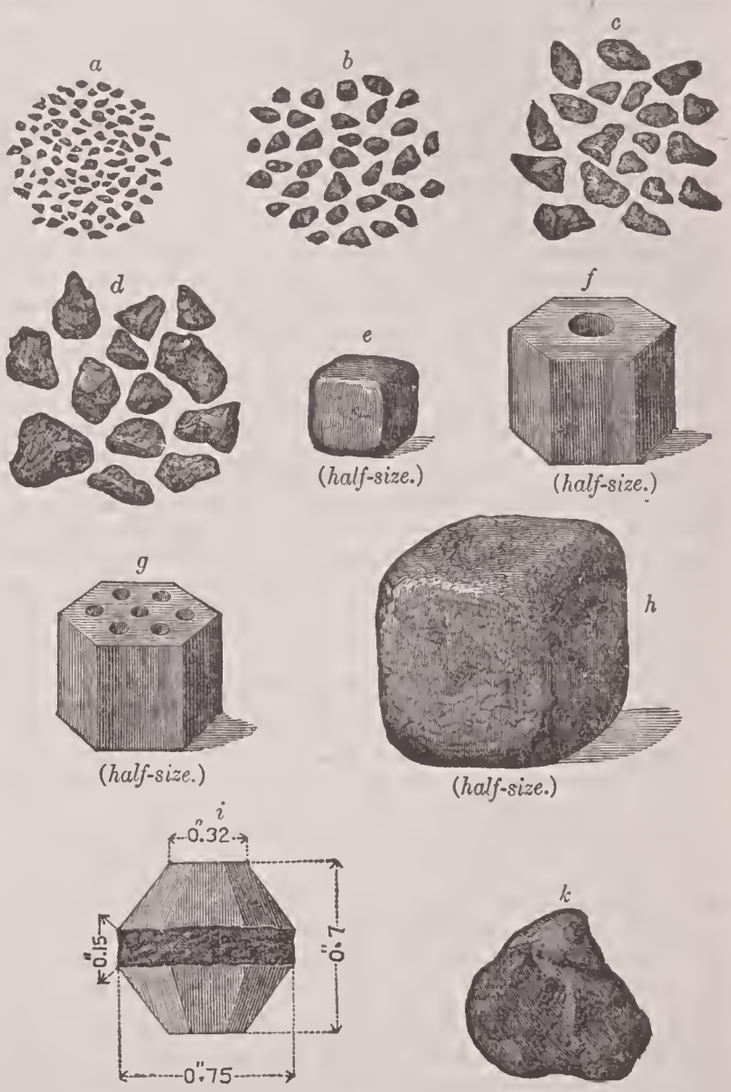


Fig. 10.

Powder for very heavy guns. Upon the introduction of very heavy ordnance, firing large charges, it was found that the ordinary (L.G. or R.L.G.) cannon powder was too *sudden* in its action, owing to the whole charge being consumed before the projectile had sensibly moved from its seat in the bore, thus causing a most violent strain to the metal of the gun. To obviate this defect, the grains or pieces were made much larger, so as to diminish the total surface of combustion, and, consequently, the volume of gas evolved at the first instant of explosion; the powder was also given a con-

siderably higher density, which retarded its combustion. These changes resulted in the adoption of the pebble and cubical powders, already mentioned, in England, and in America, of "Mammoth" powder, consisting of large, irregular-shaped grains (*k*, fig. 10) from 0″·6 to 0″·9 in size; an improvement has since been made in this powder by pressing it in uniform-sized pieces, of the shape shown in *i*, fig. 10, being the frusta of two hexagonal pyramids, separated by a prismatic space left rough.

American mammoth powder.

The figures *a* to *k* show the relative sizes and shapes of grain now commonly employed for military purposes in Europe and America, except that the three largest powders —pebble (*e*), prismatic (*f*, *g*), and cubical (*h*)—are figured half the real size to save space, whereas the remainder indicate the actual dimensions of the grains. Powder for small-arms is represented in *a*; all the other descriptions are intended for cannon of various sizes.

Rodman's perforated cake cartridge.

The improvements above described materially lessen the *initial* strain, at the expense of requiring a longer gun to burn the powder completely, but it still remains true that, even with a charge composed of large, dense pieces, the evolution of gas is greatest at the commencement of combustion, and decreases as the grains burn away, although the space occupied by the gases increases as the shot travels along the bore. This is exactly the opposite of what should theoretically take place, and causes the maximum pressure to be exerted before the inertia of the projectile has been overcome. So far back as 1860, these considerations led General Rodman, the eminent American artillerist, to employ in the experiments with his 15-inch and 20-inch cast-iron guns, what he termed a "perforated cake cartridge," composed of discs of compressed powder from 1 to 2 inches thick, and of a diameter to fit the bore, pierced with holes running parallel to the axis of the gun. In his *Properties of Metal for Cannon, and Qualities of Cannon-Powder* (Boston, 1861), Rodman demonstrated mathematically that such an arrangement of the charge would relieve the initial strain by exposing a minimum surface at the beginning of the combustion, while a greater volume of gas would be evolved from the increasing surfaces of the cylindrical hollows as the space behind the projectile became larger; this would tend to distribute the pressure more uniformly along the bore. The results of experiment perfectly bore out his theory, but he found it more convenient for several reasons to build up the charge in layers of hexagonal "prisms" of comparatively small size, fitting closely to one another, instead of having the cakes or discs as large as the bore.

Prismatic powder.

The civil war in America most probably interfered with the further development of General Rodman's powder, but the idea was taken up by a Russian military mission in the United States, and resulted in the manufacture on a large scale by Russia of what is now known as "prismatic powder." It has since been adopted in Germany for use in all heavy rifled ordnance; for the very largest guns, such as Krupp's 70-ton gun, this powder has been recently made with one central hole, having a higher density (1·78) than the original seven-hole prisms, which were about 1·68; the external dimensions are the same, 1 inch high by 1·36 in diameter. The prisms are so arranged in the cartridge that the hollows are continuous throughout.

Mode of manufacture.

Prismatic powder represents a distinct class, the peculiarity of which is that each grain or piece is pressed separately in a metal mould. In the British service, powder for heavy rifled guns, in the shape of small cylindrical pellets, with a hollow half-way through, was made some twelve years since, but has been superseded by the pebble or cubical powder cut up from press cake. To make this class of gunpowder, whether prismatic or cylindrical, we need—(1) a mould in which to place the meal or granulated powder; usually a number of moulds are contained in one plate; (2) a punch to fit each mould accurately with which to compress the powder, and needles to form the perforations; (3) an appliance for pressing the finished pellets or prisms out of the moulds; or this may be done by the punches themselves, if the moulds are closed by a removable upper plate.

The requisite pressure may be given either by hydraulic machinery, as at Waltham Abbey, or by means of a cam or eccentric on a shaft driven by steam or water power, as in the Russian and German prismatic machines. By the former plan a large number of pieces may be pressed slowly at one operation, but by the latter only about six prisms can be formed at a time; the machine, however, works very quickly, and has a small hopper for the meal, or grain, and a self-feeding apparatus, the mould plate sliding backwards and forwards, so as to be alternately underneath the hopper and punches. Self-feeding machines of this nature are found to get clogged when used with powder-meal, and this was doubtless the chief reason why granulated powder was first used; the size of grain is about that shown in fig. 10, *b*. It is probable that a more uniform density could be given to the prisms by hydraulic pressure than by the cam arrangement; the latter is said to exert a maximum pressure of 2000 lb on the square inch. The prismatic powder only needs careful drying at a moderate heat to finish it.

It has been found that all powders thus made possess less explosiveness than those granulated or cut up from press-cake; the smooth surfaces of the pieces apparently afford little hold for the flame, and thus they ignite slowly; by some this is considered a defect, but by others an advantage. For this reason, as well as those already detailed, prismatic powder strains the metal of the gun less, in proportion to the velocity obtained, than pebble or cubical, but, to give the projectile an equal velocity, the charge of prismatic must be considerably larger. The cost would probably be also greater, weight for weight.

Proof of Gunpowder.

The tests to which powder is subjected are as follows:—

1. *For proper Color, amount of Glaze, sufficiently hard and crisp Texture, and Freedom from Dust.*—These points can be judged by the hand and eye alone, and require a certain amount of experience in the examiner. The cleanness of the powder is tested by pouring a quantity from a bowl held 2 or 3 feet above the barrel; if there be any dust it will be thus easily detected. If it is injured by damp there will be little or no dust, but the grain will be "rotten," and may be broken between the fingers; minute crystals of saltpetre may be also detected on the surface in a good light.

2. *For proper Incorporation.*—By "flashing," that is, burning a small quantity on a glass, porcelain, or copper plate. The powder is put in a small copper cylinder, which is then inverted on the flashing plate; this provides for the particles being arranged in nearly the same way each test, which is very important. If the powder be very large, it must be broken up and sifted to a certain size through a small hand sieve. Properly made gunpowder should "flash," or puff off, when touched by a hot-iron, with few "lights" or sparks, leaving only some smoke marks on the plate. A badly incorporated powder will give out a quantity of sparks, and leave specks of uncombined saltpetre and sulphur, forming a dirty residue. Powder made from very slack-burnt charcoal, or which has been injured by damp, will always flash badly.

3. *For Shape, Size, and Proportion of the Grains.*—Shape can be judged by the eye only, and the size of large powders can be measured, or the number of pieces to 1 lb counted; granulated powder may readily be sifted upon the two sieves which determine its higher and lower limits of size. The proportion of different sized grains is ascertained by using three or more sieves. For example, the Government small-arm powder is sifted with 12-mesh, 16-mesh, and 20-mesh sieves; all must pass the first, not less than three-quarters be retained upon the second, and only one-sixteenth part is allowed to pass the last-named sieve.

4. *Density.*—Formerly this was ascertained by "cubing," or finding the exact weight of a carefully constructed box of known contents, when filled with powder in a particular manner. But as this plan gave only an approximate result, a mercurial densimeter has been substituted, by means of which the density can be ascertained to three places of decimals. Briefly, the machine determines with great accuracy the weight of a globe when it is (*a*) filled with mercury alone under a certain pressure, and (*b*) filled with a known weight (say 100 grammes) of powder and mercury under precisely similar conditions; then if S be the specific gravity of mercury at the time of experiment, W the weight of globe filled with mercury alone, and W′ the weight when filled with powder and mercury,

$$\text{Density} = \frac{S \times 100}{W - W' + 100}$$

5. *Moisture and Absorption of Moisture.*—The amount of water contained in gunpowder is found by drying a carefully-weighed sample in a water oven for a certain period; from the weight lost, when allowed to cool out of contact with the air before weighing, the percentage of moisture can be calculated. The hygroscopic test consists in exposing a dried sample in a box, kept at a uniform temperature, to an atmosphere artificially saturated with moisture, and ascertaining the increase of weight in a certain time.

6. *Firing Proof.*—The nature of this will depend upon the purpose for which the powder is intended. For sporting powders, it will consist in the "pattern" given by the shot upon a target at a given distance, or, if fired with a bullet, upon the "figure of merit," or mean radial deviation of a certain number of rounds; also upon the penetration it effects through boards. For military purposes the powder is now always fired from the rifle or piece of ordnance with which it is to be used, and the initial or "muzzle" velocity ascertained by the Le Boulengé electric chronograph (see GUNNERY), which measures the exact time the bullet or other projectile takes to traverse a known distance between two wire screens. By means of the "crusher gauges" already referred to, the exact pressure per square inch upon certain points in the interior of the bore can be found; the maximum pressure can be considerably modified by increasing the cubic air-space given to the charge in the powder chamber. The figure of merit is also taken for small-arm powder.

All gunpowder made by or for the British Government is subjected to very strict limits of specification upon all the above named points.

Bibliography.—Vanucchio Biringuccio, *De la Pirotechnia*, Venice, 1540; Tartaglia, *Quesiti e invenzioni diversi* (lib. iii.), Venice, 1546; Peter Whitehorne, *How to make Saltpetre, Gounpowder*, etc., London, 1573; Nic. Macchiavelli, *The Arte of Warre*, transl. by Whitehorne, London, 1588; Hanzelet, *Recueil de plusiers Machines Militaires*, Paris, 1620; Boillet Langrois, *Modelles artifices de feu*, 1620; Kruger, *Chemical Meditations on the Explosion of Gunpowder* (in Latin), 1636; Collado, *On the Invention of Gunpowder* (Spanish), 1641; *The True Way to make all Sorts of Gunpowder and Matches*, 1647; Hawksbee, *On Gunpowder*, 1686; Winter, *On Gunpowder* (in Latin); Robins, *New Principles of Gunnery*, London, 1742 (new ed. by Hutton, 1805); Stahls, *On the Nature and Utility of Saltpetre* (German), Leipsic, 1748; D'Antoni, *Essame della Polvere*, Turin, 1765 (transl. by Capt. Thomson, R. A., London, 1787); Count Rumford, "Experiments on Fired Gunpowder," *Phil. Trans. Roy. Soc.*, 1797; Cossigny, *Recherches phisiques et chémiques sur la fabrication de la poudre à canon*, Paris, 1807; Bottée et Riffault, *Traité de l'art de fabriquer la poudre à canon*, Paris, 1811; Renaud, *Instructions sur la fabrication de la Poudre approuvées par le Ministre de la Guerre*, Paris, 1811; Hutton, *Mathematical Tracts* (vol. iii.), 1812; Sir W. Congreve, *A Short Account of Improvements in Gunpowder made by*, London, 1818; Fraxno, *Tratado de la Teoria y Fabricacion de la Polvora en General*, Segovia, 1817; Coleman, "On the Manufacture and Constituent Parts of Gunpowder," *Phil. Mag.*, vol. ix.; Braddock, *Memoir on Gunpowder*, London, 1832; Col. Omodei, *Dell' origine della polvere da guerra*, Turin, 1834; Proust, *Mémoires sur la poudre à canon*, Paris; Timmerhaus, *Descriptions des divers procédés de la fabrication de la poudre à canon*, Paris, 1839; Wilkinson, *Engines of War, including the Manufacture of Gunpowder*, London, 1841; Major Mordecai, *Experiments with Gunpowder in Washington Arsenal in the years 1843–4*, Washington, 1845; La Cabane, *De la poudre à canon et de son introduction en France*, Paris, 1845; Reinaud et Favé, *Du feu Grégois et des origines de la poudre à canon*, Paris, 1845; Bunsen and Schiskoff, "On the Chemical Theory of Gunpowder," *Poggendorff's Annalen*, vol. cii., 1857; Scoffern, *Projectile Weapons of War and Explosive Compounds*, London, 1858; Gen. Piobert, *Traité d'Artillerie, Propriétés et Effets de la Poudre*, Paris, 1859; Gen. Rodman, *Experiments on Metal for Cannon, and Qualities of Cannon Powder*, Boston, 1861; Napoleon III., *Études sur le passé et l'avenir de l'Artillerie*, vol. iii., Paris, 1862; Anderson and Parlby, *On the Manufacture of Gunpowder at Ishapore*, London, 1862; Von Karolyi, "On the Products of the Combustion of Gun Cotton and Gunpowder," *Phil. Mag.*, Oct., 1863; Count de St. Robert, *Traité de Thermodynamique*, Turin, 1865; Capt. F. M. Smith, *Handbook of the Manufacture and Proof of Gunpowder at Waltham Abbey*, London, 1870; Berthollet, *Sur la force de la Poudre*, Paris, 1872; Sarrau, *Effets de la Poudre et des Substances Explosives*, Paris, 1874; Noble and Abel, *Fired Gunpowder*, London, 1875; C. L. Bloxam, *Chemistry* (art. "Gunpowder"), 3d ed., London, 1875; *Notes on Gunpowder and Gun Cotton*, published by order of the Secretary of State for War, London, 1878. (W. H. W.)

GUNPOWDER PLOT. See FAWKES.

GÜNS (Hungarian, *Köszeg*), the second town in importance of the Hungarian megye or county of Vas (Eisenburg), near the Styrian frontier, is favorably situated on the Gyöngyös, 47° 23′ N. lat., 16° 31′ E. long. It is the see of a bishop, and from 1648 until the recent administrative changes of 1876 was a royal free town. Among the more noteworthy buildings are the cathedral, episcopal palace, a seminary for priests, a gymnasium, the county-hall, a hospital, three monastic houses, a museum of Roman antiquities, a house of correction, and several manufactories of cloth and of earthenware. The agricultural products of the neighborhood consist principally of fruit and wine; the trade in the latter especially is considerable. In 1900 the number of inhabitants was 7,930, mostly of German extraction. The heroic defence of the fortress of Güns by Nicolas Jurisics against the army of Sultan Soliman, in August, 1532, has given the town a special historical interest. In 1621 it suffered from the attacks of Gabriel Bethlen's troops, and in 1705 the suburbs were plundered and burnt by the forces of Francis Rákóczy. In 1729 and 1777 the town suffered much from fire, and in 1813, 1814, and 1821 from floods. The Eszterházy family long held valuable possessions in the neighborhood, and one of their castles still stands at the northern end of the town.

GUNTER, EDMUND (1581–1626), was of Welsh extraction, but was born in Hertfordshire in 1581. He was educated on the royal foundation of Westminster school, and in 1599 was elected a student of Christ Church, Oxford. After graduating bachelor and master of arts at the regular times, he took orders, became a preacher in 1614, and in November, 1615, proceeded to the degree of bachelor in divinity. Mathematics, however, which had been his favorite study in youth, continued to engross his attention, and on 6th March, 1619, he was appointed to the professorship of astronomy in Gresham College, London. This post he held till his death, which took place on 10th December, 1626. With Gunter's name are associated several useful inventions, descriptions of which are given in his treatises on the *Sector, Cross-staff, Bow, Quadrant, and other Instruments.* He had contrived his sector about the year 1606, and written a description of it in Latin. Many copies were transcribed and dispersed, but it was more than sixteen years afterwards ere he allowed the book to appear in English. In 1620 he published his *Canon Triangulorum*, a table of logarithmic sines and tangents (extended to 7 decimal places) for every degree and minute of the quadrant. In later editions an account of the general use of the canon is prefixed, and Briggs's logarithms of the first 1000 numbers are appended. There is reason to believe that Gunter was the first to discover (in 1622 or 1625) that the magnetic needle does not retain the same declination in the same place at all times. By desire of James I. he published in 1624 *The Description and Use of His Majestie's Dials in Whitehall Garden*, the only one of his works which has not been reprinted. He introduced the words co-sine and co-tangent for sine and tangent of the complement, and he suggested to Briggs, his friend and colleague, the use of the arithmetical complement (see Briggs's *Arithmetica Logarithmica*, cap. xv.). His practical inventions are briefly noticed below.

Gunter's Chain, the chain in common use for measuring land, is 22 yards long and is divided into 100 links. Its usefulness arises from its decimal or centesimal division, and the fact that 10 square chains make an acre.

Gunter's Line, a logarithmic line, usually laid down upon scales, sectors, etc. It is also called the *line of lines* and *the line of numbers*, being only the logarithms graduated upon a ruler, which therefore serves to solve problems instrumentally in the same manner as logarithms do arithmetically.

Gunter's Quadrant, an instrument made of wood, brass, or other substance, containing a kind of stereographic projection of the sphere on the plane of the equinoxial, the eye being supposed to be placed in one of the poles, so that the tropic, ecliptic, and horizon form the arcs of circles, but the hour circles are other curves, drawn by means of several altitudes of the sun for some particular latitude every year. This instrument is used to find the hour of the day, the sun's azimuth, etc., and other common problems of the sphere or globe, and also to take the altitude of an object in degrees.

Gunter's Scale (generally called by seamen the *Gunter*) is a large plane scale, usually 2 feet long by about 1½ inches broad, and engraved with various lines of numbers. On one side are

placed the natural lines (as the line of chords, the line of sines, tangents, rhumbs, etc.), and on the other side the corresponding artificial or logarithmic ones. By means of this instrument questions in navigation, trigonometry, etc., are solved with the aid of a pair of compasses

GÜNTHER, Johann Christian (1695–1723), German poet, was born at Striegau in Lower Silesia, on the 8th April, 1695. After attending the academy at Schweidnitz, where he composed a number of verses of more than usual promise, he entered in 1715 the university of Wittenberg with the view of studying medicine; but he became idle and dissipated, contracted heavy debts, and came to a complete rupture with his father. In 1717 he went to Leipsic, where he obtained the friendship of Menck, and published a poem on the peace of Passarowitz, which acquired him an immediate reputation. Menck recommended him to the king of Poland, but unhappily the first time he appeared at court he was in a state of intoxication. From that time he led an unsettled and dissipated life, depending for an uncertain subsistence partly on money obtained for occasional poems and partly on the charity of his friends. He died at Jena, 15th March, 1723, when only in his 28th year. Goethe pronounces Günther to have been a poet in the fullest sense of the term. As a lyrical poet he stands alone among his contemporaries for freedom, spontaneity, and sincerity of utterance; and his works as a whole give evidence of deep and lively sensibility, fine imagination, clever wit, and a true ear for melody and rhythm. An air of cynicism, however, which was the necessary consequence of his aimless life, is more or less present in most of his poems, and dull, vulgar, or impure witticisms are not unfrequently found side by side with the purest inspirations of his genius.

His collected poems were published in four volumes, Breslau, 1723–1735. They are also included in Tittman's *Deutsche Dichter des 17ten Jahrh.*, Leipsic, 1874. A pretended autobiography of Günther appeared at Schweidnitz in 1732, and a life of him by Siebrand at Leipsic in 1738. See also Hoffman, *J. Ch. Günther, ein literarisch-historischer Versuch*, Breslau, 1833; and Roquette, *Leben und Dichten J. Ch. Günthers*, Stuttgart, 1860.

GUNTOOR, a town in Kistna district, Madras, situated on the Grand Trunk road, about 46 miles from Masulipatam, 17° 42′ N. lat., 80° 29′ E. long.; population 18,033. It is the headquarters of the sub-collector and the district judge of Kistna; and there is a considerable trade in grain and cotton. Guntoor was formerly the capital of a Circar (Sarkár) under the Mahometans; it was ceded to the French by the nizám in 1753. At the time of the cession of the Circars to the English in 1766, Guntoor was specially exempted during the life of Basálat Jang, whose personal *jágír* it was. In 1788 it came into British possession, and was finally confirmed in 1803.

GURDÁSPUR, a British district in the lieutenant-governorship of the Punjab, lying between 32° 30′ and 31° 36′ N. lat., and between 74° 56′ and 75′ 45′ E. long. Bounded on the N. by the native Himálayan states of Kashmir and Chamba, on the E. by Kángrá district and the river Bias, on the S.W. by Amritsar district, and on the W. by Síalkot, the district of Gurdáspur occupies the submontane portion of the Bári Doáb or tract between the Bias and the Ravi. An intrusive spur of the British dominions runs northward into the lower Himálayan ranges, to include the mountain sanatarium of Dalhousie. This station crowns the most westerly shoulder of a magnificent snowy range, the Dháola Dhár, between which and the plain two minor ranges intervene. Below the hills stretches a picturesque and undulating plateau covered with abundant timber and made green by a copious rainfall, and watered by the streams of the Bári Doáb, which, diverted by dams and embankments, now empty their waters into the Bias directly, in order that their channels may not interfere with the Bári Doáb canal. The district contains several large and important *jhíls* or swampy lakes. Few facts can now be recovered with regard to the early annals of Gurdáspur. Our first distinct historical knowledge begins with the rise of the Síkh confederacy. The whole of the Punjab then was distributed to the chiefs who triumphed over the imperial governors. In the course of a few years, however, the famous Ranjít Sinh acquired all the territory which those chiefs had held. Pathánkot and the neighboring villages in the plain, together with the whole hill portion of the district, formed part of the area ceded by the Síkhs to the East India Company after the first Síkh war in 1846. In 1861–62, after receiving one or two additions, the district was brought into its present shape, having its headquarters at Gurdáspur.

Owing to the numerous transfers of territory which took place between the census of 1855 and 1868, it is impossible to give a detailed comparison of their results. The enumeration of 1868 was taken over an area of 1822 square miles, and it disclosed a total population of 906,126 persons, — males, 501,247; females, 404,879. Classified according to religion there are — Hindus, 303,107; Mahomotans, 422,196; Síkhs, 79,387; and "others," 101,436. Only six towns have a population exceeding 5000, namely, Batála, 26,897; Derá Manak, 7199; Dinánagar, 6626; Sujanpur, 6556; Kalanaur, 6030; and Srígovindpur, 5531. Gurdáspur, the chief town and administrative headquarters of the district, had only 4137 inhabitants in 1875. The sanatarium of Dalhousie, 7687 feet above sea-level, though only returned as containing 2019 inhabitants, has a large fluctuating population during the warmer months. The district possesses throughout an excellent soil, except in some small patches on the Bias side, where sand covers the surface. The chief agricultural staples comprise wheat, barley, and gram for the spring harvest, with rice, pulses, cotton, and sugar-cane for the autumn crop. Abundant means of irrigation exist where required, either from canals, wells, or mountain streams; but in no part of the Punjab province can better crops be produced without such artificial aid. In 1875–76 the total cultivated area amounted to 855,675 acres, of which 140,639 acres were protected by irrigation against the effects of drought. The trade of the district consists mainly in the export of its agricultural produce. The imports are insignificant,—English piece-goods, salt, and fancy articles forming the main items. The local traffic centres on Batála. The principal road of the district connects Amritsar with Pathánkot, at the foot of the hills, and passes through Batála, Gurdáspur, and Dinánagar. The total mileage of highways in 1875–76 showed 54 miles of metalled and 507 miles of unmetalled road. The total revenue in 1876 was £123,608. In 1875–76 the district contained 12 civil and revenue judges; and 14 officers exercised magisterial powers. In the same year the police force numbered 596 men, supplemented by a large body of rural watchmen. In 1875–76 there were 112 schools, having an aggregate roll of 5708 pupils. The climate of Gurdáspur is not unhealthy, but large swamps and excessive irrigation expose some neighborhoods to malarious fevers and ague. The mean temperature for 1871 was 86·85° in May and 53·8° in December at Gurdáspur, and 67·8° in May and 46·96° in December at Dalhousie. The average annual rainfall for eight years ending 1873–74 was 30·96 inches. Seven charitable dispensaries afforded relief (1875–76) to 80,614 persons.

GURGÁON, or Goorgaon, a British district in the lieutenant-governorship of the Punjab, between 27° 39′ and 28° 30′ 45″ N. lat., and 76° 20′ 45″ and 77° 35′ E. long. Bounded on the N. by Rohtak, on the W. and S.W. by portions of the Ulwar, Nábha, and Jínd native states, on the S. by the Muttra district of the North-Western Provinces, on the E. by the river Jumna, and on the N. E. by Delhi, the district of Gurgáon comprises the southernmost corner of the Punjab province, and stretches away from the level plain towards the hills of Rájputáná. Two low rocky ranges enter its borders from the south and run northward in a bare and unshaded mass towards the plain country. East of the western ridge the valley is wide and open, and essentially extends to the banks of the Jumna. To the west lies the subdivision of Rewári, consisting of a sandy plain dotted with isolated hills. Numerous torrents carry off the drainage from the upland ranges, and the most important among them empty themselves at last into the Najafgarh *jhíl*. This swampy lake lies to the east of the civil station of Gurgáon, and stretches long arms into the neighboring districts of Delhi and Rohtak. Salt is manufactured from lime in wells at several villages. The mineral products are iron ore, copper ore, plumbago, and ochre. Wolves, leopards, deer, jackals, hares, and foxes are found in the district. In 1803 Gurgáon district passed into the hands of the British after Lord Lake's conquests, and under their influence improvements made steady and rapid progress. On the outbreak of the mutiny at Delhi in May, 1857, the nawáb of Farrukhnagar, the principal feudatory of the district, rose in rebellion. The Meos and many Rájput families followed his example. A faithful native officer preserved the public buildings and records at Rewári from destruction; but with this exception, British authority became extinguished for a time throughout all Gurgáon. After the fall of the rebel capital, a force marched into the district and either captured or dispersed the leaders of

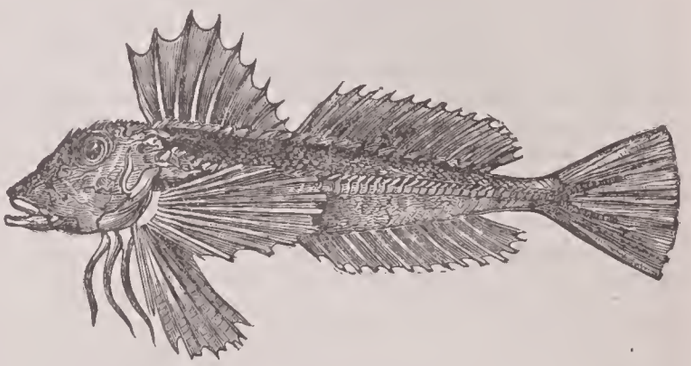
rebellion. The territory of the nawáb was confiscated on account of his participation in the mutiny. Civil administration was resumed under orders from the Punjab Government, to which province the district was formally annexed on the final pacification of the country.

The census of 1868 was taken over an area of 2015 square miles, and it disclosed a population of 696,646 persons—males, 370,251; females, 326,395. The Hindus number 480,307; Mahometans, 216,147; Sikhs, 130; and "others," 62. In 1875-76 there were four municipal towns, with populations as follows:—Rewári, 25,237; Ferozepore (Firozpur), 10,580; Palwal, 13,542; Farrukhnagar, 10,611. Gurgáon, the administrative headquarters, had in 1868 a population of 3539. Out of a total area of 1,267,335 acres, as many as 967,440 were returned in 1875–76 as under cultivation. The principal products are wheat, harley, *joár*, *bájra*, gram, oil-seeds, pulses, cotton, and tobacco. Owing to the deficiency of artificial irrigation, Gurgáon must always be exposed to drought. Seven periods of dearth have occurred since the disastrous year of 1783. In 1833 and 1837 many villages, according to report, lost their whole population through death and emigration. The traffic of Gurgáon district centres entirely upon the town of Rewári, which ranks as one of the chief trading emporiums in the Punjab. Its merchants transact a large part of the commerce between the states of Rájputáná and the northern provinces of British India. Salt from the Sambhar Lake, together with iron, forms the principal import; sugar and English piece-goods form the chief items of the return trade. In 1871–72 the imports of Rewári were valued at £208,892, and the exports at £99,028. The means of communication are not of the highest order. One good metalled road traverses the district, from Delhi to Muttra, but the lines of greatest mercantile importance are unmetalled. The Rájputáná State Railway now passes through the district, with stations at Gurgáon, Jhársa, Jataoli, Kalipur, and Rewári. The total revenue in 1875–76 was £111,885. In the same year 13 civil and revenue judges had jurisdiction, and the police force numbered 605 men, supplemented by a body of village watchmen. The number of schools was 66, with a joint roll of 3560 pupils. The summer heat of Gurgáon reaches a great intensity; no record of temperature, however, exists. The average annual rainfall for the eight years ending 1873–4 was 23·52 inches. The district contained 4 charitable dispensaries, affording relief (1875) to 18,034 persons.

GURNALL, William (1616–1679), author of the *Christian in Complete Armor*, was born in 1616 at Lynn, Norfolkshire. He was educated at the free grammar school of his native town, and in 1631 was nominated to the Lynn scholarship in Emmanuel College, Cambridge, where he graduated B.A. in 1635 and M.A. in 1639. Nothing is known of his history from the time that he left the university till 1644, when he was made rector of Lavenham in Suffolk; but it would appear from one of his letters that when he received that appointment he was officiating as minister at Sudbury. At the Restoration he signed the declaration required by the act of Uniformity, and on this account he was the subject of a libellous attack, published in 1665, entitled *Covenant-Renouncers Desperate Apostates*. He died October 12, 1679, and was buried at Lavenham. The work by which Gurnall is principally known, *The Christian in Complete Armor*, was published in three separate volumes in 1655, 1658, and 1662, and soon became so popular that in 1679 a sixth edition had been called for. It consists of a series of sermons on the latter portion of the 6th chapter of Ephesians, and is more fully described in the title page as a "Treatise of the Saint's War against the Devil; wherein a discovery is made of that grand enemy of God and his people, in his policies, power, seat of his empire, wickedness, and chief designs he hath against the saints;" and a "Magazine from whence the Christian is furnished with spiritual arms for the battle, helped on with his armor, and taught the use of his weapon; together with the happy issue of the whole war." The work is more practical than theological; and its quaint fancy, graphic and pointed style, astonishing variety of scriptural application and allusion, and fervent religious tone render it still popular with a certain class of readers.

An Inquiry into the Life of the Rev. W. Gurnall, by H. M'Keon, appeared at Woodbridge in 1830, and a biographical introduction by the Rev. J. C. Ryle, chiefly founded on this pamphlet, was prefixed to an edition of the *Christian in Complete Armor* published in London in 1865.

GURNARD (*Trigla*). The gurnards form a group of the family of "mailed cheeks" (*Triglidæ*), and are easily recognized by three detached finger-like appendages in front of the pectoral fins, and by their large, angular, bony head, the sides of which are protected by strong, hard, and rough bones. The pectoral appendages are provided with strong nerves, and serve not only as organs of locomotion when the fish moves on the bottom, but also as organs of touch, by which it detects small animals on which it feeds. Gurnards are coast-fishes, generally distributed over the tropical and temperate areas; of the forty species known seven occur on the coast of Great Britain, viz., the red gurnard (*T. pini*), the streaked gurnard (*T. lineata*), the sapphirine gurnard (*T. hirundo*), the gray gurnard (*T. gurnardus*), Bloch's gurnard (*T. cuculus*), the piper (*T. lyra*) and the long-finned gurnard (*T. obscura* or *T. lucerna*). Although never found very far from the coast, gurnards



Trigla pleuracanthica.

descend to depths of several hundred fathoms; and as they are bottom-fish they are caught chiefly by means of the trawl. Not rarely, however, they may be seen floating on the surface of the water, with their broad, finely-colored pectoral fins spread out like fans. In very young fishes, which abound in certain localities on the coast in the months of August and September, the pectorals are comparatively much longer than in the adult, extending to the end of the body; they are beautifully colored and kept expanded, the little fishes looking like butterflies. When caught and taken out of the water, gurnards emit a grunting noise. Their flesh is very white, firm, and wholesome.

GURWAL. See Garhwál.

GUSTAVUS I. (*c.* 1496–1560), king of Sweden, commonly known as Gustavus Vasa, the surname being derived from the family arms, which were a bundle or sheaf, is justly celebrated as the founder of modern Sweden; he delivered it from the yoke of Denmark, introduced the Reformation, established law and order, and laid the foundation of its industrial prosperity. His family name was Ericson; he was born about 1496 of a noble house; and he was related to the powerful family of Sture. Gustavus was at a very early age called upon to suffer for his country. Sweden was still joined to the other Scandinavian kingdoms under the union of Calmar, Denmark being the leading state. Sweden was a reluctant member of this union, and King Christian of Denmark was obliged to maintain his supremacy with a high hand. In an expedition to Stockholm this king treacherously carried off the young Gustavus and other nobles as hostages to Denmark. After being detained in Jutland for above a year, Gustavus managed to escape in disguise to Lübeck, and the great Hanse town, ever jealous of the power of Denmark, furnished him with the means of returning to Sweden, where he landed in 1520. He had now formed the resolution to deliver his country from the oppression of the Danes. He went about from place to place trying to incite the people to revolt, but on all hands he met with apathy and even resistance. For some time his life was in extreme danger; he was hunted by the Danish authorities, and worked in disguise on the farms and in the mines of Dalecarlia. The barn in which he threshed corn is preserved as a state monument. He was on the point of fleeing over the hills into Norway, when tidings came of the Blood-bath of Stockholm, in which ninety of the nobles and leading men of Sweden, including the father of Gustavus himself, were executed by the Danish king. This deed roused the slumbering patriotism of the Swedes, especially of the hardy people of Dalecarlia, who now chose Gustavus as their leader (1520). They repeatedly defeated the Danish forces, and took the principal towns. By 1523 Stockholm was taken and Sweden delivered from the Danish yoke. At a great diet held at Strengnäs in that year Gustavus was elected king of Sweden. Finland was speedily re-

covered. After liberating his country, Gustavus set himself to the far harder task of reforming and settling it. Sweden was in a very backward and disorderly condition. The nobles had great power and many selfish privileges; the clergy were wealthy, and in the war of freedom had taken the side of the Danes; the peasants were poor and discontented. There was little respect for law; the whole country was demoralized and disorganized. The reforms of Gustavus began with the church. The two brothers Peterson had already introduced the doctrines of Luther, and the chancellor Anderson had translated the New Testament into the native tongue. Vasa encouraged their efforts; in a great diet held at Westerås in 1527 he succeeded under the threat of abdicating in passing measures, by which the lands of the bishops were placed at his disposal, and full liberty was granted of preaching the gospel; but the support of the nobles had to be gained by a share of the spoils. The Reformation soon took deep root, but the troubles of Gustavus continued. He required to deal with a turbulent nobility; he had to beat off the exiled king of Denmark; thrice he needed to pacify a revolt in Dalecarlia; and he was forced to put forth the whole strength of his kingdom to quell a peasants' war in the south. The pretensions of Lübeck, which had given him real help in the war of freedom, and to which he owed a considerable sum of money, involved him in a war, by which he curtailed their commercial privileges. In all these difficulties Gustavus bore himself with equal energy and wisdom. In 1544 his position was so secure that the elective sovereignty was changed by the diet into an hereditary one. From this time till his death in 1560, except an unimportant war with Russia on the Finnish frontier, there was little to disturb the quiet progress of Sweden. Gustavus's home policy made an era in Swedish history. Law, order, and national spirit were encouraged and developed; schools were everywhere established, roads made, and foreign trade extended by advantageous commercial treaties with England and Holland. Nothing was too homely or minute for the supervision of the king; he was ready to encourage, scold, or instruct, whenever an opportunity offered in any department of industry. He even established model farms. His second and best-loved queen Margaret had a dairy farm on which twenty-two maidens tended the cows. While he avoided foreign war he did not neglect national defence; he left an excellent army of 15,000 men, and he created a considerable naval force. Altogether, few kings have done so much for any country as Gustavus Vasa did for Sweden. He was succeeded by his son Eric.

See Geijer's *History of the Swedes;* also an anonymous *History of Gustavus Vasa,* London, 1852.

GUSTAVUS II., or GUSTAVUS ADOLPHUS (1594–1632), the hero of Protestantism in the Thirty Years' War, and the first king of Sweden who played a great rôle in European history, was the grandson of Gustavus Vasa, and the son of Charles IX. He was born at Stockholm in 1594, and received an excellent education. As we learn from his friend and chancellor Oxenstierna, he gained in his youth "a complete and ready knowledge of many foreign languages, so that he spoke Latin, German, Dutch, French, and Italian as purely as a native, and besides had some foretaste of the Russian and Polish tongue." Even during his busier years, after ascending the throne, it is said that he was fond of reading the great work of Grotius, *De Jure Belli et Pacis;* also that he knew Greek, preferring Xenophon as a military historian to any other. He was introduced to the business of government at an early age; when he was only ten, his father required his presence at meetings of council and at the audiences given to foreign ambassadors. This early experience was needed; for, his father dying in 1611, he ascended the throne of Sweden in his eighteenth year. His position was a difficult one; after fifty years of civil strife, Sweden had lost the strong and compact organization which it had received from Gustavus Vasa; the finances were exhausted, the nobles were discontented, and the spirit of the people had declined. Abroad, Sweden was surrounded with enemies, Denmark, Russia, and Poland being in a state of chronic hostility with it.

To the difficult task before him the young king applied himself with equal skill and resolution. He attached the nobles to himself by his respect for their privileges and his genial manner, showed them a more honorable field of activity in a patriotic war, and even induced them to bear their due share of its financial burdens. The administration was reformed in all its branches, industry encouraged, and education greatly improved. In this way the national spirit was wonderfully raised; and Sweden was gradually prepared to play for the first time a great part in Europe—a part which seemed so disproportionate to her natural resources. At his accession Gustavus was engaged in a difficult war with Denmark, which, besides its supremacy over Norway, occupied what is now southern Sweden. The peace of 1613 left their respective frontiers very much as they had been before the war. The war with Russia ended much more advantageously for Gustavus in the peace of Stolbova (1617), by which Sweden was confirmed in the possession of the Baltic provinces stretching from Finland to Livonia. Gustavus clearly foresaw the advantage to Russia and the danger to Sweden if the former power were allowed to plant itself on the Baltic coast; and he now congratulated his country on a peace which assured her against such a risk. In 1620 Gustavus married a sister of the elector of Brandenburg, with whom he lived happily till his death. After being for many years engaged in an intermittent war with Poland, Sweden (1621) entered upon a more active conflict with that power. With some interruptions the struggle lasted till 1629, and proved an excellent training for Gustavus. Sigismund, king of Poland, was his cousin, and had at one time been king of Sweden, but had been forced to resign owing to his Catholic opinions. He still laid claim to the crown of Sweden. In this war Gustavus took Riga, and made many other conquests in Livonia as well as in Courland and Prussia, part of which he retained by the peace of Altmark, concluded under the mediation of Richelieu.

That great statesman wished to get Gustavus's hands free for a more important conflict, in which the king himself had long been eager to engage. While Gustavus had been involved in his Baltic war, the Catholic house of Austria had been swiftly raising itself on the ruins of German Protestantism to a position of absolute supremacy. In this early period of the Thirty Years' War which dates from 1618, the armies of Protestantism had been everywhere overthrown by Tilly and Wallenstein. The latter, raising a host at his own cost and bearing desolation wherever he went, garrisoned Brandenburg and Pomerania, occupied Mecklenburg, and overran the continental dominions of Denmark. The only town that successfully resisted the imperial general was Stralsund; the king of Denmark was obliged to make peace. Such a colossus, with its gigantic force of oppression and devastation and its invincible armies, Gustavus now ventured to attack. It seemed a foolhardy undertaking which excited the laughter of his enemies, when in midsummer 1630 he landed on the coast of Pomerania with his little army of 15,000 men. Yet there were many things in his favor,—the despair of the Protestant princes, who saw a great part of their lands threatened by the Edict of Restitution; the disunion of the Catholics, who forced the emperor to dismiss Wallenstein shortly after the landing of Gustavus; the help of Richelieu, who now inaugurated the French policy of weakening Germany by dividing it. This help was formally assured him by the treaty of Bärwalde (January, 1631). Yet the German princes showed no haste to join Gustavus; the duke Boguslav reluctantly consented to receive the Swedish army into his capital—Stettin. But the marvellous discipline of the Swedes, so different from the wild barbarism of the imperial army, soon gained the confidence of the German people; robbery and license were unknown; morning and evening the soldiers assembled for prayer round their regimental chaplains; such an army had never been seen in Europe. It was not less distinguished for its hardy bravery in war; keeping the field in winter as well as summer, it soon drove the imperialists out of Pomerania and the lower basin of the Oder, and stormed Frankfort-on-the-Oder. In the midst of these successes, Gustavus was greatly moved by the sack of Magdeburg (May, 1631). Fearful of being cut off from his basis of operations, he could not advance to the relief of the city without the co-operation or consent of the electors of Brandenburg and Saxony. During the delay thus caused, Magdeburg was taken by Tilly, and became a scene of the most fearful atrocities. Too late Gustavus forced the elector of Brandenburg to hand over to him the fortresses required; a desolating invasion of Saxony by Tilly compelled even the Saxon elector to seek the aid of Sweden. The union of the

Swedish and Saxon forces was followed by the battle of Breitenfeld (near Leipsic), in which Tilly was completely overthrown, and the supremacy of Catholic Austria shattered at a single blow (September, 1631). While the Saxons overran Bohemia, Gustavus, now hailed as the liberator of Protestantism, marched westwards towards the Rhine, gathering round him the friendly Germans, and driving out the imperial garrisons. Würtzburg and Frankfort were occupied; at Oppenheim he forced the passage of the Rhine against the Spaniards; he spent Christmas in the ecclesiastical city of Mainz. Early next spring he advanced into Bavaria, forcing the passage of the Lech in the face of Tilly (who was mortally wounded). Munich had to pay a war contribution to the Swede.

In this overwhelming reverse of fortune, the emperor Ferdinand was obliged to invoke the aid of Wallenstein, who soon changed the course of the war. He gathered a mighty host, cleared the Saxons out of Bohemia, and marching westwards threatened the wealthy city of Nuremberg. Afraid of a repetition of the horrors of Magdeburg, Gustavus hastened northwards and threw himself into the city with a small force. In the neighborhood Wallenstein threw up a fortified camp resolving to starve his rival out; and here the great captains watched each other for several weeks. After drawing his scattered forces together, Gustavus offered battle to the enemy, and when that was declined assaulted his entrenched position, but without effect. Leaving a sufficient garrison to defend the exhausted city, he advanced a second time into Bavaria, where he hoped to draw Wallenstein after him, and thus transfer the seat of war to the enemy's country. But Wallenstein made a desolating march through Thuringia into Saxony, which he resolved to make his winter quarters; and again Gustavus was obliged to leave his Bavarian conquests to save his ally from such a cruel guest. On a misty November day (1632) he attacked the army of Wallenstein at Lützen (near Leipsic). The numbers engaged were not great: according to Ranke, the Swedes were 14,000, the imperialists only 12,000 at the beginning of the conflict; but the battle was one of the fiercest recorded in history. The Swedes had carried the strong positions of the enemy and turned his own cannon against him, when the cavalry of Pappenheim, which had left the main army shortly before the battle, appeared on the field. The Swedes were hurled back; and the king, too eagerly hurrying forward to re-form the battle, was separated from his guards and shot. Wild with rage and sorrow the Swedes renewed the attack, overthrew the enemy, and won his artillery again. Without making any effort to recover it, Wallenstein retreated into Bohemia, while the Swedes carried the disfigured body of their king from the battlefield. It was laid to rest in the Riddarholm church at Stockholm.

Gustavus Adolphus is justly regarded as one of the noblest and greatest figures in history. Even in the art of war he made an epoch. To the huge and unwieldy masses of Tilly he opposed a light and flexible formation of three deep, which he manœuvred with unwonted rapidity. The activity of his movements was equalled by the dexterity with which his artillery and muskets were handled; at Leipsic his guns fired three shots for the enemy's one. The political plans which Gustavus entertained have been the subject of some discussion. That he aimed at founding a Swedish empire of the Baltic, and succeeded in doing so, is certain; he meant also to unite under his protection the *corpus evangelicum* of Germany. Probably too he aspired to become a candidate for the empire; and if so, he had only one disqualification, that he was a foreigner. Even with this drawback it would have been the best course available for Germany; to have enjoyed for a generation the rule of such a man would have been an unspeakable blessing, at any rate infinitely better than the supremacy of Austria, or that process of desolation and disunion which actually took place. In any case his premature death at the age of thirty-eight was an irreparable loss for German Protestantism. The Thirty Years' War, which for two years had been rendered heroic by his presence, degenerated again into a scene of the wildest barbarism, by which Germany was reduced to a wilderness, and flung back at least a century in the march of civilization.

See Geijer, *History of the Swedes*; Fryxell, *History of Sweden*, English translation by Mary Howitt, Lond. 1844, and *Geschichte Gustav Adolfs*, Leipsic, 1852; Gfrörer, *Gustav Adolf*, 4th ed., edited by Klopp, Stuttgart, 1863; Droysen, *Gustaf Adolf*, Leipsic, 1869–70; Ranke, *Geschichte Wallensteins*, 3d ed., Leipsic, 1872; S. R. Gardiner, *The Thirty Years' War*; E. C. Otté, *Scandinavian History*, Lond. 1875; Felix Esquirou de Parieu, *Gustav Adolphe*, Paris, 1875. Schiller's *Geschichte des dreissigjährigen Kriegs* is a brilliant production, but written without a careful study of the sources. (T. K.)

GUSTAVUS III. (1746–1792), king of Sweden, succeeded his father Adolphus Frederick at the age of twenty-five. He was in Paris when his father died, and was an enthusiastic admirer of everything French. His manners were popular; he was brave, resolute, and eloquent. At the beginning of his reign he found the royal power completely overshadowed by the nobles, who in the council virtually dictated the government of the country, and had involved it in frequent disturbance and disgrace. A revolt, contrived for the purpose by one of his adherents, gave Gustavus a pretext for marshalling his guards, whom he won over and employed to make a complete change in the constitution. As the nobles were disliked by the people, they were obliged to submit. Surrounded by soldiers, the diet accepted the new form of government, by which the entire administrative power including taxation was entrusted to the king. In many respects Gustavus made an excellent use of his great power; he improved the army and navy, reformed the administration of justice, abolished torture, and built hospitals. But his foolish aping of French fashions, and his dream of reviving the knightly exercises and accomplishments, led him into great extravagance. His arbitrary attempt to introduce a national dress, as well as the conversion of brandy, the national drink of Sweden, into a royal monopoly, lost him his popularity. In 1788 in his campaign against Russia, several nobles, officers of his army in Finland, refused to carry on the war because it had not been sanctioned by the estates. Angry at this Gustavus summoned the hardy Dalecarlians to his aid, deprived the nobles of their exclusive privileges, and made his power absolute. He continued the Russian war with great bravery and even success till the peace of 1790, which made no change on the Finnish frontier. Gustavus's next project, which he prosecuted with his usual energy and disregard of consequences, was a war to save King Louis XVI. from the Revolution. This war the estates, already weary of his expensive undertakings, refused to support. To avert a new *coup d'état* some nobles formed a conspiracy against him; and Ankarström, formerly an officer in the guard, shot him at a masked ball at Stockholm (1792).

GUSTAVUS IV. (1778–1837), king of Sweden, was son of the preceding. He was only fourteen years of age when his father was cut off, and his uncle Duke Charles acted as regent during the minority. Gustavus early gave proof of an obstinate strength of will and of a highly-wrought temperament bordering on insanity. Thus he went to St. Petersburg, according to agreement, to marry a granddaughter of the empress Catherine, and the whole court was assembled for the ceremony. The bridegroom, however, did not appear, and the company dispersed after waiting several hours. Gustavus had drawn back at the eleventh hour, refusing to sign the marriage treaty because it bound him to grant his future queen the free exercise of her religion. He spent his whole reign under the mastery of a fixed idea, that Napoleon was the Great Beast spoken of in the Apocalypse; and he joined the great coalition of 1805 against the conqueror. In this war Swedish Pomerania was occupied by the French. Even after Tilsit, Gustavus prosecuted the war with unbroken resolution. Sweden suffered fearfully by this obstinacy of the king; the Russians conquered Finland; the Danes invaded the southern provinces; his English allies, wearied of his irrational obstinacy, left him to his fate. Sweden also grew sick of his wrong-headed policy. The officers of the army conspired against him. He was dethroned and detained in captivity, while his uncle Duke Charles was elected to the crown (1809). After the new arrangements had been made, he was banished with the assurance of a considerable income. Under the name of Colonel Gustavson he passed a wandering life abroad, dying at St. Gall in 1837.

GUSTAVUS ADOLPHUS UNION (Gustav-Adolf-Stiftung, Gustav-Adolf-Verein, Evangelischer Verein der Gustav-Adolf-Stiftung), a society formed of members of the Evangelical Protestant churches of Germany, which has for its object the aid of feeble sister churches, especially in Roman Catholic countries. The

project of forming such a society was first broached, in connection with the bicentennial celebration of the battle of Lützen, on the 6th of November, 1832; a proposal to collect funds for a monument to Gustavus Adolphus having been agreed to, it was suggested by Superintendent Grossmann that the best memorial to the great champion of Protestantism would be the formation of a union for propagating his ideas. For some years the society was somewhat limited in its area and operations, being practically confined to Leipsic and Dresden, but at the Reformation festival in 1841 it received a new impulse through the energy and eloquence of the Hofprediger Zimmermann of Darmstadt, and in 1843 a general meeting was held at Frankfort-on-the-Main where no fewer than twenty-nine branch associations, belonging to all parts of Germany except Bavaria and Austria, were represented. The want of a positive creed on the part of the Union tended from the first, however, to make many of the stricter Protestant churchmen doubtful of its probable usefulness; though on the other hand its purely negative attitude in relation to Roman Catholicism secured for it the sympathy of the masses. At a general convention held in Berlin in September, 1846, a keen dispute arose about the admission of the Königsberg delegate Rupp, the founder of the "Free Congregations;" his exclusion, which was carried by a majority, called forth many energetic protests, and at one time it seemed likely that the society would be completely broken up. A peaceful solution of the difficulty, however, was reached at Darmstadt in 1847. Amid the complications of the Revolution of 1848 the whole movement fell into stagnation; but in 1849 another general convention (the seventh), held at Breslau, showed that, although the society had lost both in membership and income, it still was possessed of considerable vitality. From that date the Gustav-Adolf-Verein has been more definitely "evangelical" in its tone than formerly; and under the direction of Zimmermann of Darmstadt it has greatly increased both in numbers and in wealth. In 1853 the income was £13,500; in 1858 it had risen to £21,000; while in 1876 there was divided among 1406 congregations a sum of nearly £35,000. The total number of congregations assisted up to that date was 2558, and the sums distributed amounted to an aggregate of nearly £637,000. Apart from any influence it may have had in advancing the cause of Protestantism in places where it was struggling or weak, there can be no doubt that the Union has had a very great effect in helping the various separate Evangelical churches of Germany to realize the number and importance of their common interests. It ought to be added that the stricter Lutherans still continue to hold aloof from it.

The Verein has numerous special organs, of which the most important are the *Darmstädter Bote des Evangelischen Vereins der Gustav-Adolf-Stiftung* and *Fliegende Blätter*. See Zimmermann's *Geschichte des Gustav-Adolf-Vereins*, Darmstadt, 1858.

GÜSTROW, the chief town of the Wendian circle of the grand duchy of Mecklenburg-Schwerin, Northern Germany, is situated on the Nebel and on the railway from Lübeck to Stettin, 20 miles south of Rostock. The principal buildings are the castle, erected in the middle of the 16th century, now used as a workhouse; the cathedral, dating from the 13th century, and lately renovated, containing many fine monuments and possessing a square tower 100 feet high; the town-hall, dating from the 16th century; the court-houses, the music hall, and the theatre. Among the educational establishments are the ducal gymnasium, which possesses a library of 15,000 volumes, the town real-school, the city school, the trade school, and four female schools. The town is one of the most prosperous in the dukedom, and has breweries, foundries, tanneries, sawmills, brandy distilleries, and manufactories of tobacco, glue, candles, and soap. There is also a considerable trade in wool, corn, wood, butter, and cattle, and an annual cattle show and horse races are held. Population (1905), 17,298.

Güstrow was a place of some importance as early as the 12th century, and in 1219 it became the residence of Prince Henry Burewin II., from whom it received Schwerin privileges. From 1556 to 1695 it was the residence of the dukes of Mecklenburg-Güstrow. In 1628 it was occupied by the imperial troops; and Wallenstein resided in it during part of the years 1628 and 1629.

GUTENBERG, John, was born about 1410 at Mainz of noble parents, his father being Frielo zum Gänsfleisch, and his mother, whose name he adopted, Else zu Gudenberg. In 1420 the citizens of Mainz drove the patricians out of the city, and as Gutenberg's name appears about ten years later at Strasburg the family probably took refuge there. When the expelled families were recalled to Mainz, Gutenberg did not avail himself of the privilege. We next hear of him at Strasburg, where in 1434 he seized and imprisoned the town clerk of Mainz for a debt due by the corporation of that city, releasing him, however, at the urgent representations of the mayor and counsellors of Strasburg. In 1437 Gutenberg was sued before the ecclesiastical court by Emmeline zu Iserne-Thüre for breach of promise of marriage, the case being settled by his making her his wife. The active mind of Gutenberg had adopted several plans for making money before he invented the art of printing with movable types, which is his great claim upon the gratitude of mankind. Before 1425 he engaged in some experiments requiring money, when Andrew Dritzehn, a fellow-citizen, became security for him; and the same year a partnership between them was arranged to carry out Gutenberg's new plan for polishing stones. Next came an improvement in the manufacture of looking-glasses, for which money was lent by other two friends. For these a lucrative sale was expected at the approaching pilgrimage to Aix-la Chappelle, which, however, was unfortunately postponed. In 1438 was arranged a partnership between Gutenberg, Andrew Dritzehn, Andrew Heilmann, and Anton Heilmann, and that this concerned the new art of printing appears from the long law proceedings which soon after followed. The action was brought by the brothers of Dritzehn, who was dead, to force Gutenberg to reveal the secrets of the partnership. The decision was in favor of Gutenberg. In January, 1441, Gutenberg obtained 80 livres by mortgaging some house property, and again in 1442 he borrowed money of Martin Brether for carrying on his experiments. For four years after this nothing is known of Gutenberg except that his wife paid taxes in his name. He now returned to his native city, Mainz, where he borrowed 100 guilders of his kinsman Arnold Gelthus, and established himself in the house Zum Jungen, which was part of the family possessions. At this time Gutenberg must have been able to show some solid and convincing results of his new invention, for he obtained substantial aid from a shrewd goldsmith, John Fust or Faust, who advanced 800 guilders to promote the work, taking as security a mortgage on all the printing materials to be purchased. Gutenberg at once set to work upon a large folio Latin Bible, the printing of which was ended before August, 1455. During the progress of this great undertaking several forms of indulgence and other small things were printed, the earliest with a date being the Indulgence of 1454 in the library at Althorp. But the new art was certainly not a success commercially, and again Fust had to come forward with another 800 guilders to prevent a collapse. In November, 1455, Fust determined to dissolve his connection with Gutenberg, and demanded payment of his advances. Gutenberg not being able to refund so large a sum, Fust took legal proceedings against him, and he was eventually compelled to yield up the whole of the printing materials, which at once were removed by Fust to his own house at Mainz. Here with the assistance of Peter Schöffer he continued to print until the sack of the city in 1462 by Adolphus II. Gutenberg, now in the evening of life, had to make a fresh start in the world, and fortunately in Dr. Humery of Mainz found a friend who assisted him with capital. Embarrassment, however, still pursued him, and the press made slow progress. It is uncertain whether the new press of Gutenberg was in Mainz or at the neighboring town of Eltvill. On January 17, 1465, Gutenberg accepted the post, at the court of Archbishop Adolphus, of salaried courtier. He received annually a suit of livery together with a fixed allowance of corn and wine. Meantime the printing materials were lent to the brothers Bechtermunze, who printed some inconsiderable works, and upon the death of Gutenberg were claimed and taken by Dr. Humery. On February 2, 1468, died Gutenberg, poor, childless, and almost friendless, after laying the foundations of an art which was soon to dominate the world. Arnold Gelthus erected a monument to his memory near his grave, and forty years afterwards Ivo Wittig set up a memorial tablet at the legal college in Mainz.

No portrait of Gutenberg is known, those appearing upon medals, statues, or engraved plates being all fictitious. The

latest authority upon his life and work is *Gutenberg*, by Dr. Van der Linde.

GUTHRIE, Thomas (1803–1873), Scottish clergyman and philanthropist, was born at Brechin, Forfarshire, on July 12, 1803. He entered the university of Edinburgh at the early age of twelve (November, 1815), and continued to attend classes there for more than ten years. During that period he seems to have read widely in general literature, although he did not distinguish himself as a student in the strict sense. On the 2d of February, 1825, the presbytery of Brechin licensed him as a preacher in connection with the Church of Scotland; but it was not till 1830 that he was inducted to his first charge, Arbirlot, in Forfarshire, where he labored for seven years. In 1837 he became the colleague of the Rev. John Sym in the pastorate of Old Greyfriars, Edinburgh, and at once attracted notice as a great pulpit orator. Towards the close of 1840 Guthrie was chosen minister of St. John Church, Victoria Street, Edinburgh. His increasing popularity brought him flattering invitations both from London and from India; but these he firmly declined. He was an enthusiastic supporter of the movement which led to the Disruption of 1843; and his name is thenceforth associated with the Free Church. In 1847 he began the greatest work of his life by the publication of his first *Plea for Ragged Schools*. This pamphlet, amid a multitude of other encomiums, elicited a beautiful and sympathetic letter from Lord Jeffrey. A ragged school was opened on the Castle Hill, which has been the parent of many similar institutions elsewhere. Guthrie insisted on bringing up all the children in his school as Protestants; and he thus made his ragged schools not only educational but proselytizing institutions. This interference with religious liberty led to some controversy; and ultimately those who differed from Guthrie founded the United Industrial School, which is managed on the principle of combined secular and separate religious instruction. In April, 1847, the degree of D.D. was conferred on Guthrie by the university of Edinburgh; and in 1850 Dr. Hanna, the biographer of Dr. Chalmers, was inducted as his colleague in Free St. John's Church.

In 1850 Guthrie published *A Plea on behalf of Drunkards and against Drunkenness*, which was followed by *The Gospel in Ezekiel* (1855); *The City, its Sins and Sorrows* (1857); *Christ and the Inheritance of the Saints* (1858); *Seedtime and Harvest of Ragged Schools* (1860), consisting of his three *Pleas for Ragged Schools;* and *The Way to Life* and *Speaking to the Heart* (1862). These works had an enormous sale, and carried his fame to distant parts of the world. Portions of them were translated into French and Dutch. In 1862 he was moderator of the Free Church General Assembly; but he seldom took a prominent part in the business of the Church courts. In connection with the total abstinence movement he often appeared on the platform, where his oratorical talents, rich humor, genuine pathos, and inimitable power of story-telling eminently qualified him to shine. He was also greatly interested in the work of the Evangelical Alliance, of which he was one of the vice-presidents. In 1864, his health being seriously impaired, he resigned public work as pastor of Free St. John's (May 17), although his nominal connection with the congregation ceased only with his death. Guthrie had occasionally contributed papers to *Good Words*, and, about the time of his retirement from the ministry, he became editor of the *Sunday Magazine*, himself contributing several series of papers which were afterwards published separately. In 1865, he was presented with £5000 as a mark of appreciation from the public. His closing years were spent mostly in retirement; and after an illness of several months' duration he died at St. Leonard's-on-Sea, February 24, 1873.

Dr. Guthrie's fame rests on his labors as a social reformer and his extraordinary oratorical power as a preacher and platform speaker. He will always be remembered as one of the most successful and warm-hearted of Christian philanthropists; and his influence over the masses of his countrymen was very great. His theology was the moderate Calvinism generally accepted by the Evangelical school. His style is distinguished by great graphic power and richness of illustration; but, although admirably adapted for effect on a popular audience, it is far too florid and Asiatic in its rhetoric to please a sound literary critic.

See *Autobiography of Thomas Guthrie, D. D., and Memoir* by his sons, 2 vols., London, 1874–5.

GUTS MUTHS, Johann Christoph Friedrich (1759–1839), a German teacher and the principal founder of the German school system of gymnastics, was born at Quedlinburg, 9th August, 1759. He was educated at the gymnasium of his native town and at Halle university; and in 1785 he went to Schnepfenthal, where he taught geography and gymnastics in Salzmann's academy. His method of teaching gymnastics was expounded by him in various handbooks; and it was chiefly through them that gymnastics very soon came to occupy such an important position in the school system of Germany. He also did much to introduce a better method of instruction in geography. He died May 21, 1839.

His principal works are *Gymnastik für die Jugend*, 1793; *Spiele zur Uebung und Erholung des Körpers und Geistes für die Jugend*, 1796; *Turnbuch*, 1817; *Handbuch der Geographie*, 1810; and a number of books constituting a *Bibliothek für Pädagogik, Schulwesen, und die gesammte pädagogische Literatur Deutschlands*. He also contributed to the *Vollständiges Handbuch der neuesten Erdbeschreibung*, and along with Jacobi published *Deutsches Land und deutsches Volk*, the first part, *Deutsches Land*, being written by him.

GUTTA PERCHA (Gutta Taban, etc.). This name[1] is applied to the concreted or inspissated juice of various plants belonging to the natural order *Sapotaceæ*, growing in the Malay Peninsula. To what particular tree the name "gutta percha" properly belongs, there is no evidence to show; but it has been generally given to *Dichopsis Gutta* (Bentley and Trimen), or *Isonandra Gutta* (Hooker), the vernacular name of which is "taban."[2]

The *Dichopsis Gutta* attains a height of 60 to 80 feet, with a diameter of 2 to 4 feet. The leaves are obovate-oblong and entire, pale green on the upper side, and covered beneath with short reddish-brown shining down. The flowers are arranged in clusters of 3 or 4 in the axils of the leaves. The fruit, about an inch long, is of an ovoid shape, and is eaten by the Malays. In Siák (Sumatra) a vegetable butter is prepared from the seeds. The wood is soft, fibrous, spongy, of a pale color, and marked with black lines, these being reservoirs of gutta percha.[3] The gutta, as it flows from the tree, is of a grayish hue, occasionally with a somewhat roseate tinge, probably arising from the color vessels of the bark becoming ruptured through surcharge, and their contents mixing with the gutta. This species does not furnish all the gutta percha of commerce; indeed there are other trees which yield larger quantities. In all there are about thirty varieties known; but some of the vernacular names in different districts may prove mere synonyms.

The geographical distribution of the trees producing gutta percha is very restricted. Gützlaff defines the limits as 6° N. and S. lat. and 100° to 120° E. long.; whilst Captain Lingard (who has great personal experience on the subject) gives the limits as 4° N. and 3° S. lat., still further restricting the finer varieties to 3° 50′ N. and 1° S., with a temperature ranging between 66° and 90° Fahr., and a very moist atmosphere. These limits are well within the isotherm of 80° Fahr. Many of the best varieties are found only on the hill slopes at a distance from the sea-coast, each variety forming a separate grove of from 200 to 500 trees, with high forest trees above them. They grow best in a rich light loam, with a rocky subsoil.

The collection of gutta percha generally takes place directly after the rainy season, as in the dry season the gutta does not flow so readily, while during the rains ague and jungle fever are most prevalent, and the gutta is liable to be washed away from the felled trees. The yield of a well-grown tree of the best variety is from 2 to 3 lb of gutta percha, such a tree being about thirty years old, 30 to 40 feet high, and 1½ to 3 feet in circumference. A full-grown tree sometimes measures 100 to 140 feet to its first branches, with a girth of 20 feet at a distance of 14 feet from the base, and may yield 50 to 60 lb of gutta percha, which loses in six months about 35 per cent. of its weight in drying.

[1] Gutta, or as it is variously written gutah, gatta, gittáh, gátta, is the Malayan term for gum, and Percha (pronounced as in perch, *not* hard as perka), accentuated variously as pârcha, pertja, perchá, is the name of the tree; hence the term may be translated "gum of the percha tree." The old name of Sumatra was Pulo or Pulau Percha, *i. e.*, "island (Pulau) of the percha tree."

[2] Tuban, túban, tábán is the name of the tree, and, according to Logan, a new word has been added to the Malay language, viz., Menábán (Men[t]aban), *i. e.*, to collect gutta taban. The greater number of Malay nouns admit of conversion into verbs by a prefix.

[3] For figures and botanical descriptions see *Lond. Journ. Bot.*, 1848 De Vriese, *De Handel in Getah-Percha;* and Bentley and Trimen's *Medicinal Plants*, part 35, p. 16 (1878).

The methods of extracting the gutta percha are much the same amongst the Malays, Chinese, and Dyaks. The trees are cut down just above the buttresses, or *banees*, as they are called; and for this purpose a staging about 14 to 16 feet high is erected. The tools used in felling are either "billiongs" or "parangs." A billiong is a kind of axe used by the Malays in felling, building, etc. The blade is of a chisel-like form, and the tang is secured at right angles to a handle by means of a lashing of "ratan" or cane. The Chinese sometimes use an axe perfectly wedge-shaped. The parang looks more like a sword-bayonet, and in the hands of a Malay is a box of tools in itself, as with it he can cut up his food, fell a tree, build a house, or defend himself.

When the tree is felled the branches are speedily lopped off, to prevent the ascent of the gutta to the leaves. Narrow strips of bark, about an inch broad and 6 inches apart, are then removed, but not all round the tree, as its underpart in its fall becomes buried in the soft earth, much sap being thus lost. Some natives beat the bark with mallets to accelerate the flow of milk or gutta. The milk flows slowly (changing color the while) and rapidly concretes, and, according to its source, may vary from yellowish-white to reddish or even brownish in hue. The gutta as it flows is received into hollow bamboos, doubled-up leaves, spathes of palms, pieces of bark, cocoa-nut shells, or in holes scraped in the ground. If the quantity obtained is small, it is prepared on the spot by rubbing it together in the hands into a block, in one end of which a hole is made to carry it by. In this state it is known in the market as "raw gutta," or "gutta muntah." If water gets mixed with the juice, the gutta becomes stringy and is considered deteriorated, but after boiling appears quite as good. Sometimes the gutta is kept in a raw state for a month or two, and then undergoes the next step in the preparation, that is, boiling. The boiling is generally conducted in a "kwali" or pan of cast or hammered iron, of about 15 inches in diameter and 6 inches deep. The boiling is either simply with water, or with the addition of lime juice or cocoa-nut oil. If one pint of lime juice be added to three gallons of gutta juice, the latter coagulates immediately on ebullition.

On arriving at the port of shipment the gutta, before exportation, generally undergoes examination and classification into parcels, according to quality. As received in the "godowns" or warehouses it presents great diversities in condition, shape, size, and color,—from crumbling, hardly coherent, whitish or grayish "raw" or "getah muntah" fragments, to reddish or brownish blocks as hard as wood. Sometimes it is made up into all manner of grotesque shapes of animals, and it is nearly always largely adulterated with sago-flour, sawdust, clay, stones, etc. The Chinese are great adepts in assorting and classifying gutta, and frequently prepare from different varieties a certain "standard sample" by cutting or chopping the material into thin slices and boiling with water in large shallow iron pans, keeping the contents constantly stirred with poles, and adding good gutta percha and even cocoa-nut oil to give a better appearance. When sufficiently boiled the gutta is pressed into large moulds, and is then ready for shipment. This process of reboiling is wholly unnecessary, and in some cases is done only to get rid of stuff which has no right to be called "gutta percha."

The amount and value of gutta percha imported into Great Britain in 1875–77 were as follows:—

	1875.	1876.	1877.
Cwts.	19,686	21,558	26,359
Value	£149,684	£163,441	£238,327

The price of gutta percha ranges from 4d. to 3s. per lb, according to quality and demand.

History.—The early history of the use of gutta percha is somewhat obscure; the Malays and Chinese are said to have long known and used it. One of the earliest notices of it in England occurs in a catalogue of the collection of the famous Tradescants.[1] Dr. Montgomerie, a surgeon in the East India Company's service, was the first to direct attention to gutta percha as likely to prove of great utility in the arts and manufactures. Having observed the substance in Singapore in 1822 in the form of whips, he commenced experimenting with it. In 1842, being again stationed at Singapore, he followed up the subject, and his recommendation of it to the medical board of Calcutta as useful for making of splints and other surgical apparatus met with high approval. He also sent specimens, with relative information, to the Society of Arts of London, which society warmly took up the subject, and on Montgomerie's return to England in 1844 presented him with its gold medal. Some have claimed the honor of introducing gutta percha to the notice of the commercial world for Dr. (afterwards Sir) Josè D'Almeida, who sent a specimen merely as a curiosity to the Royal Asiatic Society in 1843, but careful investigation clearly decides the question of priority in favor of Montgomerie. The Society of Arts having requested him to lay before them the result of his experiments, he delivered a lecture in the autumn of 1844, and many patents were at once taken out, the chief being those of Mr. C. Hancock, Mr. Nickels, Mr. Keene, Messrs. Barlow and Forster, Mr. E. W. Siemens, and others. After this the substance soon came into general use.[2]

Properties.—Gutta percha, like many other milky juices, occurs in the laticiferous tissue of the plant, which exists in greatest abundance in the middle layer of the bark. See BOTANY, vol. iv. p. 77.

Gutta percha is resolvable into two resins, *albin* and *fluavil*. Like caoutchouc or india rubber, it is a hydrocarbon; Soubeiran gives its composition as—carbon 87·80 and hydrogen 12·20. In commercial gutta percha we have this hydrocarbon or pure gutta, *plus* a soft resin, a resultant of oxidation of the hydrocarbon. M. Payen gives the following analysis of commercial gutta percha:—

Pure gutta (milk-white in color and fusible), 75 to 82 per cent.
Resins soluble in boiling alcohol:—
1. Chrystalbin or albin ($C_{20}H_{32}O_2$), white, and crystallizing out of the alcohol as it cools, 6 to 14 per cent.
2. Fluavil ($C_{20}H_{32}O$), yellow, falling as an amorphous powder on the cooling of the alcohol, 6 to 14 per cent.

It is thus apparent that the change of pure gutta into a resin-like mass takes place naturally if means be not taken to stop it. Many a good parcel has been thus lost to commerce, and the only remedy seems to be thorough boiling as soon after collecting as possible. It must be remembered too that, in cutting through the bark to arrive at the laticiferous vessels, many other vessels and cells become ruptured, containing tannic and gallic acids, etc., and the presence of these no doubt accelerates oxidation. In opening bottles of the milky juice a turbidity and effervescence are often noticed, owing to the formation of a brownish liquid, the color being probably due to the presence of gallic acid. In improperly prepared blocks of gutta also these foreign substances induce the presence of a brown fermented and putrid liquid, which decomposes the internal mass. Many of these substances, being soluble in water, are removable by the process of boiling.

Gutta percha as met with in commerce is of a reddish or yellowish hue, but when quite pure is of a grayish-white color. In this state it is nearly as hard as wood, only just receiving the impression of the nail, is of a porous structure, and when viewed under the microscope has the appearance of a series of variously hued prisms. When moulded, rolled into sheets, or drawn into ropes, it assumes a fibrous character in the direction of its greatest length, in which direction consequently it can be stretched without rupture. If, however, a strip of a sheet be cut off across the fibre, it will be found that a redistribution of the tenacity of the slip takes place; *i.e.*, the direction of the fibrous character is developed in an opposite direction. The electrical properties of gutta percha were first noticed by Faraday. If a piece be subjected to friction, an electric spark can be obtained. On its relative electric conductivity, see vol. viii. p. 51.

At a temperature of 32° to 77° Fahr., gutta percha has as much tenacity as thick leather, though inelastic and less flexible. In water at 110° Fahr. it becomes less hard; towards 120° Fahr. it becomes doughy, though still tough; and at from 145° to 150° it grows soft and pliable, allowing readily of being rolled and moulded. In this state it has all the elasticity of caoutchouc, but this it loses as it cools, gradually becoming hard and rigid again, and retaining any form impressed on it whilst in its plastic condition. It is highly inflammable, and burns with a bright flame, dropping a black residue like sealing wax. The specific gravity of gutta percha has been variously stated at from 0·96285 to 0·99923. It is insoluble in water,

[1] In the *Museum Tradescantianum; or, a Collection of Rarieties preserved at South Lambeth, neer London, by John Tradescant*, . . . London, MDCLVI., the following entry occurs (p. 44):—"VIII. Variety of Rari'ies.—The plyable mazer wood, being warmed, will work to any form." This museum became the nucleus of the Ashmolean Museum at Oxford. The word "mazer," variously spelt, often occurs in early English poetry, and is specially mentioned in old catalogues and wills. It is by no means impossible that mazer cups may have been made of gutta percha, as its lightness, strength, and non-liability to fracture would recommend it; and curiously enough one of the vernacular names of the tree yielding gutta percha is "mazer-wood tree."

[2] See Collins on "Gutta Percha" in *British Manufacturing Industries* (Stanford & Co.), and the very interesting volume of *Specifications of Patents in Caoutchouc, Gutta Percha*, etc. issued by the Patent Office.

alcohol, dilute acids, and alkalies, but dissolves in warm oil of turpentine, bisulphide of carbon, coal tar oil, caoutchin or oil of caoutchouc, and its own oil,—for it yields by destructive distillation an oil similar to that yielded by caoutchouc under the same treatment. Ether and some of the essential oils render it pasty, and it is softened by hot water, absorbing a small quantity of the water, which is slowly parted with in cooling.

Manufacture and Applications.—Gutta percha, as received in England, is in irregular clumps or blocks, and is frequently adulterated with massive stones, sawdust, bark, sago flour, and other foreign matters; and the first step in its manufacture is to cleanse it thoroughly. The blocks are first sliced by means of a powerful circular wheel driven by machinery, and having fixed in it two or three strong chisel-like knives, by which it is divided into thin slices. These are placed in wooden troughs filled with water and heated by steam. As soon as the gutta percha becomes soft, it is taken out in baskets and placed in a toothed iron cylinder, called a "devilling" machine, which tears it into fragments; these fall into a trough of water, and the impurities sink to the bottom, leaving the purified gutta floating in the form of a spongy mass. This mass is then taken out by means of perforated shovels, thoroughly washed in cold water, and dried in baskets. It is then packed in jacketed iron chests heated by steam, and left till it becomes soft, when it is at once removed, and kneaded or masticated by means of a cast-iron cylinder, with a movable lid and an internal revolving toothed iron axis,—the result being a homogeneous dough-like reddish-brown mass. Sometimes various substances are introduced into this machine, which is called a "masticator," to increase the hardness or density of the gutta, or to color it,—such as orange or red lead, chrome, vermilion, yellow ochre, sulphur, caoutchouc, gypsum, or resin, care being taken to use such substances only as are not affected by the heat necessary in the operation. The incorporation is conducted with great nicety, as at the will of the operator a soft and elastic or a hard and horny substance can be produced. When sufficiently masticated, the gutta is placed whilst still hot between two steel cylinders, and thoroughly rolled. By means of an endless band of felt the gutta is returned again to the cylinders, the distance between which is gradually diminished so as to compress and completely drive out any contained air from the gutta percha. There are various machines for cutting driving bands, etc., to a uniform width, and for rounding off the edges and finishing. Soles for boots are made by cutting a long strip of the requisite width, and then passing the strip under a hollow die.

In making piping a machine is used consisting of a cylinder, with a die-piece attached of the requisite size. By means of a piston the gutta percha, which is introduced into the cylinder in a plastic condition, is driven through the die-piece, and the piston gives the inner diameter of the piping. As the piping issues from the machine, it passes immediately into a trough of water, which "sets" it, and prevents it from collapsing. The value of gutta percha piping is very great: it does not contaminate water as lead piping does; it withstands insects, damp, etc., and is easily manipulated, being shortened, lengthened, or repaired without trouble or expense; and its acoustic properties have led to its employment largely in the manufacture of aural, stethoscopical, and other instruments. Gutta percha speaking-tubes are now to be seen in nearly every office. The substance too, from the fact that few acids and alkalies affect it, especially if dilute, is largely employed for funnels, siphons, and other chemical apparatus.

In telegraphy gutta percha is of the very highest importance, being a cheap, lasting, and powerful insulator, easily applied to telegraphic wires. The general method of coating telegraphic wire is by charging a cylinder with plastic gutta percha, and forcing it through a die-piece, the wire forming a central core. As the wire is drawn through this "die" or "moulding" piece, it becomes coated to the requisite thickness, and after passing through water it is wound on drums ready to be coated with tarred rope, and with galvanized iron wire if required for submarine cables.

The readiness with which gutta percha, whilst in its plastic condition, receives an impression, which it retains when cold, early led to its employment in the decorative and fine arts, since it reproduces the finest lines, as in the taking of moulds from electrotypes. See ELECTROMETALLURGY.

In the production of imitations of oak and other ornamental woods, gutta percha has been largely used, since by the admixture of various substances "graining" or "marbling" can be very naturally represented, and a coating of a solution of gutta percha gives a varnish of great brilliancy.

Substitutes.—Many substances have been recommended as substitutes for, or as supplementary to, gutta percha. Among these Balata gum undoubtedly holds the first place. It is obtained from the *Mimusops Balata* (Gärtner), a tree found in British and French Guiana, Jamaica, etc. Prof. Bleekrod seems to have been the first to direct attention to this substance, by bringing it before the notice of the Society of Arts in 1857.[1] The Balata gum combines in some degree the elasticity of caoutchouc with the ductility of gutta percha, freely softening and becoming plastic, and being easily moulded like gutta percha. What small parcels have been sent to England have met with a ready sale, and were remarkably pure and free from adulteration. But unfortunately, through the difficulty of collection, the occupation being dangerous and unhealthy, the supply of this excellent article has fallen off. It is procured by making incisions in the bark of the tree about 7 feet from the ground, a ring of clay being placed around to catch the milk as it exudes. A large tree is said to yield as much as 45 lb of "dry gum."[2] *Pauchontee*, the produce of *Dichopsis elliptica*, Collins (*Bassia elliptica*, Dalzell), is a most interesting substance, and may yet prove an article of commerce if properly treated; at present, although by heat it becomes plastic and ductile, it is brittle and resin-like when cold. The tree is found very generally distributed in Wynaad, Coorg, Travancore, etc.

Many of the euphorbias yield milky juices which have some at least of the properties of gutta percha. The chief amongst these are the cattimandoo (*Euphorbia Cattimandoo*, Elliot) and the Indian spurge tree (*E. Tirucalli*, Linn.) of India, and some euphorbias at the Cape of Good Hope. The alstonia or pala gum (*Alstonia scholaris*, R. Br.) and the mudar gum (*Calatropis gigantea*, R. Br.), have also been recommended as substitutes for gutta percha. But the attempts made to utilize these substances have as yet been unsuccessful.

Future Supplies.—A very important matter for consideration is the question of the future supplies of gutta percha. It is after all only a spontaneous natural product. If a Malay or Chinese wishes to plant peppor, gambier, etc., he burns down a portion of the forest, and when he has raised two or three crops he clears a new portion, and thus finely wooded spots become denuded of trees, and covered with rank grass rendering them unfit for further cultivation. Again, to obtain the gutta percha the trees are cut down, and none are planted in their stead, so that in districts where they were in abundance one or two only are now preserved as curiosities. It is a wonder indeed that a single tree is left. A writer in the *Sarawak Gazette* says that from 1854 to 1875 over 90,000 piculs (of 133⅓ lb each) of gutta percha was exported from Sarawak alone, and this meant the death of at least 3,000,000 trees. In fact the only thing that preserves the tree at all is that it is of no use to cut one down till it is 25 to 30 years old. Sooner or later recourse must be had to cultivation and conservation. (J. CO.)

GUTZKOW, KARL (1811–1878), one of the most distinguished of modern German novelists and dramatists, was born 17th March, 1811, at Berlin, where his father held a clerkship in the war office. After completing his education at the Friedrichswerder gymnasium, he entered upon the study of theology and philosophy at the university of his native town, where, having had his interest awakened by the political and social questions of the time by the Paris revolution of July, 1830, he, while still a student, began his chequered literary career by the publication in 1831 of a periodical entitled *Forum der Journalliteratur*. Although, as was to be expected, the serial was a failure and was soon discontinued, it procured for him the notice of Wolfgang Menzel, who invited him to Stuttgart to assist him in the editorship of the *Literaturblatt*. At the same time he continued his university studies, first at Jena, then at Heidelberg, and latterly at Munich. In 1832 he published anonymously at Hamburg *Briefe eines Narren an eine Närrin*, and in 1833 appeared at Stuttgart *Maha-Guru, Geschichte eines Gottes*, a fantastic and satirical romance intended to ridicule the current conceptions of the divine. In 1835, on account of a difference with Menzel, he discontinued his contributions to the *Literaturblatt*, and went to Frankfort, where he became collaborateur with Duller on the *Phönix*, and also founded the *Deutsche Revue*. In the same year appeared *Wally, die Zweiflerin*, from the publication of which may be said to date the school of writers who, from their opposition not only to Romanticism but to all the time-honored literary, social, and religious traditions, have received the name of "Young Germany." The work was directed specially against the institution of marriage and the belief in revelation; and whatever attention it might have attracted from its own merits was tenfold increased by the action of the Government, which, besides condemning its author to three months' imprisonment, decreed the suppression of all he had written or might yet write, and prohibited him from exercising the functions of editor within the states of the *Bund*. During his term of imprisonment Gutzkow employed himself in the composition of his treatise *Zur philosophie der Geschichte*, published at Hamburg

[1] *Journ. Soc. Arts*, Oct. 8, 1857; also Aug. 24, 1860, and March 4, 1864.

[2] *Trinidad Chronicle*, Sept. 2, 1873.

in 1836, in which he opposed the Hegelian theory as to the nature and ends of history. On obtaining his freedom he went to Frankfort, where, shortly afterwards, he was married, and where he wrote several volumes on various subjects which he published at Hamburg and Stuttgart; but finding himself hampered in his literary undertakings by the prohibitions of the Prussian Government, he removed in 1837 to Hamburg. Here he inaugurated a new epoch of his literary activity by bringing out his tragedy *Richard Savage*, which immediately made the round of all the German theatres, and first decidedly won the ear of Germany for the modern drama. Of his numerous other plays the majority are now neglected; but a few have obtained an established place in the repertory of the German theatre,—especially the comedies *Zopf und Schwert* (1844) and *Das Urbild des Tartüffe* (1847), and the tragedy *Uriel Acosta* (1847); the deep tragic interest, fine dramatic situations, and terse and pregnant diction of the last entitle it to rank among the best dramas of modern times. In 1842 Gutzkow paid a visit to Paris, of which he gave an account in *Briefe aus Paris* (Leipsic, 1842). After his return to Germany he resumed his stay at Frankfort, where he was chiefly occupied in preparing for the press an edition of his collected works, published in 12 volumes, 1845–46; but in 1847 he went to Dresden, where he succeeded Tieck as director of the court theatre. About the same time began that period of his literary activity to which belongs the series of remarkable works of fiction intended to depict the action and tendency of the principal intellectual, social, and religious forces in modern society. The chief of these novels are *Die Ritter vom Geiste* (9 vols., Leipsic, 1850–52) and *Der Zauberer von Rom* (9 vols., Leipsic, 1859–61) The latter, a study of Roman Catholic life in southern Germany, is generally regarded as his masterpiece; and its vigorous and trenchant delineations of character are not more notable than its keen analysis of the motives underlying religious professions, and its subtle penetration into the characteristics and tendencies of the various forms of religious opinion. In regard, however, to both works, it may be objected that their great length, their somewhat tedious dallying over unimportant details, the intricate nature of their plots, and the hampering influence of their controversial purpose lessen considerably the legitimate effect of their many striking and original character portraits, their skilfully arranged dialogues and frequently powerfully dramatic scenes, and the cunning manner in which their incidents are blended into one whole. The success of *Die Ritter vom Geiste* suggested to Gutzkow the establishment of a journal on the model of Dickens's *Household Words*, entitled *Unterhaltungen am häuslichen Herd*, which first appeared in 1852, and was continued till 1862. In 1864 he had an attack of insanity, during which he made an attempt upon his life; and although after his recovery he continued to write as voluminously as formerly, his productions show henceforth decided traces of failing powers. To this period belong the historical novels *Hohenschwangau* (5 vols., 1868) and *Fritz Ellrodt* (3 vols., 1872); *Lebenbilder* (3 vols., 1870–72), consisting of autobiographic sketches; and *Die Söhne Pestalozzis* (3 vols., 1870), the plot of which is founded on the story of Kaspar Hauser. On account of a return of his nervous malady, Gutzkow in 1873 made a journey to Italy, and on his return took up his residence in the country near Heidelberg. Although some time before his death he had been confined to his sick chamber at Frankfort, its occurrence, 16th December, 1878, was due to accidental suffocation from smoke.

The writings of Gutzkow suffer in character from the controversy which embittered his life. His didactic purpose was too strong to allow his fine artistic faculty full freedom of action, and notwithstanding his true dramatic insight, firm grasp of character, rich vein of original thought, and wonderful comprehension of the principles at work in modern society, he did not possess that command of his materials which is necessary to mould them into poetic completeness. But although his popularity has not been commensurate even with his merits, no recent writer has exerted a more powerful influence on the opinions of modern Germany; and if his works are not destined to live by virtue of their inherent value, many of them will always be of interest as the mirror in which the intellectual and social struggles of his time are best reflected.

An edition of Gutzkow's collected works appeared at Jena, 1873–76. Since his death the issue of a popular edition has been undertaken, the first volume of which, containing the autobiography of his boyhood and his miscellaneous poems, has already appeared. His *Rückblicke auf mein Leben*, published in 1875, deals specially with that period of his life when he was director of the Dresden theatre. A complete biography by Johannes Proelss is now in process of preparation.

GÜTZLAFF, Karl Friedrich August (1803–1851), a missionary to China, was born at Pyritz in Pomerania, 8th July, 1803. At an early age he cherished a strong desire to become a foreign missionary, but the poverty of his parents made it impossible for them to aid him in attaining his wishes, and he became apprentice to a saddler in Stettin. In 1821, however, he made known his inclination to the King of Prussia, through whom he obtained admission to the Pädagogium at Halle, and afterwards to the mission institute of Jänike in Berlin. In 1826, under the auspices of the Netherlands Missionary Society, he went to Batavia, where by intercourse with the Chinese residents he perfected himself in the Chinese language. He, however, severed his connection with the Netherlands Society in 1828, and went to Singapore; and in August of the same year he removed to Bangkok, the capital of Siam, where he occupied himself with translating the Bible into Siamese. In 1829 he married an English lady, who aided him in the preparation of a dictionary of Cochin China, but she died in August, 1831, before its completion. Shortly after her death he sailed to Macao in China, where, and subsequently at Hong Kong, he worked at a translation of the Bible into Chinese, published a Chinese monthly magazine, and wrote in Chinese various books on subjects of useful knowledge. He also at different times undertook voyages on the coast of China, and in 1834 he published at London an account of them under the title *Journal of Three Voyages along the Coast of China in 1831, 1832, and 1833*. He was appointed in 1835 joint Chinese secretary to the English commission, and during the opium war and the negotiations connected with the peace that followed he rendered valuable service by his knowledge of the country and people. On account of the continued refusal of the Chinese authorities to permit foreigners to penetrate into the interior, Gützlaff in 1844 founded an institute for the training of native missionaries, which was so successful that during the first four years as many as forty-eight Chinese were sent out from it to carry on missionary labors among their fellow-countrymen. He died at Hong Kong, August 9, 1851.

Besides the works already mentioned, Gützlaff is the author of *A Sketch of Chinese History, Ancient and Modern*, London, 1834; and a similar work published in German at Stuttgart in 1847; *China Opened*, 1838; and the *Life of Taow-Kwang*, 1851 (German edition published at Leipsic in 1852). A complete collection of his Chinese writings is contained in the library at Munich.

GUY, Thomas (1644–1724), founder of Guy's Hospital, London, was the son of a lighterman and coal-dealer at Southwark. After serving an apprenticeship of eight years with a bookseller, he in 1668 began business on his own account. He dealt largely in Bibles, which had for many years been poorly and incorrectly printed in England. These he at first imported from Holland, but subsequently obtained from the university of Oxford the privilege of printing. Thus, and by an extremely thrifty mode of life, and more particularly by investment in Government securities, the subscription of these into the South Sea Company, and the subsequent sale of his stock in 1720, he became master of an immense fortune. He died unmarried, December 17, 1724. In 1707 he built three wards of St. Thomas's Hospital, which institution he otherwise subsequently benefited; and at a cost of £18,793, 16s. he erected Guy's Hospital, leaving for its endowment £219,499; he also endowed Christ's Hospital with £400 a year, and in 1765 built almshouses at Tamworth, his mother's birthplace, which was represented by him in parliament. The residue of his estate, which went to distant relatives, amounted to about £80,000.

See *A True Copy of the Last Will and Testament of Thomas Guy, Esq.*, London, 1725; J. Noorthouck, *A New Hist. of London*, bk. iii., chap. i., p. 684, 1773; Nichols, *Literary Anecdotes*, vol. iii. p. 599, 1812; and Charles Knight, *Shadows of the Old Booksellers*, pp. 3–23, 1865.

GUY OF WARWICK, an old English metrical romance which is known to have existed in French as early as the end of the 13th century. Its authorship has been assigned

to Walter of Exeter, a Franciscan monk of the 13th century, and, although this supposition has been generally disputed, Tanner regards it as probable. The romance has been retouched by some French or Anglo-Norman minstrel, but is evidently of Saxon origin, and is allied to the story of Guido Tyrius in the *Gesta Romanorum*, and probably to the romance *Sir Guy*, quoted by Chaucer in his *Rime of Sir Topas*. The hero of the story is Sir Guy of Warwick, who is said to have been the son of Siward, baron of Wallingford, to have married Felicia, the only daughter of Rohand, a famous Saxon warrior, to have become earl of Warwick in his wife's right, and after conquering Colbrond the Dane to have lived as a hermit till his death in 929. The earliest English chronicler who mentions the story as historical is John Harding. Tanner is of opinion that the first germ of the romance dates from the battle of Brunanburgh, the "Vinheide" of the *Egilssaga*, but though the story has some basis in tradition, the chief events of the hero's life are plainly mythical. Although the romance had once great popularity, it now appears dull and tedious, and has no other than an antiquarian interest.

An edition of the romance in French prose appeared at Paris in 1525 printed by Anthoine Couteau, and it is also referred to in the Old Spanish romance, *Terente el Blanco*, written about 1430. The earliest English edition is that without date printed at London by William Copland, who died in 1568 or 1569. There exists also an edition printed at London by John Cawood without date, another by Samuel Rowlands in 1667, and three by C. Bates in 1700. The earliest English manuscript of the romance is that contained in the Auchinleck MS. in the Advocates' Library, Edinburgh, which is, however, imperfect at the commencement and in the middle. It was printed for the Abbotsford Club in 1840. There is a perfect copy in the library of Caius College, Cambridge, and another in the Cambridge University Library. A fragment of the romance, from a MS. in the British Museum, was privately printed by Sir Thomas Philipps, 1838, and the same fragment was reprinted in the Abbotsford edition. The manuscript in the University Library, Cambridge, was printed for the first time in the *Romance of Guy of Warwick*, edited for the early English Text Society by Zupitza, 1875. All these English versions appear to have been translated from the Anglo-French version. There are, according to Zupitza, at least eight French MSS. in existence,—three in London, one at Oxford, two at Cambridge, one at Cheltenham, and one at Wolfenbüttel. There is also a copy in the Imperial Library at Paris; and there was one at Bruges in 1467, and one at Brussels in 1487. A portion of the Wolfenbüttel MS. has been edited by G. A. Herbing in the *Programm der grossen Stadtschule zu Wismar als Einladung zur Michaelisprüfun*, 1872. See also Zupitza, *Zur Literaturgeschichte von Guy von Warwick*, 1813; *The Percy Folio MS.*, edited by Hales and Furnivall, vol. ii.; and A. Tanner, *Die Sage von Guy von Warwick*, 1877.

GUYON, or GUION, JEANNE MARIE BOUVIÈRES DE LA MOTHE (1648–1717), a leading exponent of the quietistic mysticism of the 17th century, was born of wealthy and aristocratic parents at Montargis (dep. Loiret), on the 13th of April, 1648. From infancy a sickly and excitable child, she was at the age of two years and a half placed for a short time under the charge of the Ursuline nuns at Montargis, and in 1652 she became resident in the Benedictine convent for a somewhat longer period; but the state of her health rendered it necessary that she should again be taken home, where for a time she was left almost exclusively to the care of domestics. From her seventh to her tenth year she was once more with the Ursulines, and after another short interval at home she next passed eight months in the Dominican cloister, where she spent much time in reading the Bible, and in committing large portions of it to memory. In her 12th year she communicated for the first time, and also began to form some acquaintance with the writings of St. Francis de Sales and of his disciple Madame de Chantal, "la Sainte de Monthélon." In imitation of the latter, she tells us in her autobiography that she at this time carried the name of the Saviour visibly inscribed on her person, subjected herself to severe bodily austerities, and made a solemn vow ever to aim at the highest perfection in an absolute surrender of her will to God. She earnestly wished also to take the veil, and in fact made an attempt, by means of a forged letter purporting to be signed by her mother, to gain admission into the order of the Visitation of Mary, but her father interfered. In 1663 she removed along with her parents to Paris, and went much into society, where her youth, beauty, and talent secured for her a very flattering reception; in the following year, before she was quite sixteen, she was married to M. Guyon, a man of some wealth and position, but of weak health, and twenty-two years her senior. The union, on her side at least, had not been dictated by love; her husband's affection, though probably genuine enough, appears to have been of a somewhat tepid kind; and disparity of age, as well as wide differences of taste and habit between herself and M. Guyon, combined with other circumstances, such as the jealousy of her mother-in-law, and her own eager temper, to make her married life anything but happy. She "began to eat the bread of sorrow and to mingle her drink with tears," and her lonely and desolate heart was not comforted until it found quiet in God. It was in her twenty-first year, on the 22d of July, 1668, she tells us, that, after much reading of Thomas a Kempis, St. Francis de Sales, and other religious writers, much spiritual conversation with those who knew best about the mysteries of the "inner life" and the happiness of the state of "recollection in God," much groping in deep darkness, and much wrestling in agonized prayer, she at last experienced the change of heart which filled her with joy and peace in the life of faith. The words in which she describes that crisis, if indeed they are not colored by later experiences, are interesting and important, as showing that thus early she had already reached all that was distinctive of her quietism. "Nothing was more easy to me now than to practise prayer. Hours passed away like moments, while I could hardly do anything else but pray. The fervency of my love allowed me no intermission. It was a prayer of rejoicing and of possession, wherein the taste of God was so great, so pure, unblended, and uninterrupted, that it drew and absorbed the powers of the soul into a profound recollection, a state of confiding and affectionate rest in God, existing without intellectual effort. For I had now no sight but of Jesus Christ alone. All else was excluded in order to love with greater purity and energy, without any motives or reasons for loving which were of a selfish nature." In the months and years that followed she learned by much experience how difficult it is to keep even such heights as the soul has already gained; but her aim, ever more clearly seen and more steadily followed, continued to be "entire consecration," "perfect faith and love." Amongst those who were helpful to her during this period was Geneviève Granger, the prioress of a Benedictine community in Paris, under whose influence she, on July 22 (St. Mary Magdalene's day), 1672, drew up a solemn act of consecration, sealed with her ring and signed with her blood, in which she surrendered herself to Christ as His spouse, accepting as a part of her marriage portion "the temptations and sorrows, the crosses and the contempt, which fell to Him." In the beginning of 1674 she passed into a state of "privation" or "desolation," which she considers to have continued with but slight variations for somewhat more than six years; during the whole of this period, however, she had the benefit of the spiritual direction of Bertot, a kindred spirit, whose mystical writings she afterwards edited. On the 21st of July, 1676, she was left a widow, with three surviving children, —two sons and an infant daughter,—and began to live a life of still deeper seclusion and isolation than before, interesting herself, however, in works of charity, and in the education of her family; in connection with the latter occupation she commenced and made some progress in the study of Latin. Her temptations and crosses continued nevertheless to multiply; she began to lose hope, and to regard herself as wholly forsaken by God; in her deep despondency she began to correspond with Francis de la Combe, superior of the Barnabites at Thonon, Savoy, with whom she had ten years before become acquainted, and in whom she had even then recognized a sympathizing spirit. On the 22d of July, 1680, she tells us her soul was delivered from all its pains. "From the time of the first letter from Father La Combe, I began to recover a new life. I was then, indeed, only like a dead person raised up, who is in the beginning of his restoration, and is raised up to a life of hope rather than of actual possession; but on this day I was restored, as it were, to perfect life and set wholly at liberty. I was no longer depressed, no longer borne down under the burden of sorrow. I had thought God lost, and lost forever; but I found him again. And He returned to me with unspeakable magnificence and purity. In a wonderful manner, difficult to explain, all that which had been taken from me was not only restored, but restored with increase and with new advantages." In

this changed state of feeling she began to revolve new plans for the disposal of the remainder of her earthly life. She for some time thought of winding up her worldly affairs and taking the veil; but her duty towards her children, especially the two younger, seemed to prohibit that step. Several proposals of marriage were also received, but rejected. Gradually, in the course of 1681, she had almost, though with hesitation, reached the conclusion that she was called to active religious work, and the field to which inward intimations seemed to point was that part of France and Savoy which borders on Geneva, if not Geneva itself. The advice of D'Aranthon, titular bishop of Geneva, was asked and obtained; he approved of the proposal. After making some important arrangements with regard to her property, and entrusting her two sons to the care of suitable guardians, she accordingly secretly left Paris accompanied only by three female attendants and her daughter, then a child of five years of age. The party arrived at Annecy on the 21st of July; on the following day, at the tomb of St. Francis de Sales, Madame Guyon renewed her spiritual marriage with the Redeemer; and finally she fixed her abode at Gex under the spiritual care of D'Aranthon, by whom La Combe was assigned to her as her director in the place of Bertot, who had died some time before. Here she at once began her benevolent labors, tending the sick and poor, praying with them and giving them religious instruction; yet still it seemed to her as if the "seal of her mission was not yet broken." Something within her whispered that she had not yet found the great and special work to which God had been calling her. Amongst other things the state of her director caused her much solicitude. She saw that he had much, but felt that he ought to have more. Her vocation at last was revealed to her, to become to him a spiritual mother, and her efforts towards the fulfilment of that vocation were not in vain; La Combe at last became possessed with the doctrine of present sanctification by faith in the Saviour, and began to preach accordingly. Opposition and persecution almost immediately began; Bishop D'Aranthon did not fail to take notice of the new doctrine, though on this occasion it escaped formal condemnation by the authorities at Rome; seeing, however, that Madame Guyon was the real author of the heresy, if heresy it was (and it certainly seemed to involve a theory of perfectionism hardly compatible with Catholicism), he resolved that she should not continue her activities within his diocese unless she should consent to accept a sphere where the facilities for doctrinal propagandism would be less than those for the exercise of ordinary benevolence. He accordingly proposed that she should give what property still remained within her control to a religious house at Gex, and that she should herself become prioress; this proposal, however, she declined, chiefly on the general ground that it did not seem to be in accordance with the designs of God in regard to her. The alienation of the bishop now made her stay at Gex to be far from comfortable; and accordingly, at the close of a residence of rather more than six months, she removed early in 1682 to Thonon, apparently in the expectation of being near her adviser La Combe. Here she remained for upwards of two years, engaged in religious work of various kinds, especially in spiritual conversation with the people of the neighborhood, and in tending a small hospital which, at the suggestion of her director and with the assistance of some benevolent ladies of Thonon, she had formed. Meanwhile her doctrines of "pure love" and of that "fixed state" which consists in the complete identification of the human will with the will of God were taking more definite shape; and in 1683 they first found literary expression in *Les Torrens*, probably the best of her writings, and really in some respects a fine performance, which describes the progress of the soul from the commencement of its inward life to its union with God, by a reference to "streams or torrents flowing from the mountain tops with greater or less rapidity and with greater or less directness, and mingling at last in the ocean." Although Madame Guyon was not herself conscious of any disharmony with the teaching and practice of the Catholic Church, her doctrines could hardly fail to be regarded by the ordinary orthodoxy of that time as more or less hostile to the generally accepted views as to the nature and mode of sanctification, and as to the normal state of the graciously renewed heart; at Thonon they soon gave deep offence, and ultimately it was intimated both to her and to La Combe, on the part of Bishop D'Aranthon, that both must leave the diocese. Her next resting place for a few weeks was Turin, whence, in the autumn of 1684, she removed to Grenoble, where she again became a centre of attraction and influence. Here, for the direction of the many who flocked to her for instruction and advice, she wrote and circulated her *Moyen court et très facile de faire oraison*, a treatise in which she pointed out, doubtless in a manner highly susceptible of misconstruction, that prayer might often well be both silent and wordless. The commencement of her commentaries on the Bible also dates from this stay in Grenoble. Her numerous and popular "conférences" or meetings for conversation and prayer or "self-recollection in God," and the effect produced by the *Moyen court de faire oraison*, however, speedily excited ecclesiastical opposition similar to that which she had already encountered at Gex, and although the bishop (Camus) was himself disposed to be tolerant, if not friendly, she was ultimately constrained, in the spring of 1686, to yield to strong representations, and seek an abode elsewhere. Nice, Genoa, and Vercelli (where she again met La Combe) were visited in turn, but it was finally resolved, with the advice and concurrence of her friends, that Paris now offered itself as the field of labor most suited to her powers. Here accordingly she arrived on the 22d of July, 1686, and soon she and her teaching began to meet with a very favorable reception in the higher circles of society. But meanwhile the doctrine of Molinos and the *Guida Spirituale* had been formally condemned by the Inquisition at Rome, and the sentence had been taken up as a signal, especially in France, for the persecution of all suspected quietists. In October, 1687, La Combe was suddenly arrested by a royal "lettre de cachet" and committed to the Bastile; and by the same authority Madame Guyon herself was, three months later (29th January, 1688), ordered to be detained as a prisoner in the convent of St. Marie in the Faubourg Sainte Antoine. The charges brought against her were the maintenance of heretical opinions, the holding of private religious assemblies, contrary to the practice and rules of the Catholic Church, for the spread of these opinions; the publication of a dangerous book containing opinions similar to those of the *Spiritual Guide* of Molinos; and correspondence with Molinos. These, however, were not destined to come to a definite issue, for through influence which friends succeeded in bringing to bear upon Madame de Maintenon a release was obtained in the following October. Madame Guyon now went to live for the most part with her daughter, who had become the Comtesse de Vaux, at the family seat in the neighborhood of Paris; but while on a visit with the duchess of Charost she became acquainted with Fénelon, and a considerable correspondence began. Her influence continuing to make itself felt at Paris, Dijon, Versailles, and other places, especially in the institution of St. Cyr, founded by Madame de Maintenon in 1686, the attention of theologians was drawn afresh to the "new spirituality," as it was called; and among others both the Port-Royalist Nicole and Bossuet, bishop of Meaux, sought personal interviews. The latter, to whom she had submitted not only all her printed works but also the manuscript of an autobiography which she had written when in confinement in 1688, after more than one long conference, is understood to have expressed himself as on the whole satisfied of her orthodoxy; but the publication by Nicole of the *Réfutation des principales Erreurs des Quietistes* appears to have had an exciting influence on the public mind; rumors prejudicial not only to the orthodoxy of Madame Guyon's faith, but also to the purity of her life, were industriously spread, and caused great scandal in the highest quarters, so that at last she was constrained to write to Madame de Maintenon requesting that a number of suitable persons might be selected for the purpose of judging both of her doctrine and her morals, and offering at the same time to submit to any degree of confinement and restraint until it should please the king to appoint such persons. A commission was duly nominated, consisting of Bossuet, Bishop (afterwards Cardinal) De Noailles, and Tronson, the superior of St. Sulpice. To this tribunal she at their request submitted the *Moyen Court*, *Les Torrens*, and the manuscripts of her commentaries along with her autobiography, to which she added her *Justification*. The outcome of many deliberations, extending over some months, was the preparation of twenty-four articles, usually called the "Articles of Issy," relating to the doctrine of "pure love." Her refusal to sign a "condemnation of religious errors," as drawn up and presented

to her by Bossuet in a pastoral ordinance and letter, now led to an open rupture which resulted in her reimprisonment, on this occasion at Vincennes, on the 27th of December, 1695. Bossuet now set himself to prepare his *Instruction sur les états d'oraison* which he submitted before publication to De Noailles, and, amongst others, to Fénelon for approval. The latter after reading the manuscript withheld his imprimatur, not on account of its doctrine (with which he did not disagree), but on account of its personalities, which he held to be uncalled for and unjust. Almost forced thus into the position of a champion of Madame Guyon, he published in 1697 his *Maximes des Saintes*, a statement of the leading principles laid down by approved writers on the subject of the higher inward experience and of holy living. In the course of the controversy which followed several important works appeared, which can only be alluded to here; the dispute, as is well known, issued in the formal condemnation of Fénelon (12th March, 1699), in which achievement the hostility to Madame Guyon seems to have almost exhausted itself. She was not released, however, until 1702, in which year she was banished to Blois, where the remainder of her life was spent. Numbers of persons of all ranks, and many of them from foreign countries, visited her in this retirement; and both in correspondence and conversation she continued to manifest considerable activity, although feeling herself "called on to glorify God by submission and by private prayer, rather than by active labors." She heard mass daily, received the sacrament every alternate day, and died in full communion with the Roman Catholic Church, after an illness of three months, on the 9th of June, 1717.

La Vie de Madame de la Mothe Guyon, écrite par elle-même, first appeared at Cologne in 1720. It is based upon the autobiography which at the instance of La Combe she is known to have written during her imprisonment in 1688; it afterwards received additions and corrections from her own hands, and was finally entrusted to a confidential friend on the understanding that it should not be published until after her death. In addition to *Les Torrens Spirituels*, and the *Moyen court et très facile de faire oraison*, which were published in the *Opuscules Spirituels* in 1704, there appeared in her lifetime the *Poésies Spirituelles* (1689); and *La Bible traduit en français, avec des Explications et des Réflections qui regardent la Vie Intérieure* (1715). There are also several volumes of *Lettres Chrétiennes et Spirituelles*, addressed by her to Metternich, Fénelon, and other correspondents, many of them distinguished. The edition of the collected *Œuvres* extends to 40 vols. (1767–1791). English and German translations of the various works are numerous. Apart from the *Autobiography*, the only memoir of Madame Guyon as yet in existence is the diffuse but somewhat vague and meagre *Life*, by Thomas C. Upham (1854).

(J. S. BL.)

GUYTON DE MORVEAU, Louis Bernard, Baron (1737–1816), a distinguished French chemist, was born January 4, 1737, at Dijon, in the university of which town his father was professor of civil law. As a boy he evinced a remarkable aptitude for practical mechanics. On leaving college at the age of sixteen he became a law student in the university of Dijon, and after three years he was sent to Paris to acquire a knowledge of practice at the bar. He obtained in his twenty-fourth year the office of advocate-general in the parliament of Dijon, of which he fulfilled the duties till 1782. Before long, piqued by a slighting remark of Dr. Chardenon of Dijon, made in reply to a criticism at the close of a lecture on chemistry, De Morveau set himself to acquire a thorough knowledge of that science. With "practice for his master, and melted crucibles and retorts for tutors," as he once observed to Baumé, he speedily obtained such a mastery over his subject as to draw from Chardenon the public acknowledgment that he was "born to be an honor to chemistry." In 1772 he published at Dijon the *Digressions Académiques*, in which were set forth his views with respect to phlogiston and the phenomena of crystallization, and in 1773 he discovered the efficacy of hydrochloric acid gas as an atmospheric disinfectant.[1] He was the means, in 1774, of founding in Dijon courses of public lectures on mineralogy, materia medica, and chemistry, the last of which he himself during thirteen years gratuitously delivered. It would appear that his fellow-citizens were as yet far from holding exalted views with regard to the prerogatives of science. Accusing him of "presumptuously disarming the hand of the Supreme Being," they about this time sought to destroy his lightning conductors at the house of the academy, and were restrained from carrying out their intentions only by the assurance of M. Maret, the secretary of that institution, "that the astonishing virtue of the apparatus resided in the gilded point, which had purposely been sent from Rome by the Holy Father." In 1777–78 appeared the *Élémens de Chymie Théorique et Pratique* (3 vols. 12mo) of De Morveau, Maret, and Durande, a work highly appreciated by their contemporaries. The chemical articles in vol. i. of the section "Chymie, Pharmacie, et Metallurgie" of the *Encyclopédie Méthodique* (1786), as also some few of those of vol. ii. (1792), were from the pen of De Morveau. Of these the longest is a masterly exposition of the facts and conclusions that had up to that time been arrived at by chemists on the subject of acids.

De Morveau's first essay on a new chemical nomenclature, the origin of the present system, was published in the *Journal de Physique* for May, 1782, and was the subject of much adverse criticism. Repairing to Paris, the author successfully met the objections of his opponents; and in 1787, in conjunction with Lavoisier, Berthollet, and Fourcroy, he published *Méthode d'une Nomenclature Chimique*, the principles of which were speedily adopted by chemists throughout Europe. Constantly in communication with the leaders of the Lavoisierian school of chemistry in Paris, which he frequently visited, De Morveau soon became convinced of the untenableness of the old phlogistic doctrines, his reasons for renouncing which are stated in his volume of the *Encyclopédie Méthodique*, p. 625, *sqq.* With Lavoisier, Laplace, Monge, Berthollet, and Fourcroy, he in 1788 produced a French translation of Kirwan's *Essay on Phlogiston*, with annotations effectually disposing of the author's arguments against the new chemistry. The first manufactory of carbonate of soda in France was established by De Morveau in 1783. In 1791 he represented the department of Côte d'Or in the Legislative Assembly, and next year in the National Convention, of which he was re-elected a member in 1795. Having already become famous for aeronautical experiments at Dijon in 1783–84, he was appointed in 1794 to superintend the construction of balloons for military purposes (see Aeronautics, vol. i. p. 180). About the same time he rendered important service to his country by perfecting the processes for the manufacture of gunpowder and saltpetre. In 1796 De Morveau was made a member of the Institute. He retired from political life in 1797, and in 1798 became provisional director of the Polytechnic School, in the foundation of which he had been actively concerned. He held during 1800–14 the appointment of master of the mint, received in 1803 the cross of the legion of honor, and was made in 1805 an officer of the same order, and in 1811 a baron of the French empire. He died January 2, 1816.

Besides the above mentioned and other works, and numerous scientific papers in the *Collection académique de Dijon*, the *Journ. de Physique*, *Journ. de l'École Polytechnique*, *Mém. de l'Institut*, *Journ. des Savants*, *Bull. des Sci. de la Soc. Philomatique*, and *Ann. de Chimie*, to which last he was one of the principal contributors, De Morveau wrote—*Mémoire sur l'éducation publique*, 1762; a satirical poem entitled *Le Rat Iconoclaste, ou le Jésuite croqué*, 1763; *Discours Publics et Éloges*, 1775–82; *Plaidoyers sur plusieurs questions de droit*, 1785; *Traité des moyens de désinfecter l'air*, 1801, etc.; *Rapport fait à l'Institut sur le restauration du tableau de Raphaël connu sous le nom de la Vierge de Foligno* (with Vincent, Tannay, and Berthollet), 1802; *Mém. sur les mortiers*, etc., 1805; various governmental reports; and translations, with notes, of treatises by Bergman, Scheele, and Black.

See Berthollet, "Discours," *Inst. R. de France, Funérailles*, etc., 1816; A. B. Granville, *An Account of the Life and Writings of Baron Guyton de Morveau, F. R. S.*, 1817; T. Thomson, *Hist. of Chemistry*, ii. 1831; *Biog. Univ. et Portative des Contemporaines*, iii. p. 701, 1834; and Chemistry, vol. v. pp. 402, 403. (F. H. B.)

GUZERAT or Gujarát, the name given to the northern seaboard of the Bombay Presidency, extending from 20° to

[1] Various French biographical works attribute to De Morveau, in 1773, the discovery of the efficacy of acid vapors in destroying contagious miasma. W. Boraston, however, had already in 1630 remarked—"All acetosus and sower things doe so elose the powers, and passages of the humours, that no venomous ayre can enter therein as by experience I have often found" (*A Necessarie and Briefe Treatise of the Contagious Disease of the Pestilence*, pp. 11, 12); and Dr. George Thomson had in 1666 described how, preparing for the "dissection of a pestilent body," he got in readiness "a porringer containing Sulphur to burn under the Corps," and how, suspecting the entry into his hand during the operation of "slie, insinuating, venemous Atoms," or, in modern phrase, septic germs, he sought to nullify their effects by holding the hand in the gas of burning brimstone (Aoimotomia *or the Pest Anatomized*, pp. 71 and 77–79).

24° 45′ N. lat., and from 69° to 74° 20′ E. long. It is to the northern part of the presidency what the Konkan is to the south, and is bounded on the N. by Rájputáná, on the E. by the spurs of the Vindhya and Sátpurá ranges, on the S. by the Konkan, and on the W. by the sea. On the mainland it comprises the British districts of Surat, Broach, Káira Pánch Maháls, and Ahmedábád, with a total area of 10,082 square miles, and a population (1891) of 3,098,197; together with the great but scattered territories of the Gaikwar of Baroda, and also the native states of the Mahi Kánta and Rewá Kánta agencies, Palanpur, Radhanpur, Balasinor, Cambay, Dang, Chaurar, Bansda, Peint, Dharampur, Tharad, Sachin, Wasravi, etc. The term Guzerat is sometimes employed to include the peninsula of Káthiáwár, with its 180 petty states. The total area, inclusive of the peninsula of Káthiáwár, is 41,536 square miles. For an account of the history, geography, etc., of Guzerat, see the articles on the various states and districts. Guzerat gives its name to the vernacular of northern Bombay, viz., Gujaráthí, one of the three great languages of that presidency.

GUZMICS, Izidór (1786–1839), Hungarian theologian and scholar, was born 7th April, 1786, at Vámos-Család, in the county of Sopron. His early education was conducted at Kőszeg (Güns), Szombathely (Stein-am-Anger), and Sopron (Oedenburg); in the last-mentioned town he was instructed in the art of poetry by Paul Horváth. On the 28th October, 1805, he entered the Benedictine order, but left it on the 30th August of the following year. Having almost immediately repented this step, he again assumed the monastic garb on the 10th November, 1806. At the monastery of Pannonhegy he applied himself to the study of Greek under Farkas Tóth. In 1808 we find him at Györ (Raab), in the middle school of which town he was teaching during the two following years. In 1811 he was again at Pannonhegy, whence in 1812 he was sent to Pesth to study theology. Here he became acquainted with the works of the best German and Hungarian authors, and also took part in the editorship of the *Nemzeti* (National) *Plutarkus*, and in the translation of Hübner's *Lexicon*. After about four years' stay at Pesth, he obtained the degree of doctor of divinity, and returned to Pannonhegy, where he devoted himself to dogmatic theology and literature. So great was his activity that it is said that there was hardly an Hungarian periodical to which Guzmics was not a contributor. The most important of his theological works are —*A kath. anyaszentegyháznak hitbeli tanitása* (The doctrinal teaching of the Holy Catholic Church), and *A kereszténveknek vallásbeli egyesülésökröl* (On Religious Unity among Christians), both published at Pesth in 1822; also a Latin treatise entitled *Theologia Christiana fundamentalis et theologia dogmatica* (Györ, 1828–29, 4 vols.). Of the other literary labors of Guzmics the most meritorious is a translation of Theocritus in hexameters published in 1824. His versions of the *Œdipus* of Sophocles and of the *Iphigenia* of Euripides were rewarded by the Hungarian Academy, of which in 1838 he was elected honorary member. From 1832 to the date of his death he was editor of the *Egyházi Tár* (Ecclesiastical Treasury). In 1832 he was appointed abbot of the wealthy Benedictine house at Bakonybél, a village in the county of Veszprém. While there he built an asylum for 150 children, and founded a school of harmony and singing. He died at Bakonybél on the 1st September, 1839.

GWALIOR, a native state in political relationship with the Central India Agency and the Government of India. The state consists of several detached districts, the principal of which is bounded on the N. E. by the Chambal river, dividing it from the British districts of Agra and Etáwah; on the E. by Bundelkhand and Ságar (Saugor) districts: on the S. by the states of Bhopal and Dhar; on the W. by those of Rajgarh, Jhaláwar, and Kotah; and on the N W. by the Chambal, separating it from Karauli (Kerowlee), and Dholpúr in Rájputáná. The extreme points of the Gwalior territory are in 23° 21′ and 26° 52′ N. lat., 76° 31′ and 79° 21′ E. long. The area, including part of the ancient province of Agra and most of Malwa, is 33,119 square miles. The extreme north-eastern part is generally level, bare, and of no great fertility. A little farther south the surface rises into hills. The country is dotted over with small hills, which start abruptly out of the level plain. On one of these stands the fortress of Gwalior. The geological formation of these rocky eminences is a very fine-grained sandstone, yielding an excellent building stone. The middle tract is a plateau, having probably an average elevation of about 1500 feet. The Mandu range running east and west forms the southern boundary of the plateau, sloping gently northwards towards it, and dipping precipitously southwards towards the Narbadá (Nerbudda). The state is watered by numerous rivers. The Nerbudda, flowing west, forms the boundary of the most southern part of the state. The greater part of the drainage is discharged into the Chambal which forms the north-western and northern and eastern boundary. The Sind, with its tributaries the Kuwári, Asar, Sankh, and other smaller streams, flows through the state. The chief products are opium, known as Malwa opium, wheat, gram, pulses of various kinds, *joár*, *bájra*, *mug*, maize, rice, linseed and other oil-seeds, garlic, tumeric, ginger, sugar-cane, indigo, *al* yielding a fine red dye, tobacco, and cotton. Many species of wild beasts and birds are found throughout the state. The rivers abound in fish, especially of the carp kind.

Burhánpur is the site of a considerable manufacture of fine cottons, silks, and rich brocades. Iron ore is raised and smelted in many places. The principal imports are British woollens, cottons, silks, cutlery, cashmere shawls, pearls from the Persian Gulf, Ceylon diamonds, and agates from Bundelkhand, gold, silver, mercury, copper, lead and zinc. The chief exports are opium, cotton, tobacco, dyes, and iron. The Indore and Ajmere narrow-gauge railway, now (1879) in course of construction, will pass through the west of Gwalior state, while a railway on the broad gauge, to connect Gwalior town with Agra, is approaching completion.

During the hot and dry seasons the climate is not unhealthy, but during the rainy season fevers prevail, especially in the north. The range of the thermometer is unusually small, except during the sultry season, when it sometimes rises to nearly 100° during the day. The average rainfall during the rainy season is 50 inches.

The population of the north-eastern part of this territory is of many elements, comprising, besides Marhattás (the ruling race), Bundelas, Játs, and Rájputs, with some less distinctly defined divisions of Hindus and Mahometans. There is perhaps no part of India where the tribes of Bráhmans are so various and their number so great as in the southern and south-western parts. The Mahometan population is estimated at about a twentieth of the whole. Including the cessions to Sindhia under the treaty of 1860, the territories of the Gwalior state were in 1881 estimated to contain a population of 2,933,000 souls. The total revenue in 1875 was £1,200,000. Education is afforded by 92 schools attended by 3206 pupils.

The Gwalior family, whose armies and chiefs have played so conspicuous a part in the history of India, and whose representative now rules over a state larger than Scotland and Wales united, and richer than many independent kingdoms, was founded by Ranójí Sindhia, whose father was *pátel* (head-man) of a Deccan village. Once in the household of the peshwá, Ranójí's rise was rapid, and he was soon at the head of the bodyguard. After heading many Marhattá raids through Malwa into Hindustan, he was at the time of his death the acknowledged possessor of lands which still form part of the Gwalior state. He was succeeded by his son Mahádají Sindhia, whose ability as a statesman and a soldier has rarely been surpassed. At his death he was succeeded by his grand-nephew Daulat Ráo Sindhia. The power of Sindhia was at this time most dangerous to the British Government, who now began to take measures to check the power of this chief. Sindhia entered into a league with the rájá of Berar to defeat their aim, but their allied armies were defeated in 1803 at Assaye by a British force commanded by General Sir Arthur Wellesley, subsequently duke of Wellington. By the end of the same year, the Marhattás were completely overthrown, and Sindhia was compelled to sue for peace and to sign a treaty by which he resigned his conquered territories. Eventually, by a treaty concluded in 1805, Gwalior and Gohad were ceded to Sindhia. Daulat Ráo died at Gwalior in 1827 without an heir. On his deathbed, he left the state and succession in the hands of the British Government. The succession of a boy of the Sindhia family, Múgat Ráo, to whom it was thought the wishes of Daulat Ráo turned, was admitted by the British Government. The young mahárájá was subsequently married to the granddaughter of Daulat Ráo, and took the name of Janakji Sindhia. In 1843 he died without issue. His widow, with the concurrence of the chief nobles, adopted Bajirát Ráo, a lad eight years of age. The British Government recognized the adoption, and Bajirát Ráo, under the name of Báji Ráo Sindhia, succeeded, and is the present ruler (1879). Early in the regency disturb-

ances took place, and the advance of British troops on Gwalior became necessary to restore order. Two battles, Mahárájpur and Panniar, were fought on the same day—the 29th December, 1843—between the British forces and the mutinous army. They both resulted in the total defeat of the Gwalior troops. No event of historical importance has taken place since, except the revolt between the Gwalior contingent and Sindhia's army in 1857. The mahárájá's conduct throughout has been conspicuous for its loyalty. In recognition of his services, the Government conferred upon him the right of adoption, together with lands yielding a revenue of £30,000.

GWALIOR, the capital of Gwalior state, and fortress residence of the Mahárájá Sindhia, is situated in 26° 13′ N. lat. and 78° 12′ E. long., 65 miles S. from Agra, and 277 N. W. of Allahábád. Gwalior city has a threefold interest:—first, as a very ancient seat of Jain worship; secondly, for its example of palace architecture of the best Hindu period (1486–1516); and thirdly, as the fortress capital of one of the greatest native chiefs of India.

Jain Remains.—There are several remarkable Hindu temples in Gwalior. One, known as the Sas Báhu, understood to be of Jain erection, is beautifully adorned with bas-reliefs, and is now resorted to both by the Vaishnav and Siva sects. It was finished in 1093 A. D., and, though much dilapidated, still forms a most picturesque fragment. An older Jain temple has been used as a mosque. Another temple in the fortress of Gwalior is called the *Teli-ka-Mandir*, or "Oilman's Temple." This building was originally dedicated to Vishnu, but afterwards converted to the worship of Siva. The most striking part of the Jain remains at Gwalior is a series of caves or rock-cut sculptures, excavated in the rock on all sides, and numbering nearly a hundred, great and small. Most of them are mere niches to contain statues, though some are cells that may have been originally intended for residences. One curious fact regarding them is that, according to inscriptions, they were all excavated within the short period of about thirty-three years, between 1441 and 1474. Some of the figures are of colossal size; one, for instance, is 57 feet high, which is taller than any other in the north of India.

Hindu Palace Architecture.—The palace built by Mán Sinh (1486–1516) forms the most interesting example of early Hindu work of its class in India. Another palace of even greater extent was added to this one in 1516; both Jahángír and Sháh Jahán added palaces to these two,—the whole making a group of edifices unequalled for picturesqueness and interest by anything of their class in Central India. Among the apartments in the palace was the celebrated chamber, named the *Báradári*, supported on 12 columns, and 45 feet square, with a stone roof, forming one of the most beautiful palace-halls in the world. It was, besides, singularly interesting from the expedients to which the Hindu architect was forced to resort to imitate the vaults of the Moslems. Of the buildings, however, which so excited the admiration of the emperor Bábar, probably little now remains.

Rock Fortress.—The fort of Gwalior stands on an isolated rock. The face of the fort is perpendicular, and where the rock is naturally less precipitous it has been scarped. Its greatest length from northeast to southwest is a mile and a half, and the greatest breadth 300 yards. The rock attains its maximum height of 342 feet at the northern end. A rampart, accessible by a steep road, and farther up by huge steps cut out of the rock, surrounds the fort. The citadel stands at the northeastern corner of the enclosure, and presents a very picturesque appearance. The old town of Gwalior, which is of considerable size, but irregularly built, and extremely dirty, lies at the eastern base of the rock. It contains the tomb of Muhammad Ghaus, which was erected during the early part of Akbar's reign. The fort of Gwalior, according to Wilford, was built in 773 A. D. by Surya Sen, the rájá of the neighboring country. In 1196 Gwalior was captured by Mahmúd Ghori; it then passed into the hands of several chiefs until in 1556 Akbar gained possession of it, and made it a state prison for captives of rank. On the dismemberment of the Delhi empire, Gwalior was seized by the Ját ráná of Gohad. Subsequently it was garrisoned by Sindhia, from whom it was wrested in 1780 by the forces of the East India Company. A contest took place about the successor of Janakjí, governor of Gwalior, the adopted son of Daulat Ráo Sindhia, who died in 1843 without an heir. A revolution was impending, and the British Government had to interfere. Troops crossed the Chambal, and unexpectedly found the insurgent forces drawn up at Mahárájpur, a few miles distant from the fortress. A battle ensued on the 29th December, 1843, resulting in the complete overthrow of the Marhattás. The British contingent stationed in the town was increased, and affairs were placed on a peaceful footing. Pop. (1901), 89,154.

GWILT, JOSEPH (1784–1863), author of the *Encyclopædia of Architecture*, was the younger son of George Gwilt, architect surveyor to the county of Surrey, and was born at Southwark, January 11, 1784. He was educated at St. Paul's school, and after a short course of instruction in his father's office was in 1801 admitted a student of the Royal Academy, where in the same year he gained the silver medal for his drawing of the tower and steeple of St. Dunstan-in-the-East. In 1811 he published a *Treatise on the Equilibrium of Arches*, and in 1815 he was elected a fellow of the Society of Antiquaries of London. After a visit to Italy in 1816, he published in 1818 *Notitia Architectonica Italiana, or Concise Notices of the Buildings and Architects of Italy*. In 1825 he published, with notes and valuable additions, an edition of Sir William Chambers's *Treatise on Civil Architecture;* and among his principal other contributions to the literature of his profession are a translation of the *Architecture of Vitruvius* (1826), a *Treatise on the Rudiments of Architecture, Practical and Theoretical* (1826), and his valuable *Encyclopædia of Architecture* (1842), which has passed through a great many editions, and was published with additions by Wyatt Papworth in 1867. In recognition of Gwilt's advocacy of the importance to architects of a knowledge of mathematics, he was in 1833 elected a member of the Royal Astronomical Society. In addition to the sciences bearing on his profession he took a special interest in philology and music, and is the author of *Rudiments of the Anglo-Saxon Tongue* (1829), and of the article "Music" in the *Encyclopædia Metropolitana*. His works as a practical architect are not of much importance, the principal being Markree Castle near Sligo in Ireland, and St. Thomas's Church at Charlton in Kent. He succeeded his father as a surveyor of sewers for the county of Surrey, and held that office till 1848. He died September 14, 1863.

GWYNIAD is a name given to a fish of the genus *Coregonus* (*C. clupeoides*), inhabiting the large lakes of North Wales and the north of England. At Ullswater it is known by the name of "schelly," at Loch Lomond by that of "powen." It is tolerably abundant in Lake Bala, keeping to the deepest portion of the lake for the greater part of the year, but appearing in shoals near the shores at certain seasons. It is well flavored, like all the species of *Coregonus*, but scarcely attains to the weight of a pound. The name gwyniad is a Welsh word, and signifies "shining;" and it is singular that a similar fish in British Columbia, also belonging to the family of Salmonoids, is called by the natives "quinnat," from the silvery lustre of its scales, the word having in their language the same meaning as the Welsh "gwyniad."

GYARMAT, a Magyar term signifying *colony*, and applied to several places in Hungary. Of these the following two towns have the largest number of inhabitants.

BALASSA-GYARMAT, capital of the Cis-Danubian county of Nógrád, is situated on the Ipoly (Eipel), about 40 miles N. N. E. of Budapest, 48° 6′ N. lat., 19° 16′ E. long. It is the seat of a royal court of law and of the assizes, and has Roman Catholic and Lutheran churches, also a Jews' synagogue, a fine county hall, a house of correction, a religious institute for girls, and tax, post, and telegraph offices. In 1900 the population was 7,738, Magyars and Slavs by nationality.

FÜZES-GYARMAT, a market-town in the Trans-Tibiscan county of Békés, is somewhat unfavorably situated in the extensive marshy tract of country known as the Sárrét, 47° 5′ N. lat., 21° 13′ E. long. The town has few noteworthy buildings, with the exception of the Calvinist church and some elegant private residences. The chief products of the rich, dark, alluvial soil of the neighborhood are wheat, tobacco, hay, grapes, and other fruits. Horned cattle, pigs, and sheep (both merino and Hungarian) are bred on the wide-spreading pasture-lands, and numerous water-fowl and wading birds, especially herons, inhabit the reed-covered marshes. The water used for drinking purposes is, however, frequently muddy and warm, and unpleasant to the taste. In 1900 the population was 6,500, of whom the great majority were Magyars.

GYARMATHA, a market town in the county of Temes, Hungary, situated in a level but productive agricultural district to the north-east of Temesvár, 45° 50′ N. lat., 21° 17′ E. long. For some distance round the town the cultivation of wheat, barley, oats, maize, and the vine is largely carried on. Horse-breeding is another source of employment to many of the inhabitants. Gyarmatha has few buildings of special interest with the exception of a Roman Catholic church and the ruins of a fort. In 1900 the population amounted to 5,600, consisting of Germans, Magyars and Wallachs.

GYERGYÓ-SZENT-MIKLÓS, a market-town of Hungary, in the Transylvanian county of Csik, is situated in a mountainous but well-wooded district, 96 miles E. of Klausenburg, and about 25 W. of the Moldavian frontier, 46° 42′ N. lat., 25° 33′ E. long. Among the more important buildings are a Roman and a Greek Catholic church, a fine public school, a royal court of justice, and the post and telegraph offices. There are also cattle and timber trading houses, an office of woods, a financial commission agency, and a police station. Cattle and sheep are reared in great numbers in the surrounding country, which is noted also for its cheeses, and for the preparation of gin. The number of inhabitants at the commencement of 1900 was 6,100, consisting of Magyars, Wallachs, and Magyarized Armenians, the descendants of a band of wanderers who settled here in 1668.

GYGES, founder of the third dynasty, called Mermnad, of Lydian kings, reigned about 687–654 B. C. (*v.* Gelzer in *Rhein. Mus.* xxx.). The kindred name Gygæa, applied by Homer (*Il.*, ii. 684) to the Maconian lake, mother of the Maconian leaders, supports the statement of ancient historians that he belonged to an old Lydian family. In the reign of Candaules, Gyges, perhaps after banishment, attempted during the troubles caused by the Cimmerian invasions into Asia Minor, to gain the royal power. He was aided by foreign, especially Carian, mercenaries, but was strenuously resisted by the native population. At last it was agreed to refer the decision between the old Heraclid dynasty and the new claimant to the national god Heracles; but, to ensure impartiality, they appealed to him under his Greek form of Apollo. The Delphic oracle gave its answer in favor of Gyges, and the presents with which his gratitude enriched the shrine were seen and described by Herodotus. This story points to familiar and friendly intercourse between Lydia and the Greek states; and that the circumstance impressed itself on the Hellenic mind is shown by many romantic tales current about the fortunes of Gyges (Plato, *Rep.*, ii. p. 369; Herod., i. 8). The contemporary poet Archilochus speaks of the riches of Gyges. Under the Heraclid dynasty Ionian settlers had occupied the whole coast of Lydia, and in friendly relation with the country had rapidly prospered. But the warrior king who now began to rule was not content to leave the sea-coast in the undisturbed possession of foreigners. He and his successors maintained almost constant war with the Ionian cities. Gyges captured Magnesia and the lower city of Colophon; but the inroads of the Cimmerians diverted his attention from conquest to the defence of his own capital. At one time he was so hard pressed that he applied to Assyria for help (about 660 B. C.), and paid tribute to Assurbanipal in return for protection against these barbarians. But he afterwards threw off allegiance and assisted Psammetichus, who had revolted in Egypt against the Assyrian rule. It is mentioned in an inscription of Assurbanipal that Gyges was slain in battle by the Cimmerians, and that his son Ardys renewed the tribute.

For a full account of the reign of Gyges, and the ancient authorities for it, see Duncker, *Gesch. d. Alterthums*, vol. ii.

GYLLEMBOURG-EHRENSVÄRD, Thomasine Kristine, Baroness (1773–1856), the most eminent female writer of Denmark, was born November 9, 1773, at Copenhagen. Her maiden name was Buntzen. Her great beauty early attracted notice, and before she was seventeen she married the famous political writer Peter Andreas Heiberg. To him she bore in the following year a son, afterwards illustrious as the poet and critic Johan Ludvig Heiberg. In 1800 her husband was exiled and she obtained a divorce, marrying in December, 1801, the Swedish Baron Ehrensvärd, himself a political fugitive. Her second husband, who presently adopted the name of Gyllembourg, died in 1815. In 1822 she followed her son to Kiel, where he was appointed professor, and in 1825 she returned with him to Copenhagen. In 1827 she first appeared as an author by publishing her romance of *The Polonius Family* in her son's newspaper *The Flying Post*. In 1828 the same journal contained *The Magic Ring*, which was immediately followed by *An Everyday Story*. The success of this anonymous work was so great that the authoress adopted until the end of her career the name of "the Author of *An Everyday Story*." From this time forward she took a foremost place among the writers of her time, but preserved her anonymity with entire success. In 1833–34 she published three volumes of *Old and New Novels*. *New Stories* followed in 1835 and 1836. In 1839 appeared two novels, *Montanus the Younger* and *Ricida*; in 1840, *One in All*; in 1841, *Near and Far*; in 184-, *A Correspondence*; in 1844, *The Cross Ways*; in 1845, *Two Generations*. From 1849 to 1851 the Baroness Ehrensvärd-Gyllembourg was engaged in bringing out a library edition of her collected works in twelve volumes. On the 2d of July, 1856, she died in her son's house at Copenhagen. Not until then did the secret of her authorship transpire; for throughout her life she had preserved the closest reticence on the subject even with her nearest friends. The style of Madame Ehrensvärd-Gyllembourg is clear and sparkling; for English readers no closer analogy can be found than between her and Mrs. Gaskell, and *Cranford* might well have been written by the witty Danish authoress. She introduced into the literature of her country a novel vein of realism and domestic humor, and, although she has had many imitators, she is still without a rival.

GYMNASIUM, was the name applied by the Greeks to a building designed for the practice of physical exercises. From the earliest times we hear of athletic sports in honor of heroes and gods. Sometimes they are celebrated among the funeral rites of a deceased chief, sometimes they form part of a periodic festival. At first competitors exercised stript of their outer garments (*γυμνοί*); hence arose the name gymnasium. Afterwards the habit of exercising naked became universal. In the continuance of their history the Greeks grew more attached to such sports; their free active life, spent to a great extent in the open air, fostered the liking almost into a passion. The victor in any athletic contest, though he gained no money prize, was rewarded with the honor and respect of his fellow-citizens; and a victory in the great religious festivals was counted an honor for the whole state. In these circumstances the training of competitors for the greater games became a public concern; special buildings and officials were provided for the purpose by the state. But, as gymnastics became more and more an institution of social life, the gymnasia were applied to other uses even more important. The most interesting points are the connection with education on the one hand, with medicine on the other. Due training of the body and maintenance of the health and strength of children were the chief part of earlier education. Except the time devoted to letters and music, the education of boys was conducted in the gymnasia, where their moral training was as carefully attended to by special officers as their physical exercises. As they grew older conversation and social intercourse took the place of the more systematic discipline. Philosophers and sophists assembled to talk and to lecture in the gymnasia, which became places of general resort for the purpose of all less systematic intellectual pursuits, as well as for physical exercises. Plato, when treating of education, devotes much consideration to gymnastics (see especially *Rep.* iii. and various parts of *Leges*). Gymnastic exercises proper were designed, not merely as in Sparta, to foster the taste for war and the activity and strength needed for using weapons, but also to produce graceful carriage and healthy tone of the body. According to Plato, the sophist Prodicus first pointed out the connection between gymnastics and health. Having found such exercises beneficial to his own weak health, he formulated a method which was adopted generally, and which Hippocrates improved on. Galen lays the greatest stress on the proper use of gymnastics, and throughout ancient medical writers we find that special exercises are prescribed as the cure for special diseases. The regulation of the gymnasium at Athens is attributed by Pausanias (i. 39, 3) to Theseus, Solon made several laws on the subject; but, according to Galen, it was reduced to a system in the time of Clisthenes. Ten gymnasiarchs, one from each tribe, were appointed annually. These performed in rotation the duties of their office, which were to maintain and pay the persons that were training for public contests, to conduct the games at the great Athenian festivals, to exercise general supervision over the morals of the youths (they could, for example, remove any philosopher whose teaching they thought injurious), and to adorn and keep up the gymnasium. This office was one of the ordinary *λειτουργίαι*, and great expense was entailed on the holders. Under them were ten sophronistæ, with a salary of a drachma per day. Their duty was to watch the conduct of the youths at all times, and especially to be present at all their games. The

practical teaching and selecting of the suitable exercises for each youth were in the hands of the pædotribæ and gymnastæ. The latter also superintended the effect on the constitution of the pupils, and prescribed for them when they were unwell. Aliptæ oiled and rubbed dust on the bodies of the youths, acted as surgeons, and administered the drugs prescribed.

The gymnasia built to suit these various purposes were large buildings which contained, not merely places for each kind of exercise, but also a stadium, baths, covered porticos for practice in bad weather, and outer porticos where the philosophers and men of letters read public lectures and held disputations. In Athens there were three great public gymnasia,—Academy, Lyceum, and Cynosarges,—and every Greek city of consequence seems to have possessed one. Ruins of them exist at Pergamus, Ephesus, Alexandria, in Troas, etc., from which, and from the accounts of Vitruvius (v. 11), it would appear that all were constructed on much the same plan. The details will be found most clearly given in Rich's *Dictionary of Greek and Roman Antiquities*.

Much of the healthy buoyant elasticity of mind for which the Greek race is remarkable, as well as the active and beautiful physical development which no other race has ever equalled, is due to the love of gymnastics. The plastic art also owes its perfection in the treatment of the human form to the constant opportunity which artists had of observing the nude body in various attitudes. But abuses were liable to occur. The careful provisions made by Solon and later legislators to keep up the moral character of the gymnasia did not prevent them from fostering the vice which appears so much in Greek life. Though introduced in Rome, where Nero built the first public gymnasium, gymnastics did not suit Italian habits, and never became popular.

Gymnasium, in its modern use, generally signifies a school for gymnastic exercises, but it is sometimes used also to denote a higher school intended to give immediate preparation for the universities. The latter application of the term is specially prevalent in Germany.

GYMNASTICS, in the general acceptation of the term, denotes every exercise which tends to develop and invigorate the bodily powers, such as walking, running, riding, fencing, rowing, skating, dancing, and many others. In another sense gymnastics includes those manly and healthful games which have been encouraged by all high-minded nations as calculated to improve the physical strength and keep alive the martial spirit of their people. In a more limited sense, the term has been employed to denote the modern system of bodily exercises. Physical strength was the veritable god of antiquity, and we therefore find the elements of a system of gymnastics in most nations from the earliest times. In the infancy of society, when the individual was valued according to his personal strength and prowess, it was only natural that the utmost care should be bestowed on those arts which most surely led to distinction. All education then consisted chiefly in the practice of such exercises as were best calculated to develop muscular strength and make the tenure of life as secure as possible. The first gymnastic exercises, both of those nations that reached the highest civilization and of barbarians, were the same, viz., running, leaping, swimming, and the throwing of missiles. These exercises were at a very remote period systematized and reduced to a science by the Greeks (see GYMNASIUM). Among the Romans of the republic, the games in the Campus Martius, the duties of camp life, and the preliminary military exercises to which the soldier devoted himself, besides the enforced marches which were imposed upon him, and the part he took in the erection of public edifices, served to take the place of the gymnastic exercises required by the Greeks. In the Middle Ages, chivalry with its jousts, its feats of horsemanship, and encouragement to the arts of fencing, single stick, etc., took the place of the ancient gymnastic exercises. The invention of gunpowder, which modified the system of warfare, and the increasing value of individual life,—in a word, the progress of civilization—closed the career of the champions and votaries of physical strength, and gymnastic exercises in the course of time were neglected. Rousseau, in his *Émile*, was the first to call attention to the injurious consequences of such indifference; and it is in a large measure to his eloquent appeals that gymnastics have in recent times been held to constitute an integral part of school education, although it cannot be said that in every country the practical application of his views has met with much success. The good effects of the innovation which he advocated have nowhere been more strikingly exemplified than in Germany. When many parts of that country groaned under the iron yoke of Napoleon, Jahn and his followers, encouraged by the Prussian minister Stein, were establishing *Turnplätze* or gymnastic schools, from which issued the well-trained youth who in due time drove the French legions across the Rhine.

Of late years public attention has been drawn to the increasing deterioration in the physique of the population of England, and several proposals have been put forward to check an evil which can no longer be concealed. These proposals may be arranged under the banners of two rival camps. The one maintains the opinion put forward in a work just published on exercise and training in the following words (*Exercise and Training*, 1878):—

> "In our opinion the natural varieties of exercise of cricket, foot-ball, and rowing for boys, hunting, shooting, etc., for men, pursued at the different seasons of the year, are quite sufficient for a proper development of all parts of the body, in accordance with the uses of the different limbs, for the development of special muscles; or, where a great variety of exercise cannot be procured, a system of gymnastics may be pursued. To the advocates for the adoption of systematic physical education by means of gymnasia at our schools, whilst we concede the immense value of such establishments in our large towns, where outdoor exercise and field sports are difficult of attainment, or in cases where from the physical debility the muscles have to be gradually developed, still we maintain that the national games played by the English schoolboy are infinitely superior to any system of artificial exercise ever devised."

On the other side we have the advocates of physical education by means of regular gymnastic exercises superintended by trained and educated teachers, the whole placed under competent medical supervision. Among the staunch supporters of the latter view may be named Dr. Roth, and Mrs. Westlake, a member of the London School Board. The following considerations appear to be of great weight as supporting the views put forward by the advocates of physical education. While the national games may seem to some sufficient for the physical development of the ordinary youth and manhood of a country, it must not be forgotten that there is a vast and rapidly increasing portion of the population, especially in large cities, to whom the "national games" are quite unknown diversions, and that it is among this class that the most marked deterioration in physical development is only too apparent. The children of this class dwell cooped up in narrow, ill-lighted, and worse-ventilated courts, from which they are often dragged to undergo a certain amount of mental training, in many cases perhaps too severe to be sustained by their debilitated and enfeebled bodies. Whilst so much is being done for the mental culture of the rising generation, their physical culture is left very much to inclination or chance. But there is another source of danger put forward by those who advocate the sufficiency of the national games, viz., "the neglect of any classification of games at school, and allowing the weak and strong to engage in them indiscriminately, to the detriment of the physical well-being of the more delicate;" and they proceed to show the injury that may be done by the present system of competitive out-door sports unregulated by judicious restraint. Important information on this subject will be found in two papers published in the *St. George's Hospital Reports* for 1874–76, by Mr. C. Roberts, F.R.C.S., and by Mr. Street, and another, in the *Tenth Annual Report of the State Board of Health of Massachusetts*, by Professor Edward Hitchcock. Mr. Roberts points out that between the ages of fifteen and seventeen the greatest amount of physical development takes place, and that if at this period a boy is subjected to a great strain upon his strength his future growth may be interfered with, or the foundation laid of constitutional disease. Prof. Hitchcock's paper embodies the experience of seventeen years of careful observation. Acting upon the well-grounded opinion that neither mental serenity nor mental development can exist with an unhealthy animal organization, and admonished by "the sad deaths of two promising young men, and the breaking down in health of others just at the end of their college courses," the authorities of Amherst college were impelled to demand that the college officials should give a proper attention to physical health as well as to the culture of those powers for which departments were ordinarily created and endowments made.

In 1859 a department of physical education and hygiene was created, concerning which we read in the catalogue of 1861–62 that—

"Its design is to secure healthful daily exercise and recreation to all students; to instruct them in the use of the vocal organs, movements of the body, and manners, as connected with oratory; and to teach them, both theoretically and practically, the laws of health. This daily physical training is a part of the regular college course. The professor is an educated physician, and has not only a general oversight of the health of the college, but students have the privilege of consulting him without charge. While the gymnasium will furnish opportunities for the highest physical training, the required exercises will be such as can be performed without undue effort or risk of injury."

Each class at a stated hour on four days of the week appears at the gymnasium, and all perform their part in systematic and methodical exercises timed to music. The statistics of this department show some interesting facts in reference to the duration of sickness among students. While the average amount of time lost on account of sickness by each laborer in Europe is found to be 19 or 20 days each year, the returns of Amherst College sick-list for term time give 2·64 days as an annual average of time lost to every student, and 11·36 days to each sick student for 17 years. A decrease in the amount of sickness during the course is also an important feature in the health of the college.

From replies to questions put by Dr. Roth to the heads of the educational bodies, and also from the recorded personal experience of his son, Mr. B. Roth, F. R. C. S., it appears that considerable attention is now being paid to the best methods for improving the physical education of the people in nearly all the Continental states. The greatest activity is perhaps shown by Sweden, Germany, France, Belgium, and Italy; and even in Russia the question is attracting much public attention, Dr. Berglind having been ordered to write a special book on the subject. In Hungary also the Government has made physical education an obligatory part of the school curriculum. In Prussia gymnastic instruction was formally recognized by a cabinet order of June, 1842, and by a royal order of 1862 a guide-book of gymnastic instruction was introduced into the primary schools and into the training colleges for teachers. In Sweden this subject appears to have earlier attracted attention, for in 1813 the Government, under the direction of P. H. Ling, founded the Royal Central Gymnastic Institute at Stockholm, where teachers of both sexes are gratuitously trained for two years, and receive a diploma after undergoing a theoretical and practical examination. In Belgium, under the united efforts of MM. Delcour and Émile Greyson, considerable progress has been made, although much has still to be done, owing to the opposition raised by the municipality of Brussels to the views put forward by the Government. In the girls' schools the exercises are accompanied by music, after the example set by Colonel Ameros, who about the beginning of this century introduced into France a series of gymnastic exercises adapted to a jingling rhyme and to music. The chanting governed the movements, marked the intervals of repose, and helped to strengthen the organs of the voice and respiration. In France the necessity for the physical education of the people began to attract attention about the year 1845, owing probably to the energy displayed by Jahn in Prussia. M. de Salvandy proposed to introduce the teaching of gymnastics into the Lycées of Paris and Versailles, and a commission was appointed by him, which, however, never presented a report. In 1850, 1851, 1855, and 1856 several attempts were made to enforce compulsory gymnastic training, but the principle was not accepted till 1869, when M. V. Duruy took for his basis of action the labors of the commission presided over by Dr. Hillairet. After the fall of the empire M. Jules Simon addressed the head masters of the colleges and schools in France as follows: —

"I beg you to assist me in introducing gymnastics into our habits in a profitable and earnest manner. This is not only in the interest of public health; a healthy child is better prepared for study, and especially for the battle of life. Morality gains by this education of the body; much money is not wanted for the purpose; and in case of need, exercises can be performed without a trapeze or dumb-bells. Our medical men will help us to do our task; if the children are once accustomed to, and take pleasure in, these healthy exercises, we may be sure of a prompt amelioration of the race."

In England we find that the first attempt to introduce scientific physical education among the people was made in parliament in 1862 by Lord Elcho. This attempt failed, as also did another made in 1875 by P. A. Taylor, M. P. for Leicester, although supported in an able speech by Mr. Butler Johnstone. Lord Sandon, then vice-president of the committee of council on education, told Parliament that "the Government has done all that could be expected of them for physical education by taking steps to substitute military drill for ordinary drill." The substitution, it may be remarked, does not appear to have any advantage over the drill it displaced, as the military authorities declared the ordinary military drill to be insufficient for the requirements of the soldier, and have during the last sixteen years instituted gymnasiums at Aldershott, Gibraltar, Malta, and elsewhere, the teachers in which have, for the most part, passed under the care of Mr. Maclaren of Oxford, one of the principal authorities on the subject in England. Without entering into details, it may be admitted that the physical condition of the people, if not actually deteriorating, is not improving, and it is a significant fact that within the last year or two it has been found necessary to lower the standard in the British army, and that Dr. Ord, in his report for 1869, states that out of 5567 boys 4410 were rejected as under the standard of width of chest and height. We have already referred to the tendency to rely on the casual outdoor sports for maintaining the physique of the population, and to a great extent to depreciate systematic gymnastic exercises and physical education. That in some quarters, however, this opinion is not entertained is shown from the fact that the London School Board has appointed Miss Löfving of the Stockholm Training College to instruct certain of their teachers so as to fit them for teaching the girls in the schools. It is to be regretted that in the blind asylums so little is done for the physical education of the inmates. An institution in Milan provides for the training of ricketty children by carefully regulated gymnastic exercises; but this institution seems to be the only one of its kind in Europe.

To show that the importance of gymnastics has not been overstated, we may describe the effects produced on twelve non-commissioned officers sent by the military authorities to be trained as teachers for the British army by Mr. Maclaren. The men ranged from nineteen to twenty-nine years of age, and in height from 5 feet 5 inches to 6 feet. In Mr. Maclaren's own words, "the muscular additions to the arms and shoulders and the expansion of the chest were so great as to have absolutely a ludicrous and embarrassing result, for before the fourth month several of the men could not get into their jackets and tunics without assistance, and when they had got them on they could not get them to meet down the middle by a hand's breadth." In a month more they could not get into them at all, and new clothing had to be procured, pending the arrival of which the men had to go to and from the gymnasium in their greatcoats.

Although there is some diversity of opinion among teachers of gymnastics as to the relative value of the different exercises, some holding that "free exercises" are sufficient, others that certain mechanical appliances are necessary, yet all agree that, to ensure healthy and perfect development of the organs of the body, a course of gymnastics must commence with such simple exercises as walking, running, jumping, etc. The introductory course ordinarily consists of "movements and positions" and the use of dumb-bells and bar-bells. In some French gymnasiums, especially those presided over by M. Laisné of Paris, an instrument invented and called by him a "xylofer" is in use, consisting of a wooden stick strengthened and weighted with a rod of iron, and corresponding apparently to the bar-bell of English teachers. Another form of movable apparatus, also in use in some Continental schools, consists of sticks on which slide wooden spheres of from 6 to 7 inches diameter, prevented from slipping off by india-rubber rims at each end. The movements which accompany the use of the stick are intended to expand the chest and increase the power of the muscles of the back. In stretching the arms outwards from the bent position, the spheres fly outwards and very much increase the energy of the movement.

For the preliminary exercises with movable apparatus, the dumb-bell is that usually selected. It was in use in England in the time of Elizabeth. It has many advantages over the Indian club, the practice of the dumb-bell requiring a less amount of room, and not presenting the risk the club does of overstraining the body by its unskilful use.

The dumb-bell admits of being exactly proportioned to the individual strength of each learner, and can be adjusted in

weight as his strength increases. The exercises also that may be performed with it give employment to all parts of the body and to both sides equally. The *bar* is simply a two-handed dumb-bell. Next in order come walking, running, and leaping, the exercises being so regulated that both the distance and speed are gradually increased. The *leaping rope* is suspended from a beam, and enables the leaper to clear a barrier at the same time that it gives employment to both the upper and lower limbs. The *leaping pole* is usually made of ash, and varies from 8 to 10 feet in length. Its use may be left to the pleasure of the pupil after he has acquired some dexterity with the leaping rope.

The *horizontal beam* is a round wooden beam so mounted that it may be moved up and down. The exercises on this are chiefly balancing the body in the sitting and erect posture, and when moving along it.

The *vaulting bar* differs from the preceding in being somewhat thinner, so as to be easily grasped by the hand. The appropriate exercises on it have for their object the strengthening of the muscles of the upper extremity and loins. The *vaulting horse* allows of a wider range of exercises, and requires a greater amount of strength and dexterity. The muscles of the upper and lower limbs and trunk are all benefited by its use. The *fixed parallel bars* are used to develop the muscles of the trunk and upper limbs, but chiefly the former. The *movable parallel bars* may be used for the same exercises as the preceding. The *trapeze* consists of a horizontal bar suspended by ropes at a height of 4 or 5 feet from the floor. Considerable practice is required to perform the exercises on this machine with dexterity and neatness. The *horizontal bar*, the *bridge ladder*, the *plank*, the *inclined plane*, the *prepared wall*, and the *mast*, and several modifications of these that are used, permit of a great variety of exercises.

In "calisthenics" the exercises are more directed to ensure grace and ease in the several movements of the body than muscular development, and are, therefore, closely allied to the "movements and positions" or "free exercises" of the gymnast. Among these exercises dancing takes a prominent part, being at once healthful and graceful.

See Combe's *Education, its Principles and Practice*, edited by Jolly; Maclaren's *Physical Education;* the various works (in French) of Prof. N. Laisné, Capt. Docx, and Dr. Le Blond; and numerous pamphlets by Dr. Roth. (H. A. H.)

GYMNOTUS. See EEL and ELECTRICITY.

GYNÆCOLOGY (from the Greek *γυνή, γυναικός*, a woman, and *λόγος*), that branch of medicine which concerns the pathology and treatment of affections peculiar to the female sex. See MEDICINE.

GYOMA, an old market-town in the Trans-Tibiscan county of Békés, Hungary, is situated on the banks of the Körös main stream, 46° 57′ N. lat., 20° 50′ E. long. It has a fine town-hall, Roman Catholic, Calvinist, and Lutheran churches, a Jews' synagogue, tax, post, and telegraph offices, a brewery, several elegant private residences, and a large station on the Szolnok-Arad Railway. The soil of the surrounding country, though in some places clayey, is in others of a rich and productive character, and the inhabitants succeed in raising plentiful crops of wheat, mangcorn, barley, millet, and maize, besides cultivating several kinds of orchard fruit and grapes. The more considerable landholders rear great numbers of sheep, pigs, and horned cattle. An abundant supply of fish and waterfowl is yielded by the Körös, which is here spanned over by a wooden bridge and by the railway. Enormous quantities of firewood are floated down the stream on rafts. The fields are protected from floods by a large dyke, whilst a similar service is rendered by the Nagy-Iván, Csergetyü, Jokai, and Német trenches, which usually become dry during summer. In 1900 the population of Gyoma was 11,545, by nationality Magyars. Before 1682 three other communes, viz., Ege, Pó, and Nyárszeg, stood on the wide-spreading tract belonging to Gyoma. In that year they were, however, completely destroyed, and now only traces of their former existence remain.

GYÖNGYÖS, the second town in importance of Heves county, Hungary, is situated at the foot of the Mátra, south-west of Eger (Erlau), and is connected by a branch line with the Budapest-Miskolcz royal state railway, 47° 47′ N. lat., 19° 59′ E. long. Gyöngyös is the seat of a court of justice, and of a board of taxes, and contains three churches, a large monastic establishment belonging to the Franciscans, a gymnasium, manufactories of leather, hats, and woollen cloth, and distilleries. The town carries on a brisk trade, especially in the Vissontaer and Egri (Erlauer) red wines, which are produced in great quantities in the neighborhood. In 1900 the population was 16,440, mostly Magyars by nationality. The Hungarians defeated the Austrians at Gyöngyös on the 3d April, 1849.

GYÖNGYÖSI, ISTVÁN or STEPHEN (1620–1704), one of the most talented Hungarian poets of the 17th century, was born of poor but noble parents in 1620. The county of his birth is variously given as Gömör or Bons, the date as August 5 or November 3. His abilities early attracted the notice of Count Ferencz Wesselényi, who in 1640 appointed him to a post of confidence in Fülek castle. Here he remained till 1653, when he married, and commenced his public career as an assessor of the judicial board. In 1681 he was elected as a representative of his county at the diet held at Soprony (Oedenburg). From 1686 to 1693, and again from 1700 to his death in 1704, he was deputy lord-lieutenant of the county of Gömör. Of his literary works the most famous is the epic poem *Murányi Venus* (Caschau, 1664), which hymns the praises of his benefactor's wife Maria Szécsi, the heroine of Murány. Among his later productions the best known are—*Rózsa-Koszorú*, or Rose-Wreath (1690), *Kemény-János* (1693), *Cupidó* (1695), *Palinodia* (1695), and *Chariklia* (1700). His poems are chiefly remarkable for energy, feeling, and popular sentiment. The earliest edition of his collected poetical works is by Dugonics (Pressburg and Pesth, 1796); the best modern selection is that of Toldy, entitled *Gyöngyösi István válogatott poétai munkái* (Select poetical works of Stephen Gyöngyösi), 2 vols., 1864–65.

GYPSUM, the hydrated sulphate of lime, $CaSO_4.2H_2O$, is a mineral substance occurring in various rock formations, especially in Tertiary deposits, in very considerable abundance and under varying conditions. In its transparent crystalline state it is known as selenite; when it presents a finely fibrous opalescent appearance, it is termed satin spar; and the name alabaster is reserved for the pure milky white massive varieties. Gypsum is very generally disseminated, the most famous locality for the finer qualities worked into alabaster vases and figures being Castelino, about 30 miles from Leghorn; while Montmartre, Argenteuil, and other places in the environs of Paris, and in the neighborhood of Derby in England, furnish inexhaustible supplies chiefly for the preparation of plaster of Paris and for agricultural use, etc. It is also found in large quantities in Nova Scotia, New York, Virginia, and Michigan. The application of gypsum as a manure is referred to under AGRICULTURE, vol. i. p. 313, and its employment for ornamental purposes is described under ALABASTER, vol. i. p. 389. The preparation of plaster of Paris, so called from the fact that the industry chiefly centres in several Parisian suburbs, is the principal primary object of the quarrying or mining of gypsum. By the application of heat gypsum begins, at a temperature of about 175° Fahr., to part with its combined water. An increase of temperature causes the desiccation to proceed with great rapidity, and for manufacturing purposes the best results are obtained at from 230° to 250°. For making plaster of Paris, gypsum is burnt in kilns at about the latter temperatures, and subsequently it is powdered and ground to a fine uniform flour. So prepared it possesses the valuable property of recombining with water when mixed with it, and setting, from a thin paste, into a solid mass, the phenomenon being accompanied with some expansion and the evolution of heat. It is to this property of recombining with water that the value of plaster of Paris is principally due. When, however, gypsum is burnt at a temperature of 480° and upwards, the sulphate rehydrates only with great difficulty, and at still higher temperatures it loses all power of absorbing water, and in this respect it then resembles anhydrite, the natural water-free sulphate of lime. Plaster of Paris is largely used for obtaining copies of statuary figures, coins, medals, sculptures, and carvings, and also for taking casts from natural objects. It is also employed as the material for moulds for electro-deposits, and for the manufacture of embossed and pressed pottery ware. Still more extensively is it consumed in the finishing of internal plaster work in houses, and for making cornice mouldings and other architectural enrichments in positions sheltered from the weather. Plaster of Paris work is, like gypsum, soluble in water at a temperature of 32° to the extent of ·205 per cent., rising to a maximum solubility of ·254 at 95° Fahr. Plaster casts made simply with water are soft, porous, and easily injured, and various plans have been devised for producing a harder and more compact body with plaster. Keene's cement, which may be taken as a type of the hardened plasters, is made by

treating the burnt gypsum in a solution of 1 part of alum to 12 of water at a temperature of about 95°. After about 3 hours the plaster is removed, dried, and rebaked in the furnace, and then thoroughly ground and powdered. Thus prepared, the plaster needs comparatively little water to slake it, and it sets much more slowly than the ordinary plaster, while the comparative tenacity of the two varieties is as 1·5 to 1. Parian cement is plaster hardened with water containing 10 per cent. of borax; and stucco is plaster rendered tenacious by being prepared with a strong solution of glue. When water containing lime or a solution of gum-arabic is used to slake burnt gypsum, a hard plaster is also obtained, which by smoothing, coloring, and subsequent polishing with oil assumes a marble-like surface. A fair imitation of meerschaum is also made in hardened plaster by polishing, tinting the surface with a solution of gamboge and dragon's-blood, and treating it with either melted paraffin or stearic acid. It is understood that the cheaper "meerschaum" pipes and cigar-holders are thus prepared.

GYROSCOPE, GYROSTAT, are names given to instruments which are used to demonstrate certain properties of rigid bodies, when made to rotate rapidly about the axis round which they are kinetically symmetrical.

In some of its forms the gyroscope has been known for a very long time, and is, in all probability, of French or German invention. Almost the first instrument of the kind that we hear of, and of which the present gyroscope is merely a modification, is that of Bohnenberger, which was constructed as early as 1810, and is described in Gilbert's *Annalen* for 1818 (lx. p. 60). It consisted of a heavy spheroid which could rotate inside a circular ring round its shorter axis,—the axis running on pivots situated at opposite ends of the ring's diameter. This ring, with its contained spheroid, was similarly made movable inside a second ring, and round an axis at right angles to the axis of the spheroid. In the same way this second ring, with its contents, could rotate inside a third ring, and round an axis at right angles to each of the others. From this it will be seen that the spheroid had all degrees of free rotation,—one point only within it being fixed, namely, the intersection of the three axes.

Under the title of precession instruments, various pieces of apparatus, involving the gyroscope principle, have been in use for a number of years for illustrating the precession of the equinoxes, and the parallelism of the earth's axis as it revolves round the sun. An instrument of this kind was given by Arago to Professor Playfair, which must have been in existence since 1816–17. Mention is made of a similar instrument as being brought from Italy to Mr. Babbage in 1827. At the close of that year a notice of an instrument akin to the gyroscope made by Mr. Henry Atkinson was read before the Astronomical Society. In 1836, in a paper read before the Royal Scottish Society of Arts, Mr. Edward Sang, C. E., Edinburgh, suggested an experiment with an instrument exactly similar to the gyroscope, by which the rotation of the earth on its axis could be directly proved. He says: "While using Troughton's top an idea occurred to me that a similar principle might be applied to the exhibition of the rotation of the earth. Conceive a large flat wheel, poised on several axes all passing exactly through its centre of gravity, and whose axis of motion is coincident with its principal axis of permanent rotation, to be put in very rapid motion. The direction of its axis would then remain unchanged. But the directions of all surrounding objects varying, on account of the motion of the earth, it would result that the axis of the revolving wheel would appear to move slowly." This suggested experiment was actually carried out in 1852 by M. Leon Foucault, although, in all probability, without any knowledge on his part of Mr. Sang's suggestion. Already, in 1851, Foucault, in his famous experiment with the pendulum at the Pantheon in Paris, had shown how the constancy of the plane of a pendulum's vibration could be used to show the rotation of the earth, and now, in 1852, he applied the property of the "constancy of the plane of rotation" of a gyroscope for the same purpose. The name gyroscope was given to the instrument by Foucault at this time, and in order to perform the experiment successfully the instrument had to be constructed with the utmost exactness. The experiment was repeated at the Liverpool meeting of the British Association, and by causing a considerable sensation in the scientific world at the time was the means of bringing the gyroscope into public notoriety. In *Poggendorff's Annalen* for 1853 there is a description of a gyroscope made some time before by Fessel, and about the same time we hear of various modifications of the instrument introduced by Profs. Baden Powell, Wheatstone, and others. Quite recently, in 1878, there has appeared in the *Scientific American* an account of a new form of gyroscope made by Mr. G. M Hopkins. In this instrument the heavy fly-wheel is driven by an electric current after the manner of an electro-magnetic engine, and so its rotation can be kept up for any length of time.

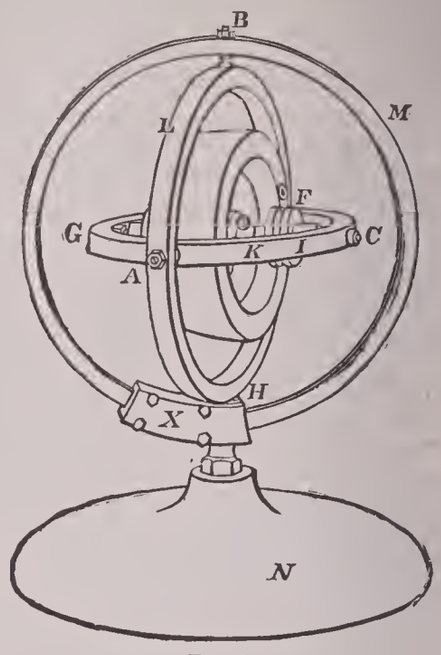


Fig. 1.

The construction of the gyroscope will be readily understood from fig. 1, which is engraved from a photograph of a large instrument made by Mr. Sang.

It consists of a fly-wheel, with a heavy rim accurately turned and balanced, which can rotate round an axis GC forming a diameter of the ring K. This ring also can rotate about the axis AF which is at right angles to GC, and is a diameter of the ring L. Similarly this ring L can rotate about the vertical axis BH, which is perpendicular both to GC and AF, and forms a diameter of the ring M, which is screwed to the heavy sole-plate N. In order to suit certain experiments the ring M, by means of a clamp arrangement seen at X, can be turned round to make the axis BH inclined at any angle with the vertical. With this instrument the following among many interesting experiments may be made.

1. Either by a large fly-wheel and band, or by running out a long cord coiled several times round the V-grooved wheel on the end of the axis, let a very rapid rotation be given to the fly-wheel round the axis OC, and in the positive direction (that is, counter-clock-wise as seen from C). Such a rotation can readily be given so rapid as to last a long time. While so revolving let a weight be placed at G so as to cause a rotation round OA, also in the positive direction, and it will then be observed that a slow rotation of the whole mass takes place about the vertical axis OB, but in the negative direction. If the weight be put at C, the wheel rotating as before, the rotation round OB will be in the positive direction. Reversing the rotation of the wheel will in both cases produce a reversal of the rotation round OB.

2. The fly-wheel still rotating in the positive direction, let a positive rotation be given to the ring L round OB, and immediately the axis of the wheel OC will tilt up, rotating in the positive direction round OA till it reach the vertical position, where it will remain, and then it will be observed that the fly-wheel is rotating in the positive direction round OB. Should the axis OC, in consequence of inertia, be carried a little past the vertical, and the direction of rotation round OB be then suddenly reversed, the axis OC will continue to revolve in the positive direction round OA, till it reaches the vertical pointing downwards, when it will again be stationary, and the wheel will now be rotating in the negative direction round OB. By gently oscillating the ring L at the instant the axis of the fly-wheel is passing the vertical, a continuous rapid rotation round OA can be given to the ring K carrying the rotating fly-wheel with it.

3. Let the fly-wheel be now made stationary, and, while in this position, let simultaneous rotations in the positive direc-

tion be given round both OA and OB; the fly-wheel will then be observed to begin to move in the negative direction round OC.

The explanation of all these experiments follows readily from the theory of the composition of rotations round different axes. Let the angular velocities about OA, OB, OC, be ϖ, ρ, σ respectively. If simultaneous angular velocities σ and ϖ be given about OC and OA in the positive direction, these can be compounded into an angular velocity about a new axis OI, which divides the angle AOC into two parts such that

$$\frac{\varpi}{\sigma} = \frac{\sin \text{COI}}{\sin \text{AOI}} = \frac{\sin \text{COI}}{\cos \text{COI}} = \tan \text{COI} = \tan \theta \text{ (suppose)}.$$

OI is, therefore, the position of the instantaneous axis, and as OC will always tend to coincide with it, OC will move round the axis OB in the negative direction. It will be noticed also that, ϖ remaining the same, $\tan \theta$ will be less as σ is greater. This shows that the rotation round OB, or the motion in azimuth, will be slower as the speed of the fly-wheel is greater. This accords with experiment. In precisely the same way by considering simultaneous angular velocities about OC and OB and OA and OB, can experiments 2 and 3 be explained.

Perhaps the most common form of gyroscope is that which has been largely sold under the name of the gyroscope top. It is a modification of the gyroscope introduced by Fessel. In it the ring containing the rotating wheel is either supported on a vertical pivot at the end of the axis, or simply held suspended by a string attached to the same point, as

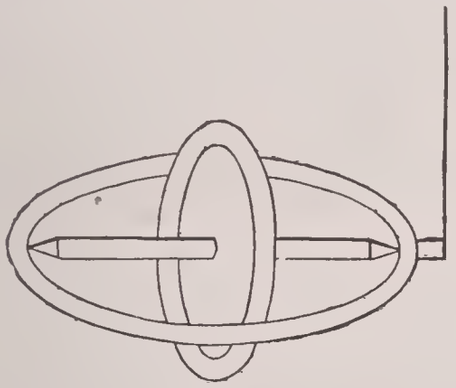


Fig. 2.

represented in fig. 2. In this case, when the wheel is rapidly rotated, and its axis initially inclined at an angle with the vertical, a slow motion round the vertical axis is observed to take place. This rotation is accompanied by a feeble nutation of the axis, which is unobservable by the eye so long as the wheel rotates rapidly. The rotation in azimuth would continue uniform if the velocity of the wheel

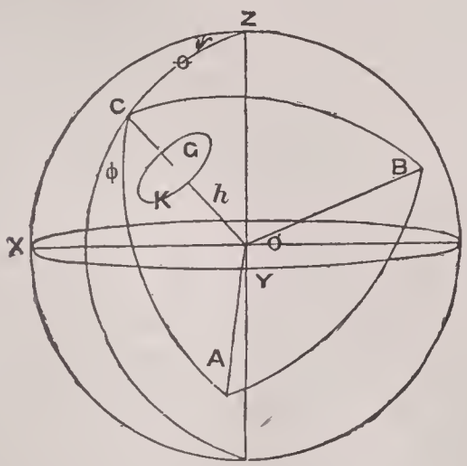


Fig. 3.

remained constant, but it gradually decreases in speed, the nutation at the same time becoming more apparent as the velocity dies away, till the gyroscope finally settles with the axis of the wheel in the direction of the prolongation of the supporting string. A short analytical investigation of this particular case may serve to give some idea of how problems on the gyroscope generally may be attacked. For clearness in the woodcut (fig. 3) we suppose the ring containing the wheel removed.

Let K represent the wheel of mass M; h the distance of the centre of gravity G from O; OC the axis of the wheel, supposed of unit length; OA, OB, two other axes through the fixed point O at right angles to OC and to each other; OX, OY, OZ, three rectangular axes fixed in space, with which OA, OB, OC (axes movable with the body) initially coincide; ψ, ϕ, θ, angles on the unit sphere which define the point C.

If A, B, C be the moments of inertia, and ϖ, ρ, σ the angular velocities about OA, OB, OC respectively, the equation of kinetic energy T gives

$$T = \tfrac{1}{2}(A\varpi^2 + B\rho^2 + C\sigma^2);$$

but

$$\varpi = \dot{\theta} \sin \phi - \dot{\psi} \sin \theta \cos \phi;$$
$$\rho = \dot{\theta} \cos \phi + \dot{\psi} \sin \theta \sin \phi;$$
$$\sigma = \dot{\psi} \cos \theta + \dot{\phi}.$$

Substituting and making A = B, as is clearly the case, we have

$$T = \tfrac{1}{2}A\dot{\theta}^2 + \tfrac{1}{2}A\dot{\psi}^2 \sin^2\theta + \tfrac{1}{2}C(\dot{\psi} \cos \theta + \dot{\phi})^2.$$

Applying Lagrange's equations of motion, which are for this case

$$\frac{d}{dt}\cdot\frac{dT}{d\dot{\psi}} - \frac{dT}{d\psi} = 0,$$
$$\frac{d}{dt}\cdot\frac{dT}{d\dot{\phi}} - \frac{dT}{d\phi} = 0,$$
$$\frac{d}{dt}\cdot\frac{dT}{d\dot{\theta}} - \frac{dT}{d\theta} = Mgh \sin \theta,$$

we get

$$(1)\ \frac{d}{dt}\left\{ A\dot{\psi} \sin^2\theta + C(\dot{\psi} \cos \theta + \dot{\phi}) \cos \theta \right\} = 0;$$

$$(2)\ \frac{d}{dt}\left\{ C(\dot{\psi} \cos \theta + \dot{\phi}) \right\} = 0;$$

$$(3)\ A\ddot{\theta} - A\dot{\psi}^2 \sin \theta \cos \theta + C \sin \theta \dot{\psi}(\dot{\psi} \cos \theta + \dot{\phi}) = Mgh \sin \theta$$

Integrating (2), we get

$$\dot{\psi} \cos \theta + \dot{\phi} = \text{a constant} = n,$$

which represents the angular velocity about OC.

Now if the motion be steady we must have both θ and $\dot{\psi}$ constants. Let them be represented by α and μ respectively. Then equation (3) gives

$$-A\mu^2 \sin \alpha \cos \alpha + C\mu n \sin \alpha = Mgh \sin \alpha.$$

$$\therefore \mu = \frac{Mgh + A\mu^2 \cos \alpha}{Cn}.$$

By this formula we can calculate, for any particular instrument, the angular velocity in azimuth from having given the angular velocity of rotation of the fly-wheel and *vice versa*.

An important case of motion, and one also very interesting both mathematically and physically, is got by including a gyroscope in a pendulum bob and supporting the rod from a universal flexure joint. This constitutes the gyroscopic pendulum. The joint is usually got by attaching a short length of fine steel wire rigidly to the end of the rod, and suspending the whole by means of the other end of this wire firmly clamped into a fixed support. When the gyroscope is rapidly rotated, and the pendulum drawn a little aside from the vertical and then let go, its lower end is observed to describe a beautiful curve consisting of a series of equal closed loops, all equally near each other and radiating from a centre point. This curve, which is a species of hypotrochoid, is figured in Thomson and Tait's *Natural Philosophy*, where also the whole theory of the gyroscopic pendulum will be found.

As has been already mentioned, a remarkable apparent effect is produced by the earth's diurnal rotation upon a rapidly rotating gyroscope. This arises from what Foucault called the "fixity of the plane of rotation," and what Thomson and Tait have recently called "gyrostatic domination." In virtue of this principle, the axis of the rotating fly-wheel tends always to preserve a fixed direction in space, and, in consequence, will appear to move in a direction opposite to that in which the earth's rotation is at each instant actually carrying it.

If we suppose the gyroscope represented at fig. 1 to have all degrees of free rotation round the point O, and to be in every way exactly balanced about that point, and also to have all its pivots nearly void of friction, then, at whatever part of the earth's surface it may be placed, the fly-wheel while rotating rapidly will be observed to move gradually and finally take up such a position that its axis OC is parallel to the earth's axis, and also that its direction of rotation round OC is the same as that of the earth round its axis. Should the ring K be fixed so that the axis GC can only move in a horizontal plane, then the ring L will move in azimuth till it has placed GC in the direction north and south and such that the direction of rotation of the fly-wheel coincides with that of the earth. Further, should the ring L be fixed in the plane of the meridian, so that

GC can only move in altitude, then GC will be observed to tilt up till it is parallel to the earth's axis, the direction of rotation of the wheel being, as before, the same as that of the earth. These effects may be explained as follows:—

Let λ be the latitude of the place, and ω the angular velocity of the earth on its axis; also, at starting, let the ring K be in the horizontal plane, and let OC make an angle α, in azimuth, with a horizontal line ON drawn from O northwards; further, let the rotation of the wheel round OC be positive. Now ω can be resolved into three angular velocities at right angles to each other, viz.:—

$\omega \sin \lambda$ round the vertical line,
$\omega \cos \lambda \cos \alpha$ round a line parallel to OC, and
$\omega \cos \lambda \sin \alpha$ round a line parallel to ON.

Of these $\omega \sin \lambda$ gives the velocity in azimuth, $\omega \cos \lambda \cos \alpha$ can only affect the velocity of the wheel, while $\omega \cos \lambda \sin \alpha$ gives the velocity of OC in altitude. These being the actual component velocities communicated to the gyroscope by the earth, the apparent velocities will be equal and opposite to them.

The apparatus actually employed by Foucault to demonstrate the rotation of the earth differed somewhat from that represented in fig. 1. In it the corresponding ring to L was suspended from a fixed stand by the thread without torsion, and rested at its lowest point by a pivot in an agate cup. Also the ring corresponding to K, which carried the fly-wheel, rested on knife edges within L, and could be removed at pleasure, in order that the rotation might be given to the fly-wheel. Great care was also taken to have every part thoroughly well balanced. It is stated that the experiment was several times successfully performed, and Foucault by means of his apparatus was thus able, without astronomical observation, to find out the latitude of the place, the east and west points, and the rate of the earth's motion. The same experiment has lately, it is said, been successfully performed by Mr. G. M. Hopkins. His fly-wheel, being driven by electricity, has the advantage of rotating at a uniform rate for any length of time. By attaching a small mirror to the frame which carries the revolving wheel, and using a spot of light reflected from it as an index, he has been able to make manifest the earth's rotation in a very short time.

An ingenious practical application of the gyroscope principle was suggested and carried into effect about the year 1856 by Professor Piazzi Smyth. His aim was to devise a telescope-stand which would always remain level on board ship, notwithstanding the pitching and rolling, and so facilitate the taking of astronomical observations at sea. For this purpose the stand was supported on gimbals, and underneath it were placed on fine pivots several heavy fly-wheels which could be put in rapid rotation, some on vertical and some on horizontal axes. The complete apparatus, involving many ingenious details as to driving the fly-wheels, etc., was tested by Professor Smyth on board the yacht "Titania" during a voyage to Teneriffe, and found to work with perfect satisfaction. A full account of the method will be found in *Trans. Royal Scottish Society of Arts*, vol. iv.

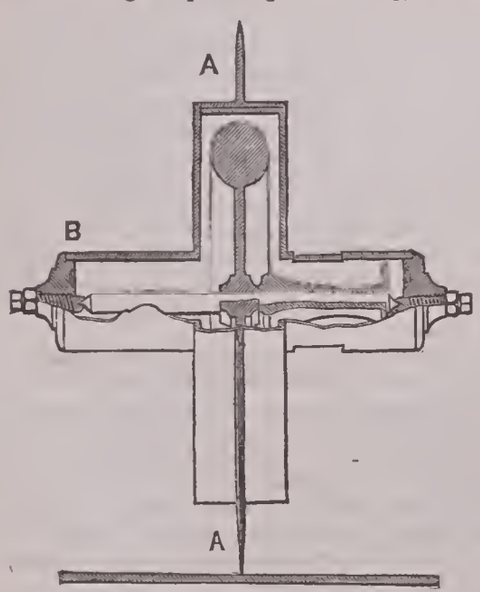


Fig. 4.

Gyrostat.—This is a modification of the gyroscope, devised by Sir William Thomson, which has been used by him as well as by Professor Tait for a number of years to illustrate the dynamics of rotating rigid bodies. It consists essentially of a fly-wheel, with a massive rim, fixed on the middle of an axis which can rotate on fine steel pivots inside a rigid case. The rigid case exactly resembles a similarly-shaped, but hollow, fly-wheel and axis closely surrounding the other but still leaving it freedom to move. Slits are made in the containing case whereby a cord can be coiled several times round the axis for the purpose of setting the fly-wheel in motion. There is also attached to the rigid case, in the plane passing through the centre of gravity of the wheel at right angles to its axis, a thin flange of metal, which is called the bearing edge. The circumference of this flange is not a circle but a curvilinear polygon of sixteen or more equal sides. The object of making it so is to prevent the instrument from rolling like a wheel on the bearing edge when the fly-wheel is rotating rapidly. A drawing of the gyrostat, with a portion of the case removed to show the inside, is given in fig. 4. A represents the bearing edge upon which the whole balances. To suit certain experiments, a sharp conical steel point can be fixed on to the end B by means of a bayonet joint.

The gyrostat is a most instructive instrument, and with it many interesting experiments can be performed. We can only mention a few taken from Thomson and Tait's *Natural Philosophy*, vol. i. Part I., where the mathematics of the whole subject will be found fully given.

1. Let the gyrostat be placed on a flat sheet of glass with its bearing edge in a vertical plane as represented in the figure. Neglecting translations, it has in that position clearly two freedoms, one in azimuth and the other inclinational. Of these, the first is neutral and the second unstable when the fly-wheel is still; but when it rotates rapidly the second will become stable, the first remaining neutral as before. When the fly-wheel is spinning rapidly, the persistence with which the gyrostat keeps the erect position is very remarkable. A blow from the fist on the side of the case is met by a strong resistance, the instrument being thrown into a state of violent tremor, which subsides, however, after a few seconds. If, while the fly-wheel is still rapidly spinning, a weight be hung on at B, the whole apparatus will, like the gyroscope, immediately begin to move round a vertical axis.

2. Let the gyrostat be supported on knife-edge gimbals at its lower end, and with the axis vertical. In this position it has two freedoms, each unstable, without rotation of the fly-wheel, but with it both stable. A similar result is obtained by supporting the gyrostat on a universal flexure joint, constituting an inverted gyroscopic pendulum.

3. Let the gyrostat be supported on two equally long stilts tangential to the bearing edge. In this position the two freedoms, one azimuthal the other inclinational, are both unstable without, but both stable with, rapid rotation of the fly-wheel.

4. Let the gyrostat be attached to a bar of wood by thrusting the bearing edge through a narrow slot in the middle of the bar, and then let it be suspended by strings attached to the ends of the bar, the bar being horizontal. By this we have the means of slinging the gyrostat bifilarly in four different ways, two with the strings parallel and two with them crossed, the gyrostat being alternately above and below the wooden bar. Each of these ways has four freedoms, which can be reduced to three by a third string in each case. A little consideration will show in each case the stable and unstable modes without and with rotation of the fly-wheel.

It only remains to mention a very interesting and intricate gyrostatic problem which has been lately suggested by Sir William Thomson. He supposes a string of gyrostats to be formed with their axes all in the same straight line, and each attached to the other by a small universal flexure joint of thin steel wire. If this string be disturbed after the fly-wheels have all been put into rapid rotation, a remarkable cork-screw motion passes along the wire. For particulars we must refer to a paper announced by Sir William Thomson in the *R. S. E. Proceedings*.

In addition to the references in the text the following will be found useful:—*Ast. Notices*, vol. i.; *Comptes Rendus*, Sept., 1852; Paper by Professor Magnus translated in Taylor's *Foreign Scientific Memoirs*, new ser., part 3, p. 210; *Ast. Notices*, vol. xiii. pp. 221–248; *Theory of Foucault's Gyroscope Experiments*, by the Rev. Baden Powell, F.R.S.; *Ast. Notices*, vol. xv.; articles by Major J. G. Barnard in *Silliman's Journal*, 2d ser., vols. xxiv. and xxv.; E. Hunt on "Rotatory Motion," *Proc. Phil. Soc. Glasgow*, vol. iv.; J. Clerk Maxwell, "On a Dynamical Top," *Trans. R. S. E.*, vol. xxi.; *Phil. Mag.*, 4th ser., vols. 7, 13, 14; *Proc. Royal Irish Academy*, vol. viii.; Sir William Thomson on "Gyrostat," *Nature*, vol. xv. p. 297; Price's *Infinitesimal Calculus*, vol. iv. (J. BL.)

GYTHIUM was an ancient Achæan town on the La-

conian Gulf, south-west of the mouth of the Eurotas, near the site of the modern port Marathonisi. It lay opposite the island Cranæ, at the foot of the fertile valley of the Gythius. On its coins the common types are Apollo and Heracles, the founders of the city. Heracles, the Phœnician god Melkart, points to an early connection with Tyre. The Phœnicians maintained a great trade with the shores of the Laconian Gulf, and Aphrodite Migonitis, the Phœnician Astarte, had a temple at Migonium, the modern Marathonisi. Aphrodite and Asclepius also occur on its coins, and the latter had a temple in the city. A great port in the period of Phœnician intercourse, Gythium became a secondary town after the Dorian conquest, as is proved by the absence of early coins; and it was only after the decay of Sparta that it again became an important city. It was the ordinary station of the Spartan fleet, and was considered the port of Sparta, from which it was distant about 30 miles. In the wars against Athens it was therefore exposed to frequent attacks. Tolmidas, the Athenian commander, burned it (455 B. C.). Later it was besieged unsuccessfully by Epaminondas (370 B. C.). It was strongly fortified by the tyrant Nabis; but he was compelled by Flamininus to give up Gythium and other coast towns to the Achæan league (195 B. C.). When, soon afterwards the whole country became a Roman province, Gythium had its own magistrates, στράταγοι and ἔφοροι (see inscr. in Lebas, *Voyage Archéol.*, 242*a*, and *Gött. Gel. Anz.*, 1865, p. 461). Augustus made it one of the twenty-four Eleuthero-Laconian towns. The existing ruins, called Paleopoli, are all of the Roman period. According to Strabo (p. 363), it had an artificial harbor, of which Col. Leake could see no trace. In the town was a well sacred to Asclepius, and at three stades' distance was the stone Argos, where Orestes was relieved from his madness.

GYULA, chief town of the Trans-Tibiscan county of Békés, Hungary, is favorably situated on the Fehér (White) Körös, and has a well-built station on the Nagy-Várad (Grosswardein) and Eszék line of the Alföld-Fiume Railway, in 46° 38′ N. lat., 21° 17′ E. long. The outer ditch of the old ruined fortress, the tower of which serves as a prison, divides Gyula into two parts, named respectively Magyar-Väros (Hungarian-town) and Német-Väros (German-town). Stone bridges facilitate communication over the canals, which flow from the Körös, and intersect the streets. Among the principal buildings are Roman Catholic, Old United Greek, Lutheran, and Calvinist churches, and a Jews' synagogue, also a fine castle with gardens, a county hall, an ancient Turkish bath, many handsome private residences, and several oil-mills. Gyula is, moreover, the seat of the county assemblies and administration, of a royal court of justice, of the assizes, and of a board of taxes, and has post and telegraph offices, and a savings-bank. The inhabitants are employed partly in industrial and commercial pursuits, partly in farming and cattle-breeding. The fairs are much resorted to for the purchase of corn, horned cattle, sheep, pigs, wooden wares, and gall-nuts. The chief agricultural products of the surrounding country are wheat, barley, oats, and maize; there is also a good supply of garden fruit, grapes, and vegetables. In 1900 the population amounted to 22,466, consisting chiefly of Magyars, Wallachs, and Germans.

H.

H HAS varied in form from the Phœnician and old Hebrew symbol ח, called Cheth, only by the removal of the upper and lower horizontal lines. (For the oldest forms of the letter see ALPHABET.) The closed form is sometimes found in old Greek inscriptions, and, though less frequently, in South Italy.

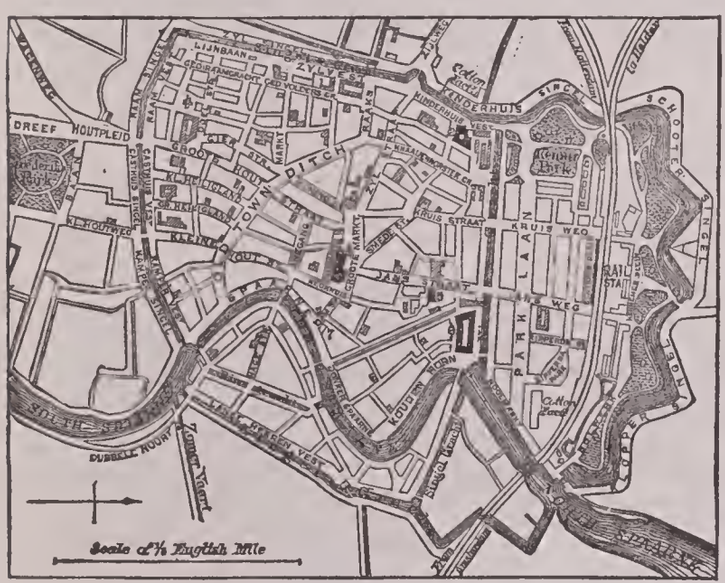
Its value in Phœnicia was probably a continuous guttural sound—the sound which it had in Hebrew—resembling the German *ch*, and with no English counterpart. In Greece it represented nothing more than the spirant *h*, so long as a separate symbol to denote that sound was felt to be necessary. Afterwards it was generally employed to denote a second *e*-sound, under the name of *Eta;* probably it had before been called *Heta*. The time of this change varied in different parts of Greece. In the alphabet of the island of Thera we find H representing *e* as early as the 40th Olympiad, though it still sometimes retained its old value. At Athens the date was 403 B. C., and here the practice did not vary. But in most of the alphabets of Greece proper, of Peloponnesus, and of the Italian colonies, H still remained as the rough breathing; and as such it consequently passed into the Latin alphabet. It is possible that *h* in a very few Latin words, when it occurs as a medial sound (*e. g., traho, veho*), was a continuous guttural. But generally it occurs at the beginning of a word, and can hardly have been more than a breathing. Even as this it early became evanescent. During the classical period of Latin literature it was retained in the speech of educated men, doubtless in part by Greek influence. But in the popular speech it was rapidly disappearing as an initial sound, although it continued to be written, and indeed was often written wrongly, at the beginning of words where it had no place; *e. g., umor* was written *humor*, and the *h* has held its own in English spelling down to our day. The sound is almost completely lost in modern Italian.

It is not settled beyond dispute by what mechanism the *h*-sound is produced. The old view (held by Lepsius and others) is that *h* has a distinct position of its own, further back in the throat than the gutturals, in fact, immediately above the larynx,—that it is a surd, to which the corresponding sonant is the slight gurgle heard between words of which the first ends and the second begins with the same sound (*e. g.*, "go over"), if we take care to close the glottis between the two words but not to alter the position of the other vocal organs. A quite different view is held by Whitney, M. Bell, and others, that *h* has no distinct position of its own, but is sounded in or through the position of the following sound; for example, that in saying *ha* we do not put the vocal organs into two positions, one for *h* and one for *a*, but we put them into the position for *a*, and then produce the breath and the vowel without any change of position, the *h* being a mere expiration of breath through the open glottis; similarly *hi, hu*, etc., are produced with the vocal organs in the position for *i, u*, etc., respectively; in each case the vocal chords vibrate for the vowel after the expiration of breath, but there is no change made within the orifice of the mouth between the *h*-sound and the vowel. This view is at least a plausible one.

HAARLEM, a city of the Netherlands, the chief town of the province of North Holland. By rail it is 11 miles W. of Amsterdam, 19 S. of Alkmaar, and 20 N. of Leyden. Distant about 5 miles from the German Ocean, it communicates with the Zuyder-Zee by the Spaarne and the Ij. The railway to Amsterdam was opened in 1839, and that to Alkmaar in 1867.

Haarlem is a typical Dutch town. The branches of the Spaarne and an extensive system of canals bring the ship-traffic into the heart of it, and turn its streets into so many quays. The roadways are paved with bricks; the houses have gable-ends with old-fashioned crow-steps; and everything wears a decent and quiet aspect, which to one man is dulness and to another "aristocratic gravity and modest coquetry." What the city lacks in liveliness it makes up by the interest of its historical associations and the number of its scientific and artistic institutions. The great market place especially has much that is worth seeing: the town-house and the cathedral of St. Bavo; the old meat market, a building of the end of the 16th century in the old Dutch style; the stadsdoelen, or place where in former times the burgesses used to assemble in arms; and the statue erected to Koster in 1856, when in Holland he was still generally considered the inventor of printing. St. Bavo's is one of the most famous churches in the Netherlands. It is a cruciform structure completed in 1538, and makes a considerable impression on the spectator by the great length (about 426 feet) of its main axis and the height and steepness of the roof. The tower is about 255 feet high. Within the lofty vaulting is supported by twenty very light columns, and there is a good deal of beauty about the perspective of its

aisles. The organ, built by Christian Muller of Amsterdam between 1735 and 1738, was for some time the largest in the world, and is still celebrated for the sweetness of its tone, especially in the vox humana stop. It possesses four key-boards, 64 stops, and 5000 pipes, the largest of which is 15 inches in diameter. Among the monuments in the church are those of Bilderdijk the poet and the hydraulic engineers Christiaan Brunings and Fredrik William Conrad, the latter the projector of the sluices at Katwijk. In the belfry are the *damiaatjes*, small bells presented to the town according to tradition by William I., the conqueror of Damietta. At the head of the scientific institutions of Haarlem may be placed the Dutch society of sciences (*Hollandsche Maatschappij van Wetenschappen*) founded in 1752, which possesses very valuable collections in botany, natural history, and geology. Teyler's foundation (Teyler's Stichting), instituted in accordance with the last will of Pietre Teyler van der Hulst for the study of theology, natural philosophy, poetry, history, drawing, and numismatics, has various auxiliary collections in the founder's former residence. The Dutch society of industry, founded in 1777, is still active and flourishing, with branches established all over the country. In 1871 it instituted a colonial museum, which along with the royal museum of modern art is accommodated in the pavilion formerly the residence of an Amsterdam banker, Hope, and acquired for the crown by King Louis Napoleon.



Plan of Haarlem.

1. Gas Works.
2. Infirmary.
3. Town-House.
4. The Cathedral of St. Bavo or Groote Kerk.
5. R. C. Ch. of St. Joseph.
6. Barracks.
7. Teyler's Foundation.

The colonial museum presents a complete survey of the manifold products of the Dutch possessions in the East Indian Archipelago, and the royal museum has a collection of 250 pictures. Among the benevolent institutions of the city it is enough to mention the hospital for old men founded in 1608, and the beautiful Teyler's Hospital.

The staple industries of Haarlem have been greatly modified in the course of time. Under the counts of Holland cloth-weaving and brewing were in a very thriving condition; but under Charles V. they lost enormously in importance. While 2000 pieces of cloth had been manufactured annually in the end of the 15th century, 800 or 900 was the number for 1515; and the breweries diminished from 120 in 1494 to 95 in 1503, and by 1513 were no more than 77. After the revocation of the edict of Nantes, silk, lace, and damask-weaving were introduced by French refugees, and in course of time these industries gave employment to 10,000 of the population. About the close of the 18th century this remarkable prosperity was a thing of the past; and it was not till after the Belgian revolution that Haarlem began to turn its attention to the various departments of manufacture in which it is now engaged. Cotton factories, carriage-works, bleach-works, cotton and silk dye-works, a famous type-foundry, oil-works, soap-works, breweries, and a factory for preserved meats are among the more important establishments. The extensive workshops of the Dutch railway company are also of value to the town. One of the printing establishments has the reputation of being the oldest in the Netherlands, and publishes the oldest Dutch paper, *De Opragte Haarlemmer Courant*. As market gardening, especially in the flower department, is largely carried on in the immediate vicinity, Haarlem is the seat of a flourishing trade in "Dutch roots," especially in hyacinths, tulips, fritillaries, spiræas, and japonicas. A considerable business is also done in the butter, cheese, and other agricultural produce from the surrounding country.

Though the population of Haarlem has been steadily increasing since the beginning of the present century, it has not become so great as it was in the 17th. In 1570 the total was 20,772 souls, of whom 1836 were Dutchmen capable of bearing arms, 1215 Englishmen and Frenchmen, 1856 Germans, and 15,865 women and children. By 1622 it had increased to 39,455. A rapid decline took place in the 18th century; from 26,281 in 1748 the number sank to 21,227 in 1796, and by 1815 it was not more than 17,432. Seven years later we find 18,453 inhabitants, 21,667 in 1830, 24,012 in 1840, 25,852 in 1850, and 27,534 in 1860. The year 1874 showed 32,758, and three years later the number was no less than 35,692. In 1869–1870 there were 14,471 members of the Dutch Reformed Communion, 11,574 Roman Catholics, and 565 Jews. Pop. (1906), 69,700.

Haarlem is mentioned in a register of the 10th century as Haralem. From Count William II. it obtained a charter in 1245, and in the course of the following centuries it rapidly advanced in prosperity. In 1492 the insurgents called the "bread and cheese folk" got possession of the town, but before the year was out it was recovered by the imperial general Duke Albert of Saxony. The year 1493 was witness of a great conflagration, and in 1509 the plague claimed its many victims. In 1559 Haarlem became a bishop's see. The prominent part that its inhabitants took in the revolt of the Netherlands brought upon it an unparalleled disaster. Don Frederick son of the duke of Alva invested the town with 30,000 men in December, 1572, and after a siege, in which the burghers defended themselves with admirable and pertinacious heroism, it was obliged to capitulate in July, 1573. The conquerors, in spite of their promise of mercy, took barbarous vengeance, and it was not till July, 1577, that the town was recovered from their grasp by the prince of Orange. In its subsequent history the main events are the inundations of 1775 and 1791, the arrival of the Prussians in 1787, and the quatercentenary celebration of the invention of printing in 1823.

See F. Allan, *Geschiedenis en beschrijving van Haarlem van de vroogste tijden tot op onze dagen onder medewerking van Ekema, Enschede, en Geelings.*

Haarlem Lake, or Haarlemmer Meer, a commune of the province of North Holland, constituted by the law of 16th July, 1855. It has an area of about 46,000 acres, and its population has increased from 7000 in 1860 to 13,602 in 1873. As its name indicates, the commune was formerly a lake, and, according to Amersfoordt, this lake was a relic of a northern arm of the Rhine which passed through the district in the time of the Romans. In 1531 the Haarlemmer Meer had an area of 6430 acres, and in its vicinity were three smaller sheets of water—the Leid'sche Meer or Leyden Lake, the Spiering Meer, and the Oude Meer or Old Lake—with a united area of about 7600 acres. The four lakes were ultimately incorporated into one by successive inundations, and by 1647 the new Haarlem Lake had an area of 36,400 acres, which by 1740 was increased to 42,000. As early as 1643 Jan Adriaanszoon Leeghwater proposed to endyke and drain the lake; and similar schemes, among which those of Nikolaas Samuel Cruquius in 1742 and of Baron van Lijnden van Hemmen in 1821 are worthy of special mention, were brought forward from time to time. But it was not till 1836, when one furious hurricane on the 9th of November drove the waters as far as the gates of Amsterdam, and another on the 25th of December sent them in the opposite direction to submerge the streets of Leyden, that the mind of the nation was turned seriously to the matter. In August, 1837, the king appointed a royal commission of inquiry; the scheme proposed by the commission received the sanction of the second chamber in March, 1839, and in the following May the necessary law was passed. The first business was to dig a canal round the lake for the reception of the water and the accommodation of the great traffic which had previously been carried on. The canal was made 38 miles in length, with a depth of 9 feet, and a width of 130 feet on the west side of the lake and 115 on the east side. The preliminary works were not completed till 1845. The area enclosed by the canal was rather more than 70 square miles; the average depth of the lake was 13 feet 1·44 inches; and as the water had no natural outfall it was calculated that probably 1000 million tons would have to be raised by mechanical means. A gigantic steam-engine designed by Messrs. J. Gibb and A. Dean of London was erected and named in honor of Leeghwater. It could raise 112 tons at each stroke and discharge 1,000,000 tons in 25½ hours. The total weight of iron

used for the engine, pumps, etc., was 640 tons, and the cost of the machinery and buildings amounted to £36,000. Two other engines of equal size and power were afterwards constructed by Messrs. Harvey of Hayle and Messrs. Fox and Co. of Perran, in Cornwall, the makers of the "Leeghwater." They were named respectively the Cruquius and the Van Lijnden. Pumping commenced in 1848, and the lake was dry by the 1st of July, 1852. At the first sale of the highest lands along the banks on August 16, 1853, 784 hectares were bought for 575,000 florins, or 733 florins per hectare; but the average price afterwards was less. The whole area of 42,000 acres recovered from the waters has brought in 9,400,000 florins or about £780,000, so that the actual cost to the nation has only been 4,400,000 florins or £300,000, though the expense of the enterprise amounted to 13,787,377 florins or £1,080,000. The soil is of various kinds, loam, clay, sand, and peat; most of it is sufficiently fertile, though in the lower portions there are barren patches where the scanty vegetation is covered with an ochreous deposit. Corn, seeds, cattle, butter, and cheese are the principal produce. The roads which traverse the commune are bordered by pleasant-looking farm-houses built after the various styles of Holland, Fricsland, or Brabant. Hoofddorp, Venneperdorp or Nieuw Vennep, Abbenes, and the vicinities of the three great steam-engines are the spots where the population has clustered most thickly. The first church was built in 1855; in 1877 there were seven. In 1854 the city of Leyden laid claim to the possession of the new territory, but the courts decided in favor of the nation.

A list of works on the Haarlem Lake is given by Gevers van Endegeest, *Du desséchement du Lac de Harlem* (The Hague, 1849–1861, 3 parts, with plates). See also J. P. Amersfoordt, *Het Harlemmer-meer*, Haarlem, 1857, published by the Amsterdam *Maatschappij Felix Meritis*.

HABAKKUK (חֲבַקּוּק), one of the minor prophets of the Old Testament, the eighth in order in the Massoretic text. The name of the prophet is peculiar to him, and occurs only in his own writing (i. 1; iii. 1). As to its meaning there is some uncertainty, but it is probably a formation from a verb signifying *to entwine, to embrace* (חָבַק), and means "embraced" or simply "embrace" (Jerome, *Pr. ad Hab.*; Gesenius and Fürst on the word). In the Septuagint and with the Greek fathers it appears in the form of Ἀμβακούμ, which would seem to indicate that the Hebrew was read and pronounced Habbâkuk (חַבָּקּוּק), the double *b* being changed for the sake of euphony into *mb*. The change of the *k* into *m* at the end of the word Bleek says is without analogy; but in the change of Beelzebub into Beelzebul we have an analogous instance of the substitution of a liquid for a mute,—probably because to the Greek ear it was not agreeable that a final syllable should begin and end with the same rough consonant. Of the prophet's personal history nothing is certainly known. In the inscription of his book he is simply called "the prophet;" nor can we with certainty determine at what time he lived and prophesied. From the use of the word "my" in the subscription to the psalm in chap. iii., "To the chief singer on my stringed instrument" (ver. 19), it has been inferred that he was of the tribe of Levi, inasmuch as it is supposed from this that he held a place among those by whom officially the musical service of the temple was conducted, a place which only a Levite, it is alleged, could occupy. But this seems rather too much to build on the mere use of the word "my," nor is it quite certain that only Levites took part with stringed instruments in the service of song in the temple. King Hezekiah, after his recovery from his sickness, composed a psalm of thanksgiving, and in reference to it he says, "We will sing my songs to the stringed instruments all the days of our life in the house of the Lord;" for he "had said, What is the sign that I shall go up to the house of the Lord?" (Isa. xxxviii. 20, 22); from which it may be inferred that others besides Levites might take part in the liturgical music of the temple. Were there any truth in the assertion in the additions to Daniel in the Apocrypha that Habakkuk was sent by the Lord from Judæa to Babylon with food for Daniel in the lions' den, this would give us the date of the prophet's activity; but on such a manifest fiction nothing can be built. According to one tradition the prophet was buried at Keilah in the tribe of Judah; according to another at Hukkok (now Yakuk) in the tribe of Naphtali.

The book of Habakkuk falls into two parts,—the former of which (chaps. i. and ii.) has the inscription, "The burden which Habakkuk the prophet saw," and the latter (chap. iii.) the inscription, "Prayer" (or hymn) "of Habakkuk on Shigyonoth." Both parts have reference to the same subject, the invasion of Judah by the Chaldeans, who are expressly named (i. 6). In both this is regarded as a chastisement from the Lord upon the people for their sins; but whilst in the earlier part the prophet appears as a reprover and denouncer of evil, in the latter he gives utterance to emotions of reverence, confidence, and joy in God as the Saviour of His people. In the former part the prophecy is in the form of a dialogue between Jehovah and the prophet. The prophet, deeply troubled because of the corruption of his people, cries to God and asks how long such a state of things is to continue (i. 2–4); to which God replies in effect that He is about to bring on the sinful nation a heavy calamity by raising against them the Chaldeans—"that bitter and impetuous nation"—whose fierce and terrible hosts should devastate the land,—at the same time intimating that this scourge should pass away, and that the invaders, though the instruments of God's vengeance, should not be held guiltless (5–11). The prophet then appeals to God, the Everlasting and Holy One, and asks how the employment of such instruments to inflict punishment on the people of His choice is reconcilable with the divine rectitude and unchangeableness (12–17), but declares that he will stand on his watch-tower that he may learn what God will say to him, hoping that some word of comfort may be vouchsafed to him which he may carry to his people. The word comes; the Lord will not suffer the ungodly, the transgressor, and the idolater to escape; a five-fold woe is denounced against the enemies of God's people; the just are encouraged to abide in faith, cheered with the assurance that as a result of God's judgments on the wicked the knowledge of the glory of the Lord shall fill the earth as the waters cover the sea; for God is in His holy temple, His purposes shall stand fast, therefore let all the earth be still and await his coming (ii. 1–20). The latter part of the book is a hymn of praise in which the prophet in his own name and that of the people celebrates the majesty and mighty deeds of the Lord, and gives exulting expression to the confidence and joy with which His true subjects rest in Him (iii. 1–19). This hymn is in form and style like one of the Psalms, and was doubtless intended for use in the temple service. To some it has appeared that this third chapter is wholly unconnected with the two preceding. But though different in character and style, it stands closely connected in substance with what goes before, and forms with this one whole. In the former part we have the burden which the prophet had to bear to the people; in the latter we have the utterance of the feelings produced by the contemplation of the facts and revelations therein set forth, viewed in the light of God's manifestations of Himself on behalf of His people in former times.

This book, which it is generally agreed was written by the prophet himself, forms one of the finest remains of ancient Hebrew literature. In conception and style it is not inferior to any production of the most flourishing age of prophecy. The language is pure, the thought is lofty, and in the construction artistic skill is displayed. With the mantle of the prophet the author bears also the chaplet of the poet.

At what time Habakkuk prophesied remains uncertain. From i. 5, 6, where the invasion of Israel by the Chaldeans is represented as a thing so strange as to be incredible when announced, it has been inferred that the prophecy was uttered whilst as yet the people of Israel were unacquainted with the Chaldeans as a warlike power,—long, therefore, before the battle of Carchemish (606 B.C.), in which Necho, king of Egypt, was defeated by Nebuchadnezzar. The date of the prophecy has accordingly by some been relegated to the reign of Manasseh; and this has been supposed to receive confirmation from the fact that during that reign there were prophets who foretold the coming on the nation of a calamity such as that the ears of all who heard of it should tingle (2 Kings xxi. 10 *ff.*); and of these prophets Habakkuk may have been one. The words of the prophet, however, do not necessarily imply that at the time he uttered his prophecy the people were so ignorant of the Chaldeans that they could not believe what he was commissioned to announce to them regarding an invasion of the country by that "bitter and hasty" nation; it is rather the immediateness and terribleness of the catastrophe which he represents as what would pass belief, even when announced by a prophet of the Lord. It is further to be observed that his words imply that the calamity he was sent to announce would happen in the days of those to whom he spoke, which could hardly be said of a generation that had reached adult age during the latter half of Manasseh's reign, that is, fully sixty years before the invasion of Judah

by Nebuchadnezzar. It may be added that it is very improbable that during the reign of Manasseh, when idolatry had to such an extent superseded the worship of Jehovah, such a psalm as that of chap. iii. would have been composed for the temple service by any one living in Judah. A later date, it would thus appear, must be assigned to the prophecy. Vitringa has suggested that it was uttered in the time of Josiah, and this is accepted by Delitzsch and others. To this it has been objected that the state of things described in the beginning of the book does not accord with what we know to have been the state of things in Josiah's reign, and moreover that the declaration that the calamity threatened should happen in the days of the existing generation does not tally with the assurance given by the prophetess Huldah to King Josiah, that the evil the Lord was about to bring upon Jerusalem should not happen in his day (2 Kings xxii. 15–20). Neither of these objections, however, has much weight. To the former it may be replied that, though in the later part of Josiah's reign a better state of things than that described by the prophet prevailed, in the early part of it things were probably exactly such as he represents; and to the latter it may be replied that the two declarations are not irreconcilable, for though the invasion of the Chaldeans might happen in the time of the existing generation to whom the prophet spoke, it might be not till after the death of Josiah that Jerusalem should be taken; which in point of fact was the case. A more serious objection is that the psalm in chap. iii. could not have been composed in the early part of Josiah's reign before the reforms which he introduced had been begun, and that the first and second chapters could not have been uttered after these had been inaugurated, because then the state of things there described did not exist. To meet this it has been suggested that the two parts of the book may have been composed at different times, the earlier part in the beginning and the later after the middle of Josiah's reign. This is possible; but the standpoint of the prophet is in both parts so much the same that it is not probable that any marked interval of time elapsed between the composition of the two. We are, however, so imperfectly acquainted with the minuter details of the history of the times that for aught we can tell there may have been seasons during the reign of Josiah when the good and the evil in the nation were so mixed that a prophet, whilst denouncing the wickedness he saw around him, and threatening a woe on the nation because of it, might yet be inspired by the remembrance of God's dealings with his people in the past and the hope of better things for the future to give utterance to such a strain of adoration and exultant gladness as the hymn at the close of the book presents; nor is there any reason to doubt that the pious king and such men as Hilkiah the high priest, and those associated with him as "rulers of the house of God" (2 Chron. xxxv. 8), would be so in sympathy with the prophet in this that they would readily approve of his psalm being consigned to "the chief singer" to be used in the temple service. An argument in favor of assigning the date of this prophecy to the reign of Josiah has been drawn from the numerous coincidences in sentiment and phraseology between this book and those of Jeremiah and Zephaniah (*cf.* Hab. i. 8 with Jer. v. 6, iv. 13, and Zeph. iii. 3; Hab. i. 13 with Jer. xii. 1; Hab. ii. 9 with Jer. xlix. 16; Hab. ii. 13 with Jer. li. 58; Hab. ii. 16 with Jer. xxv. 27; Hab. ii. 20 with Zeph. i. 7, etc.); and if in these instances Jeremiah and Zephaniah have imitated Habakkuk or quoted from him, the argument must be held conclusive, for both these prophets began to prophesy in the later part of the reign of Josiah. De Wette, Hitzig, Ewald, Bleek, and others assign the prophecy to the reign of Jehoiakim; but for this there seems no good reason. (W. L. A.)

HABEAS CORPUS, in English law, is a writ issuing out of one of the superior courts, commanding the body of a prisoner to be brought before the court. There are various forms of this writ, according to the purposes for which it is intended. Thus *habeas corpus ad respondendum* is to bring up a prisoner confined by the process of an inferior court in order to charge him with a fresh action in the court above. Other forms are *ad satisfaciendum* (when judgment has been had against a prisoner in the court below), *ad faciendum et recipiendum*, or *cum causa* (to remove the proceedings into the superior court, the defendant being under arrest), *ad testificandum* (when the prisoner is wanted as a witness), etc. These forms are now of little or no importance. The most famous form of the writ is the *habeas corpus ad subjiciendum*,—the well-known remedy for the violation of personal liberty. It is addressed to the person in whose custody another is detained, and commands him to bring his prisoner before the court, with a statement of the day and cause of his capture and detention,—"*ad faciendum, subjiciendum, et recipiendum*, to do, submit to, and receive whatsoever the judge or courts awarding the writ may consider on that behalf." It is described as a high prerogative writ, *i. e.*, it is one of a number of extraordinary remedies, such as *mandamus*, prohibition, and the like, which the courts may grant on proper cause being shown. The writ of *habeas corpus* issues only after motion before the court or application to a judge, made on a sworn statement of facts setting up at least a probable case of illegal confinement. It is a common-law writ. "From the earliest records of the English law," says Hallam, "no freeman could be detained in prison except upon a criminal charge or conviction, or for a civil debt. In the former it was always in his power to demand of the Court of King's Bench a writ of *habeas corpus ad subjiciendum*, directed to the person detaining him in custody, by which he was enjoined to bring up the body of the prisoner with the warrant of commitment that the court might judge of its sufficiency and remand the party, admit him to bail, or discharge him, according to the nature of the charge. The writ issued of right, and could not be refused by the court."[1] *Habeas corpus* is, in fact, the appropriate instrument for enforcing the law of personal liberty, as declared in the Great Charter,—that no "freeman may be taken or imprisoned but by the lawful judgment of his peers or by the law of the land."

In Darnel's case (3 Car. I., 1627) the judges held that the command of the king was a sufficient answer to a writ of *habeas corpus*. The House of Commons thereupon passed resolutions to the contrary, and after a conference with the House of Lords the measure known as the Petition of Right was passed, which, *inter alia*, recited that, contrary to the Great Charter and other statutes, divers of the king's subjects had been imprisoned without any cause shown, and when they were brought up on *habeas corpus*, and no cause was shown other than the special command of the king signified by the privy council, were nevertheless remanded to prison, concluded "that no freeman in any such manner as is before mentioned be imprisoned or detained." In Jenkes's case, 1676, the lord chancellor (Lord Nottingham) refused to issue a *habeas corpus* in the vacation. Shortly afterwards was passed the famous Habeas Corpus Act (31 Car. II. c. 2), which is sometimes described as a consequence of the harsh if not illegal refusal of the writ in Jenkes's case, but which, as Hallam shows, was really due to the arbitrary proceedings of Lord Clarendon. The Act itself passed the Lords after many similar measures sent up by the Commons had been rejected.

The Habeas Corpus Act recites that great delays have been used by sheriffs and jailers in making returns of writs of *habeas corpus* directed to them; and for the prevention thereof, and the more speedy relief of all persons imprisoned for criminal or supposed criminal matters, it enacts in substance as follows. (1) When a writ of *habeas corpus* is directed to a sheriff or other person in charge of a prisoner, he must within 3, 10, or 20 days, according to the distance of the place of commitment, bring the body of his prisoner to the court, with the true cause of his detainer or imprisonment—unless the commitment was for treason or felony plainly expressed in the warrant of commitment. (2) If any person be committed for any crime—unless for treason or felony plainly expressed in the warrant—it shall be lawful for such person or persons (other than persons convicted or in execution by legal process) *in time of vacation*, to appeal to the lord chancellor as a judge, who shall issue a *habeas corpus* returnable immediately, and on the return thereof shall discharge the prisoner on giving security for his appearance before the proper court—unless the party so committed is detained upon a legal process or under a justice's warrant for a non-bailable offence. Persons neglecting for two terms to pray for a *habeas corpus* shall have none in vacation. (3) Persons set at large on *habeas corpus* shall not be recommitted for the same offence unless by the legal order and process of the court having cognizance of the case. (4) A person committed to prison for treason or felony shall, if he requires it, in the first week of the next term or the first day of the next session of oyer and terminer, be indicted in that term or session or else admitted to bail, unless it appears on affidavit that the witnesses for the crown are not ready; and if he is not indicted and tried in the second term or session after commitment, or if after trial he is acquitted, he shall be discharged from imprisonment. (5) No inhabitant of England (except persons contracting, or, after conviction for felony, electing to be transported) shall be sent prisoner to Scotland, Ireland, Jersey, etc., or any place

[1] *Constitutional History*, vol. iii. c. 13.

beyond the seas. Stringent penalties are provided for offences against the Act. A judge delaying *habeas corpus* forfeits £500 to the party aggrieved. Illegal imprisonment beyond seas renders the offender liable in action by the injured party with treble costs and damages to the extent of not less than £500, besides subjecting him to the penalties of *præmunire* and to other disabilities. "The great rank of those who were likely to offend against this part of the statute was," says Hallam, "the cause of this unusual severity."

The Habeas Corpus Act, it will be seen, applies only to the case of persons imprisoned on *criminal* charges. In 1758 the question arose whether, in the case of an impressment for military service, a *habeas corpus* could be applied for under the Act, and other questions of some difficulty were raised as to its effect in particular cases. The judges who were consulted by the House of Lords differed in their opinions, and ultimately the Act 56 Geo. III. c. 100 was passed, "for more effectually securing the liberty of the subject." It enacts (1) that a writ of *habeas corpus* shall be issued in vacation time in favor of a person restrained of his liberty (except persons imprisoned for debt or by civil process)—a privilege granted by the Act of Charles II. only in the case of commitments for criminal offences; (2) that though the return to the writ be good and sufficient in law, the judge shall examine into the truth of the facts set forth in such return, and if they appear doubtful the prisoner shall be bailed; (3) that the writ shall run to any harbor or road on the coast of England, although not within the body of any county. The last clause was intended to meet doubts on the applicability of *habeas corpus* in cases of illegal detention on board ship.

In Anderson's case, in 1861, the Court of Queen's Bench decided somewhat reluctantly that the writ runs to all the foreign dominions of the crown even when there are independent local judicatures. In consequence of this decision the Act 25 and 26 Vict. c. 20 was passed, enacting that "no writ of *habeas corpus* shall issue out of England, by authority of any judge or court of justice therein, into any colony or foreign dominion of the crown where her Majesty has a lawfully established court or courts of justice, having authority to grant and issue the said writ, and to ensure the due execution thereof throughout such colony or dominion."

In times of public danger it has been found necessary to suspend the Habeas Corpus Act by a special statute. This was done in 1817 by the Act empowering the king to secure and detain such persons as his Majesty shall suspect are conspiring against his person and government. More recently this extreme measure has been judged necessary in the case of Ireland (see 29 Vict. c. 1, continued for a short period by annual acts).

In the United States of America the law of *habeas corpus* has been inherited from England, and has been generally made to apply to commitments and detentions of all kinds. Difficult questions, unknown to English law, have arisen from the peculiar features of the American State-system. Thus the constitution provides that "the privilege of the writ of *habeas corpus* shall not be suspended unless when, in cases of rebellion or invasions, the public safety may require it;" and it has been the subject of much dispute whether the power of suspension under this provision is vested in the president or the congress. The weight of opinion seems to lean to the latter alternative. Again, conflicts have arisen between the courts of individual States and the courts of the Union. It seems that a State court has no right to issue a *habeas corpus* for the discharge of a person held under the authority of the Federal Government. On the other hand, the courts of the Union issue the writ only in those cases in which the power is expressly conferred on them by the constitution.

HABINGTON, William (1605–1654), one of the most pleasing of English minor poets, was born at Hendlip in Worcestershire, on the 4th of November, 1605. His father, Thomas Habington, was a prominent Catholic; to his mother, Lady Mary Habington, was attributed the revelation of the Gunpowder Plot. The poet was educated first at St. Omer, and refusing to become a Jesuit was removed to Paris. On his return to England he met and fell in love with Lady Lucy Herbert, second daughter of Lord Powis, whom he celebrated under the poetical name of Castara. After some opposition he won her hand, and they were married about the year 1632. In 1634 he first published his famous volume of lyrical poems entitled *Castara*, which was reprinted in 1635 and 1640. In the latter year he also published a prose *History of King Edward IV.* and *The Queen of Arragon*, a tragi-comedy. This play was published at the request of his kinsman, the earl of Pembroke; it was afterwards revived by Samuel Butler. The last work printed by Habington was *Observations upon History*, 1641. In 1647 his father died; and during the Commonwealth, as we learn from Anthony Wood, the poet "did run with the times, and was not unknown to Oliver the usurper." He died November 30, 1654, and was buried in the family vault at Hendlip. Habington possesses all the faults of his age except its impurity; he is honorably known as the chastest of the Royalist lyrists. His genius was gently fantastic, mild in its play of fancy, delicately ingenious, and of an unruffled stately dignity. He never rises to sublimity or passion, but he is always gentlemanlike and often extremely graceful. His best verses have a very modern tone, and remind the reader of the 18th rather than the 17th century.

The works of Habington have not been collected. An excellent edition of *Castara* was published by Mr. Arber in 1870, and *The Queen of Arragon* has been included in the Dodsley collection.

HACHETTE, Jean Nicolas Pierre (1769–1834), an eminent French mathematician, was born at Mézières, where his father was a bookseller, on the 6th May, 1769. For his early education he proceeded first to the college of Charleville, and afterwards to that of Rheims. In 1788 he returned to Mézières, where he was attached to the school of engineering as draughtsman to the professors of physics and chemistry. When twenty-three years of age he succeeded from among a number of candidates in gaining the professorship of hydrography at Collioure and Port-Vendre. While there he sent several able papers, in which some questions of navigation were treated geometrically, to Monge, at that time minister of marine, through whose influence he obtained an appointment in Paris. Thence he passed to a deputy-professorship at Mézières, and towards the close of 1794, when the École Polytechnique was established, he was chosen one of its staff, being appointed along with Monge over the department of descriptive geometry. There he instructed some of the ablest Frenchmen of the day, among them Poisson, Arago, and Fresnel. Accompanying Guyton de Morveau in his expedition, earlier in the year, he was present at the battle of Fleurus, and entered Brussels with the French army In 1816, on the accession of Louis XVIII., he was expelled from his chair by Government, at the same time that his friend and fellow-worker Monge was removed from the Institute. He retained, however, till his death the office of professor in the faculty of sciences in the École Normale, to which he had been appointed in 1810—the same year in which he married the daughter of the physician Maugras. The necessary royal assent was in 1823 refused to the election of Hachette to the Academy of Sciences, and it was not till 1831, after the Revolution, that he obtained that well-merited honor. He died at Paris, January 16, 1834. Hachette was held in high esteem for his private worth, as well as for his scientific attainments and great public services. His labors were chiefly in the field of descriptive geometry, with its application to the arts and mechanical engineering. It was left to him to develop the geometry of Monge, and to him also is due in great measure the rapid advancement which France made soon after the establishment of the École Polytechnique in the construction of machinery. His writings on descriptive geometry are still of value.

Hachette's principal works are his *Deux Suppléments à la Géométrie Descriptive de Monge*, 1811 and 1818; *Éléments de Géométrie à trois dimensions*, 1817; *Collection des Épures de Géométrie*, etc., 1795 and 1817; *Applications de Géométrie Descriptive*, 1817; *Traité de Géométrie Descriptive*, etc., 1822; *Traité Elémentaire des Machines*, 1811; *Correspondance sur l'École Polytechnique*, 1804–1815. He also contributed many valuable papers to the leading scientific journals of his time.

HACHETTE, Louis Christophe François (1800–1864), a French publisher, was born at Rethel in the Ardennes, May 5, 1800. After studying three years at a normal school with the view of becoming a teacher, he was in 1822 on political grounds expelled from the seminary. He then devoted several years to the study of jurispru

dence; but in 1826 he resolved to establish in Paris a publishing business, the main object of which should be the issue of works adapted to improve the system of school instruction, or to promote the general culture of the community. The series of works which from that time were brought out by him included manuals in various departments of knowledge, dictionaries of modern and ancient languages, educational journals, and French, Latin, and Greek classics annotated with great care by the most eminent authorities. Subsequent to 1850 he, in conjunction with other partners, published a cheap railway library, scientific and miscellaneous libraries, an illustrated library for the young, libraries of ancient literature, of modern foreign literature, and of modern foreign romance, a series of guide-books, and a series of dictionaries of universal reference. In 1855 he also founded *Le Journal pour tous*, a publication with a circulation of 150,000 weekly. There can be no question that by his efforts to circulate such a variety of wholesome and instructive literature, Hachette is entitled to rank among the greatest benefactors of his country. He also manifested great interest in the formation of mutual friendly societies among the working classes, in the establishment of benevolent institutions, and in other questions relating to the amelioration of the poor, on which subjects he wrote various pamphlets; and he lent the weight of his influence towards a just settlement of the question of international literary copyright. He died 31st July, 1864.

HACKBERRY, a name given to the fruit of the *Celtis occidentalis*, L., belonging to the natural order *Ulmaceæ*. It is also known under the name of "sugar berry," "beaverwood," and "nettle tree." The hackberry tree is of middle size, attaining from 60 to 80 feet in height, and with the aspect of an elm. The leaves are ovate, cordate-ovate, and ovate-lanceolate, with a very long taper point,—mostly glabrous above, and usually soft-pubescent beneath. The soft filmy flowers appear early in the spring before the expansion of the leaves. The fruit or berry, about the size of a bird-cherry, is of an obovate shape, of a reddish or yellowish color when young, turning to a dark purple in autumn. This tree, together with other species of the same genus, is distributed through the deep shady forests bordering the river banks of New England to Wisconsin and even further southward. The fruit has a sweetish and slightly astringent taste, and is largely eaten in the United States, and, although not officinal, has been highly recommended in cases of dysentery. The seeds contain an oil like that of almonds. The bark is tough and fibrous like hemp, the wood is hard and compact and heavy, and next to ebony and box has been spoken of as the best for durability, strength, and beauty; its tenacity and flexibility have led to its employment as shafts for carriages, hoops, etc. The root has been used as a dye for linens. The root, bark, and leaves of *C. orientalis* are employed in the East as a remedy in epilepsy.

HACO, or HAKON (*c.* 920–960), surnamed the Good, king of Norway, was the son of Harold Fairhair by a female slave, and was presented by Harold to King Athelstan of England, to mark his contempt for an insult he had received. The child was placed by a Norse warrior on Athelstan's knee, who was thus made to observe the symbol of adopting a child that was base born. Athelstan did not, however, take vengeance on the innocent cause of his anger, but brought him up as one of his own sons. On hearing of the death of Harold, he supplied Haco with men and ships, and sent him to Norway to wrest the throne from Eric, eldest son of Harold, whose violent and cruel reign had during the life of his father gained him the general hatred of his subjects. The news of Haco's arrival in Norway spread, says the saga, "like fire through dried grass." Eric at once took flight to Orkney and then to England, and Haco was chosen king at every "thing." Haco, though himself a Christian, found it impossible in his time to establish Christianity in Norway. He ruled his kingdom with great justice and prudence, and gained for it many victories over the Danes by land and sea. He was slain in a great fight against the Danes, led by the sons of Eric, about the year 960.

HACO V., surnamed the Old, king of Norway, son of Haco IV., was on the death of his father in 1204 excluded from the throne on the ground of supposed illegitimacy, and only became king in 1223, after his mother, to establish his rights, had undergone the ordeal of fire. He greatly increased the prosperity of Norway, and he also added to his kingdom Iceland and Greenland. As he had a dispute with Alexander III. of Scotland in regard to the sovereignty of the Hebrides, he set sail about 1263 on a great expedition against the west of Scotland, where he took possession of Arran and Bute, but suffered such a severe defeat at Largs that he was compelled again to put to sea. After losing many ships by storm, he sailed to Orkney, where he died in the following winter. It is supposed by some that his fleet in his voyage north passed between Skye and the mainland, and that it is from this fact that the narrow sound of Kyle-Akin received its name.

For the kings named Haco see the *Heimskringla* of Snorro Sturluson, which, however, does not include the reign of Haco V., translated into English by Samuel Laing, London, 1844. The saga of Swerre and his successors was published by Unger under the title *Konunga Sögur*, Christiania, 1870–73. The *Saga Hâkonar Hâkonarsonar* forms the 10th volume of the *Fornmanna Sögur*, published at Copenhagen, in 12 vols., 1825–39, and translated into Danish and Latin in 12 vols., 1828–46. See also *Sturlunga Saga*, 2 vols., Oxford, 1878, and Carlyle's *Early Kings of Norway*, London, 1875.

HADAD, the name of a Syrian deity, is met with in Scripture as the name of several human persons; it also occurs in the compounds Benhadad, Hadadrimmon, and Hadadezer. The etymology of the word, of which Hadar, Ader, and Arad appear to be incorrect variations, is obscure; the divinity primarily denoted by it, however, according to Philo of Byblos (Müller, *Fr. Hist. Gr.*, iii. 569; *cf.* Macrob., *Saturn.*, i. 23), is the king of the gods, the greatest and highest, the sun; and these interpretations seem to point to some such radical meaning as *unicus*. The Syrian kings of Damascus seem to have habitually assumed the title of Benhadad, or son of Hadad (three of this name are mentioned in Scripture), just as a series of Egyptian monarchs are known to have been accustomed to call themselves sons of Ammon-Ra. The word Hadadrimmon, for which the inferior reading Hadarrimmon is found in some MSS., in the phrase "the mourning of (or at) Hadadrimmon" (Zech. xii. 11), has been a subject of much discussion. According to Jerome and all the older Christian interpreters, the mourning for what occurred at a place called Hadadrimmon (Maximianopolis) in the valley of Megiddo is meant, the event alluded to being generally held to be the death of Josiah; but since Hitzig and Movers the opinion has been gaining ground that Hadadrimmon is merely another name for Adonis or Thammuz, the autumn sun-god, the allusion being to the mournings by which the Adonis festivals were usually accompanied (Hitzig on Zech. xii. 11, Isa. xvii. 8; Movers, *Phönizier*, i. 196).

Full materials for the whole discussion will be found in Baudissin's *Studien zur Sem. Religionsgesch.* (1876), Abh. v. This author, however, has considerably modified his views in Herzog and Plitt's *R. E.*, *s. v.*, having in his earlier essay been misled in important points by statements of Schrader (*Keilinsch. und A. T.*, pp. 101 *seq.*), which have since been found to require correction (see Gutschmidt, *Neue Beiträge*, p. 47 *seq.*; Wellhausen's criticism of Baudissin in *Gött. Gel. Anz.* (1877), Stück 6; Schrader, *Keilin. und Geschichtsforsch.* (1878), pp. 371 *seq.*, 538 *seq.*).

HADDINGTON, or EAST LOTHIAN, a maritime county of Scotland, lies between 55° 46′ 10″ and 56° 4′ N. lat. and between 2° 8′ and 2° 49′ W. long. It is bounded on the N. by the Firth of Forth, on the E. by the North Sea, on the S. by Berwickshire, on the W. by Edinburghshire. Its seaboard is 31¾ miles. Its greatest length from east to west is 25 miles, its breadth from north to south about 16 miles. Its area covers 179,142 acres (280 square miles), of which 189⅓ are under water, 5505 foreshore, and 142½ in "links." The general outline of the county is that of an irregular quadrilateral figure with its northern angle projecting into the sea. Along a south-and-north line through the county town, the land slopes gradually up from the coast to the Garleton Hills, thence down to the Tyne valley, and then up again to the Lammermuir Hills, which occupy the southern district of the county. On the east and west the ground slopes from the Lammermuirs to the sea, but near the sea the fall is so gentle that the land has the appearance of a plain. Two almost isolated hills break the level,—North Berwick Law (940 feet) on the coast, and Traprain Law (700) in the eastern part of the Tyne valley. The chief summits of the Lammermuir Hills are Spartleton (1534), Lammerlaw (1500), and Soutra Hill

(1230). The only stream of any importance is the Tyne, which, after a course of 7 miles in Midlothian, flows through the county with a gentle current north-east past the town of Haddington, and falls into the sea at Tynemouth. A very fine variety of trout is found in it; and below the rocks of the linn at East Linton salmon are occasionally caught. The Whiteadder rises in the county and flows south-east into Berwick.

Geology and Mineralogy.—The Lammermuirs are composed chiefly of Lower Silurian strata, overlaid in part by Old Red Sandstone and conglomerate—one great mass of the latter extending south-east from Spott, with a breadth of 3 or 4 miles, across the hills into Berwickshire. Another belt of Old Red Sandstone rather more than 1 mile in breadth begins at the sea a little to the south of Dunbar, and stretches along the base of the Lammermuirs. Patches of Old Red Conglomerate occur also here and there in the Lammermuirs further to the west, and are seen in the upper tributaries of Gifford and Humbie waters. The ground to the north of the Lammermuirs is occupied chiefly by rocks belonging to the Calciferous Sandstone and Carboniferous Limestone series of the Carboniferous formation. The Calciferous Sandstones cover a wide area west and east of Haddington, extending south to the Lammermuirs, along the base of which they trend south-west beyond the county boundary. They also appear in the lower reaches of the Tyne valley, covering a considerable area between Tynninghame Links and Biel Water. Again they are seen on the shore between Torness Point and Dunglass Burn, whence they strike inland. The hilly tract between Haddington and North Berwick is made up of various volcanic rocks of Lower Carboniferous age, such as porphyrite, dolerite, and tuff. In the western part of the county the Carboniferous Limestone series occupies an extensive area and is rich in limestones and coal-seams. This area forms the eastern margin of the Midlothian coal-field. A patch of the Limestone series also appears upon the coast about a mile south of Dunbar. Besides these bedded aqueous and volcanic rocks, there are numerous intruded masses, dykes, and veins of felstone and basalt, and some pipes of tuff and agglomerate which mark the sites of ancient volcanoes of Lower Carboniferous age. Granite is found at Priestlaw. Deposits of glacial origin are met with more or less abundantly, especially in the low-lying tracts. These consist of till or boulder-clay and mounds and sheets of sand and gravel, underneath which the older rocks are often concealed over wide areas. Alluvial deposits occur along the course of many streams, but the only considerable alluvial flats are those of the Tyne.[1]

Coal of a very fair quality is extensively worked in the west. So long ago as 1200 the monks of Newbattle obtained this mineral from Prestongrange. Limestone is found throughout the greater part of the shire. A vein of hematite of a peculiarly fine character was discovered in 1866 at the Garleton Hills, and wrought for some years; but from a variety of causes the works have been meanwhile suspended.

Climate.—The climate is on the whole mild and equable. East winds, however, prevail in the months of March, April, and May, and from the lie of the county it is exposed to their full sweep. The amount of rainfall is far below the average of Great Britain. During the period 1835–64 the average annual rainfall was 24·85 inches,—the greatest fall heing 32·7 in 1836, the least 17·3 in 1842. The average monthly fall is lowest in April (1·16) and highest in August (2·57). In 1872 the rainfall reached the exceptional amount of 41·51 inches.

Agriculture, etc.—The soils are various. The Lammermuirs are of course unproductive, but the slopes to a considerable height are cultivated; and for a considerable way down the land is very good. In the centre of the county there is "a tenacious yellow clay resting upon a tilly subsoil," and this land is not well suited for agricultural purposes. Along the margin of the Firth the soil is naturally of a sandy nature, but farther inland it is composed of rich loam and is very fertile. The most productive region is the land about Dunhar. The potatoes there are very good, and under the name of "Dunbar reds" are highly esteemed in the London market, selling at times for as much as £45 an acre. From the beginning of the present century till within the past few years East Lothian agriculture has on the whole heen held to be the best in Scotland. This is not so much due to the natural fertility of the soil as to the enlightened enterprise of its cultivators. Andrew Meikle here first introduced the threshing mill (1787). Tile draining was first extensively used here, and the reaping machine (now universally employed) and the steam plough were introduced at a comparatively early period of their history. The high price of grain at the time of the Crimean War gave a great impetus to farming, and in consequence rents rose as much as from 15*s.* to £1 per acre; this, with the increased cost of labor, which has risen 35 or 40 per cent. (ahout 10*s.* per acre) within the last seven or eight years, has sadly diminished the profits of the farmer. The size of the farms is above the average of Great Britain. The majority are from 200 to 500 acres—a very few from 600 to 1200 acres. They are usually let on leases of nineteen years' duration. The rotation of crops is generally the six-course shift, viz., (1) grass (pasture or hay), (2) oats, (3) potatoes, turnips, or heans, (4) wheat, (5) turnips, (6) barley.

According to the agricultural returns of 1879, of the total area of 179,142 acres 115,364 acres were under cultivation, distributed as follows:—corn crops, 44,719 (wheat, 7910; barley, 19,536; oats, 15,746); green crops, 25,656 (potatoes, 9835; turnips and swedes, 14,796); clover and grass, 27,194; permanent pasture, 16,000; bare fallow, 1075. Of live stock the numbers were—horses, 3818, or 3·3 for every 100 imperial acres as against a general average for Scotland of 4·2; cattle, 8205, or 7·1 as against 23·0; sheep, 108,672, or 94·2 as against 145·1; pigs, 2485, or 2·2 as against 2·7.[2] These comparatively small averages are of course explained by the fact that the county is not a pastoral one. It deserves to be noted, however, that its flocks of Leicester sheep have for years been justly celebrated, and shorthorns of a very high class have been successfully bred.

Game is no great hindrance to agriculture. A source of greater annoyance is the immense number of wood pigeons which, in defiance of all efforts to hold them in check, commit great havoc yearly.

The wages of farm servants average about 18s. weekly, the "grieve" or farm overseer receiving a little more; hut of this only from £20 to £25 per annum is given in money. The rest is paid in kind, and consists of meal, potatoes, a cow's keep, a cottage, and piece of ground. These cottages have been greatly improved of late years, and are now very fair dwellings indeed. The "bothy system" is practically a thing of the past. Extra field lahor is supplied hy gangs of Irish or Highland workers, who dwell in the towns, hut go out during the day to work in the country. The regular employés are hired for the most part at "feeing markets," though advertisement and private arrangement are also often employed.

According to the return for 1873–74, there were 1509 proprietors in the county owning a total of 171,739 acres, of the annual value of £349,209.[3] The average rental was £2 0s. 8d. per acre,—that of all Scotland heing £1. There were 1191 proprietors (79 per cent. of the whole) who owned less than 1 acre; from 1 to 188 owned 10 acres, and 47 from 10 to 100; and 9 owned between 5000 and 21,000, the largest proprietors being—Marquis of Tweeddale, Yester House, 20,486 acres; Lady Mary Hamilton, Biel, 14,345; Balfour of Whittinghame, 10,564; Earl of Wemyss, Gosford, 10,136; Sir G. Grant Suttie, Balgone, 8788; Earl of Haddington, Tynninghame, 8302; Earl of Hopetoun, 7967; Hunter of Thurston, 6492; and Houston of Clerkington, 5148.[4]

Communication.—The county is well supplied with roads. The chief line of railway, however, runs along the coast, and this, notwithstanding the aid of hranch lines, places a considerahle district at a serious disadvantage.

Population, etc.—The population of the county, which is divided into 25 parishes, was 37,676 in 1871, showing an increase of 78 over the number for 1861. It thus appears that the growth of the county town, of North Berwick, a thriving watering-place, and of the mining parishes does little more than counterhalance the decrease in purely agricultural parishes, which in some cases amounts to as much as from 7 to 18 per cent. The chief towns and villages are—Haddington, the county town, 4004; Dunbar, 3422; North Berwick, 1418; Tranent, 2306; East Linton, Prestonpans, Aherlady, Gullane, and Dirleton. The county returns one member to parliament, and the burghs of Haddington, Dunbar, and North Berwick unite with Lauder (Berwickshire) and Jedburgh (Roxhurghshire) in returning another. Population in 1901, 38,662.

Educational Endowments.—The provision for education outside of the public school system is inconsiderable. Schaw's and Stiell's Hospitals in the parishes of Prestonpans and Tranent are charitable educational institutions. In Salton parish there is a fund for educational purposes, left by Gilbert Burnet, bishop of Salisbury. According to the Endowed Schools' Report of 1875, the annual incomes of these were £864, £812, and £97 re-

[1] See the *Geology of East Lothian*, by Howell, Geikie, and Young, with Appendix on Fossils, by G. W. Salter. Other works are enumerated on p. 69 of this treatise.

[2] The statistics of the five preceding years do not show any very great variation from these figures.

[3] In 1878–79 the lands valuation of the county amounted to £363,173 10s.

[4] For further particulars as to the agriculture, see Scott Skirving's prize essay printed in vol. v. (4th series, 1873) of the *Highland and Agricultural Society's Transactions.*

spectively. School and college bursaries are given annually by the East Lothian Association.

History and Antiquities.—The early Celtic inhabitants of the district have left as memorials of their possession a few local names, and some traces of circular camps (Garvald and Whittinghame parishes) and hill forts (Bolton parish). The Romans built here no enduring edifices, and there are no certain remains of their camps, but they brought the ground to a high degree of cultivation. The county afterwards formed part of the Saxon kingdom of Northumberland, but it was joined to Scotland by Malcolm II. in 1020. It was fairly prosperous till the wars of Bruce and Balliol; but from that time till the union of the kingdoms it suffered from its proximity to the English border, and from civil wars. In more modern times it was the scene of two great battles—that of Dunbar (1650) gained by Cromwell over Leslie and the Covenanters, and that of Prestonpans (1745) in which Prince Charles defeated Sir John Cope. The prosperity of the county, like that of many other parts of Scotland, is the growth of the present century.

The chief ruins are—Hailes Castle, where Queen Mary of Scots resided for a brief period after her abduction by Bothwell; Dunbar Castle, defended in 1337 by Black Agnes against the earl of Salisbury; Dirleton Castle, a venerable ruin of the 12th century,—taken in 1298 by Edward I. and again in 1650 by Cromwell's forces; Innerwick Castle, near Dunbar; the collegiate church of Seton in the parish of Tranent, built before 1390; North Berwick Abbey, founded about the middle of the 12th century; and Tantallon Castle, opposite the Bass Rock, formerly the chief seat in the east of the Douglas family. The genius of Scott has given to Tantallon a name in English literature greater even than its name in Scottish history; and readers of *Marmion* will also remember the name of Hobgoblin Hall, romantically situated near the village of Gifford (about six miles south of the county town), a place connected by name and legend with all manner of popular superstitions. Of modern mansions the chiefs are Broxmouth Park (Duke of Roxburgne), Yester House (Marquis of Tweeddale), Tynninghame House (Earl of Haddington), Gosford and Amisfield House (Earl of Wemyss)—Gosford containing a fine collection of pictures, Lennoxlove House (Lord Blantyre), Biel and Archerfield (Lady M. Hamilton), Winton House (Lady Ruthven), and Salton Hall (Fletcher). A lofty column on one of the Garleton hills, erected to the memory of the fourth earl of Hopetoun, is seen from nearly every part of the county.

Of the eminent men born in or connected with the county, the following may be mentioned:—Sir David Lyndsay of the Mount was born 1490 at Garleton Castle, an old keep now utterly ruinous; William Dunbar was born at Biel about 1460; Blair, author of the *Grave*, and Home, author of *Douglas*, were successively ministers of Athelstaneford; David Calderwood, the historian of the Kirk of Scotland, was minister at Pencaitland, and Principal William Robertson at Gladsmuir; George Heriot, the famous goldsmith of James VI., is said to have been born in Gladsmuir. The historic families of Fletcher of Salton, Dalrymple of Hailes, Maitland of Lethington, and Hamilton of Preston belong to the county.

HADDINGTON, a royal and parliamentary burgh, and the chief town of the above county, is situated on the banks of the Tyne, about 17 miles east of Edinburgh. It occupies almost the centre of the shire to which it has given the name. It consists of two main streets, which are wide and well built,—High Street to the south and Market Street to the north; both run towards the Tyne, here crossed by three bridges, two of which connect the town with its suburb of Nungate. This suburb consists of old and ruinous houses, and is inhabited for the most part by Irish agricultural laborers. The systems of drainage and water supply are excellent, but the want of manufactures and the inconvenience of its railway branch line have prevented the growth of the burgh.

The chief edifices are the county buildings, the corn exchange, which next to that of Edinburgh is the largest in Scotland, the town-house adorned with a very elegant spire 150 feet high, and the district asylum for the insane. There is a monument of some pretensions to Robert Fergusson of Raith, and a somewhat trifling one to the memory of Home the author of *Douglas*. The chief structure, however, is the church, an edifice probably dating from the 13th century. It is 210 feet long, and is surmounted by a square tower 90 feet high. One part is used as the parish church; the remainder, though ruinous, is now preserved with a care that makes some amends for centuries of neglect. To this church the name of *Lucerna Laudoniæ* has long been applied, but it seems probable that the edifice to which Fordun and Major applied that name was the church of the Franciscan Friars close to the Tyne, of which not a fragment now remains. The Nungate possesses the ruin of an old chapel of St. Martin. The grammar school of Haddington was established at a very early period, and carefully fostered by the burghal authorities. At one time it attained considerable eminence, but latterly fell into complete disuse. Under the name of the Knox Memorial Institute, a very handsome school building has been erected (1879), and with this the ancient burgh school is incorporated. The population of the burgh in 1861 was 3874 and in 1901 3992.

Haddington is said to have been erected into a burgh by David I. It must have been a place of considerable importance, for when the "Curia Quatuor Burgorum" subsisted there was an appeal from the sentences of burgh courts to that of the chamberlain at Haddington. There are also extant charters in its favor from Robert the Bruce and Robert II. Exposed as it was to the English attack it was frequently ravaged and burned. In 1548 it was fortified by Lord Grey of Wilton, the English commander, but was besieged in the following year by the Scotch and their French auxiliaries, who forced the garrison to abandon the town. As one result of all this struggle and suffering, it is impossible to dig far in any direction without coming on human remains. Haddington has also suffered frequently from floods. An inscription in the centre of the town commemorates one of the most notable of these (October 4, 1775), marking the point to which the water rose. John Knox was born (1505) at the Giffordgate in the Nungate; John Brown, a celebrated dissenting divine, several of whose descendants have been eminent in science and literature, had a charge in Haddington for many years; and Edward Irving was for some years mathematical master in the burgh school.

For the general history of the county see Chalmers's *Caledonia*, vol. ii.; also Dr. Barclay's paper on "Haddington," in the 1st vol. of the *Transactions of the Society of Antiquaries of Scotland*, vol. i. (1792); Hepburn's *View of the Agriculture of East Lothian* (1794); Somerville's *Survey of East Lothian* (1805); *New Statistical Account of Scotland*, vol. ii. (1845); *History of Haddington*, by James Miller (1844). The siege of the town is fully narrated in *Histoire de la Guerre d'Escosse*, by Jean de Beaugué. For an account of the burgh records, see Thomas Thomson's paper in the *Proceedings of the Society of Antiquaries of Scotland*, vol. ii. pt. iii. The question as to the birthplaces of Knox, Lyndsay, and Dunbar is fully discussed in David Laing's editions of those writers. (F. WA.)

HADDOCK (*Gadus æglefinus*, the *Schell-fisch* of the Germans, *Hadot* of the French), a kind of cod-fish distinguished by a black lateral line and a blackish spot above the pectoral fin. It is common round the British and Irish coasts, and generally distributed along the shores of the North Sea, extending across the Atlantic to the coast of North America. The haddock is prone, however, to abandon for a longer or shorter period a locality frequented by it. It attains to a weight of 15 lb, and is one of the most valuable food fishes of Europe.

HADERSLEBEN (Danish, *Haderslev*), a town of Prussia, capital of a circle in the province of Schleswig-Holstein, is situated 48 miles north of the town of that name, in a pleasant valley on the Hadersleben fiord, which is about 9 miles in length and communicates with the Little Belt. The principal buildings are the beautiful church of St. Mary dating from the 13th century, the theological seminary established in 1870, the gymnasium, and the hospital. The industries include iron-founding, tanning, and the manufacture of machines, tobacco, and gloves. The harbor, owing to the accumulation of mud, is only accessible to small vessels. The population in 1905, without the garrison, was 9,281.

Hadersleben is first mentioned in 1228, and received town rights from Duke Waldemar II. in 1292. It suffered considerably during the wars between Schleswig and Holstein in the 15th century. In November, 1864, it was ceded along with Schleswig to Prussia. Two Danish kings, Frederick II. and Frederick III., were born at Hadersleben.

HADES. See PLUTO and ESCHATOLOGY.

HADJI KHALFA. See HAJJI KHALFA.

HADRAMAUT. See ARABIA.

HADRIAN, Roman emperor (117–138 A. D.), distinguished for the peace and beneficent energy of his government, was born at Rome 76 A. D. His full name was Publius Ælius Hadrianus; his ancestors, originally from Picenum, had been settled at Italica in Spain since the time of the Scipios. He lost his father at the age of ten, and was placed under the guardianship of Trajan, a cousin of his father and also a native of Italica, who was already a conspicuous man in the Roman army. We know little of Hadrian's youth; but he gave early promise of the readiness and versatility which distinguished him in later life, for he was so ardent a student of Greek that men nicknamed him Græculus. At fifteen he entered on the practical career of war and government which befitted a Roman, and grew

fond of the chase even to excess. Patronized by Trajan and assisted by powerful friends he rose rapidly, filling successively all the civic and military offices, which now, as under the republic, were open to young men of good birth. On Trajan's elevation to the empire Hadrian was the first to congratulate him. He served with distinction in both the Dacian campaigns; in the latter Trajan presented him with the ring he had received from Nerva, a proof of his regard which justified him in aspiring to be his successor. If Trajan was not always favorably disposed towards Hadrian, the good-will of the empress Plotina never failed him, and was particularly helpful in some of the most critical turning points of his career. She it was who secured his alliance with Sabina, granddaughter of the emperor's sister, a marriage, however, which proved anything but happy. She, it was thought, did him still more effectual service at Trajan's death, even determining the question of the succession in his favor. When that emperor returned from his victorious war in Parthia, the succession was still undecided; and we are assured on the express testimony of Dion Cassius that Plotina and her friends concealed his death for several days in order to facilitate the elevation of Hadrian. Whatever may have been the truth of such stories, Hadrian's claim to the empire rested on the unquestionable fact that he was the fittest man. His position as prefect of Syria, and commander of the legions with which Trajan had prostrated the Parthian empire, made him supreme in the army, while his peaceful disposition and civil demeanor must have made him acceptable to the senate. Yet he was not unconscious of the insecurity of his position; for he hastened to propitiate the army by a donation of twice the usual amount, and to excuse his abrupt elevation to the senate by alleging the impatient zeal of the soldiers and the welfare of the state, which could not exist without an "imperator." The first important act of Hadrian was to abandon the late conquests of Trajan, and again to make the Euphrates the eastern boundary of the empire. At his elevation the provinces were unsettled, and the barbarians on the frontier restless and menacing. He was convinced that the old limits of Augustus offered the most defensible frontier, and that the energy of the emperor was sufficiently occupied in governing the provinces already won. This policy of renunciation was ascribed to jealousy of Trajan, but history has recognized its wisdom. While arranging the affairs of the East, Hadrian had an opportunity of pardoning some eminent citizens who were accused of hostility to him, and after his return to Rome he confirmed his popularity by many gracious acts. Modestly declining the honors heaped upon himself, he carefully rendered the last offices to the deceased emperor, and considerably lightened the burdens of the citizens. During an absence in Mœsia, where he had gone to compose some troubles with the Sarmatæ and Roxolani, a formidable conspiracy was formed against him. The details are obscure; but four consular men, among the most eminent of Rome, were accused of being concerned in it, and were put to death. Some, however, went so far as to say that the conspiracy was a scheme devised by Hadrian for getting rid of dreaded rivals. It was a dark transaction which threw a suspicion on his character. On his return to Rome he exerted himself to undo the evil effects of it by a generous and popular policy. Towards the senate he expressed the utmost deference and consideration; he admitted the most eminent of its members to familiar intercourse, raised them to the highest honors, and supplied the indigent with means to maintain their position. He was equally liberal to the body of the people, granting them a large donation of money, remitting the arrears of taxes for the last fifteen years, and increasing the funds which Trajan had devoted to the alimentation of poor children. These measures of Hadrian might be criticised as the calculating policy of one who felt his position to be insecure, and who could afford to be generous to the city out of the revenues of the empire. But such a theory could not apply to what is most characteristic in his rule,—his unwearying care for the provinces and for the empire as a whole. He understood the true task of a Roman emperor better perhaps than any of his predecessors. More clearly than any of them he saw that the period of conquest was past, that an extension of the frontiers would only weaken the defensive power of the empire, that the time for consolidation and for softening the distinction between Rome and the provinces was come. While Trajan had been guilty of the anachronism of rivalling Alexander the Great, Hadrian made it the work of his life to become acquainted with the provinces, to learn their needs and resources, to improve and benefit them; he sought to be the effective ruler of the empire as a whole, and so was the first to realize the cosmopolitan task which his position imposed. For this end he sought to obtain a personal knowledge of the people he had undertaken to govern. Leaving Rome in 119, he visited probably every province of the empire. After traversing Gaul he inspected the legions on the Rhine, and then crossed to Britain, where he built (121) the great rampart from the Tyne to the Solway which bears his name. He returned through Gaul into Spain, and then proceeded to Mauritania, where he suppressed an insurrection. We next find him in the East averting a war with Parthia by a timely interview with the king. From the Parthian frontier he travelled through Asia Minor and the islands to Athens, where he sojourned a considerable time, and so returned by Sicily to Rome, having made the circuit of the empire. After some stay at Rome he resumed his travels. It is impossible to fix the details of this second progress with any exactness. It was chiefly in the East; and he did not finally return to Rome till 134. Everywhere he left lasting traces of his restless and beneficent energy; he built aqueducts and temples, and raised fortifications in suitable places; he inspected the details of the administration, learned to know the officials, and made himself at home in the military encampments. He was accompanied by a body of architects and artisans organized like a legion, whom he employed to gratify his passion for building in a truly imperial manner. Athens was the favored scene of his architectural labors; he added a new quarter to the city, and finished the temple of the Olympian Zeus. While Hadrian spent his life in inspecting the provinces, and was not disinclined to purchase peace by a subsidy to the restless tribes on the frontiers, he did not neglect the army. All along the frontier his legions stood in constant preparation for battle. He maintained a rigorous discipline, the rules he drew up for the army long served as a kind of military code. He trained them to the severest exercises, and anticipated all complaint by sharing in their fatigues, walking bare-headed on a march of 20 miles a day, and partaking of their coarse fare of cheese, lard, and sour wine. The only important war in which this army was tested was the great rebellion of the Jews, which broke out in 131, and lasted for several years. The founding of a Roman colony on the site of Jerusalem, and an order of Hadrian forbidding the rite of circumcision, were the causes of the war. The Jews fought with the most resolute despair, and they were crushed only by a powerful army commanded by the best general of the empire. According to Dion, 580,000 Jews fell in battle. The whole country was reduced to a wilderness. But the loss of the Roman legions was so severe that in writing to the senate Hadrian omitted the customary formula:—"If you and your children are well, it is well; I and the army are well." In the later years of his life Hadrian discontinued his travels, and lived at Rome or near it. His health, which had been impaired by long exposure to the extremes of heat and cold, began to fail; and, what was worse, the dark and suspicious moods which had broken out occasionally in his earlier years became more frequent and fatal. His aged brother-in-law Servianus fell a victim to his jealousy; his wife Sabina died, not without a rumor of poisoning. Most of those who had been his familiar friends, and had been raised by him to the highest offices, were superseded, or banished, or put to death. But his passion for architecture did not abate. He built for his residence the great villa of Tibur, which was eight miles in circuit, and was a kind of epitome of the world, with miniatures of the most celebrated places in the provinces, and even of Hades. He built a splendid mausoleum, which has been the nucleus of the castle of St. Angelo, and rebuilt several edifices at Rome. In these years he had to choose a successor. His first choice was Ælius Verus, who did nothing to justify such a distinction. The next was Antoninus Pius, so called from the filial assiduity with which he cherished the last days and the memory of his adopted father. Antoninus saved him from suicide, to which his physical sufferings impelled him, and from imbruing his hands in the blood of many noble Romans, who had provoked his moody and fickle temper. Hadrian died at Baiæ, 138 A. D. The cruelty of his later life had so eclipsed the lustre of his early rule that the senate at first refused him divine honors, and were

prevailed upon to grant them only at the urgent solicitation of Antoninus. In the travels and administrative energy of Hadrian we see only one side of his character. He had a versatile and many-sided mind, in which the faculty for command, speculative curiosity, and literary ambition were strangely blended. Not satisfied with the toils imposed on the laborious autocrat of the world, he sought to excel the Greek professors and artists each in his own special walk. In painting, sculpture, and music, in rhetoric and philosophy, he considered himself the competent rival and critic of men who had made these pursuits the work of a lifetime. The architect Apollodorus atoned for his frankness with his life. The more politic Favorinus, when reproached for yielding too readily to the emperor in some grammatical discussion, replied that it was unwise to dispute with the master of thirty legions. The product of Hadrian's pen which has been most celebrated is the dying address to his soul:—

"Animula vagula, blandula,
Hospes comesque corporis,
Quæ nunc abibis in loca
Pallidula, rigida, nudula;
Nec, ut soles, dabis jocos?"

Under Hadrian Salvius Julianus composed a "perpetual edict," which is supposed to have been a fixed code of some kind, but the exact significance of the edict is disputed. Still there can be no doubt that Roman law owes much to Hadrian.

The sources for Hadrian's life are unsatisfactory; the chief are Spartianus in the *Scriptores Historiæ Augustæ*, and Dion Cassius as abridged by Xiphilinus, lib. lxix.; see also Aurelius Victor, *De Cæsaribus*, and Eutropius; for modern works consult Merivale's *History of the Romans under the Empire;* Gregorovius, *Gesch. Hadrians;* and W. W. Capes's "Age of the Antonines" in the series *Epochs of Ancient History.* (T. K.)

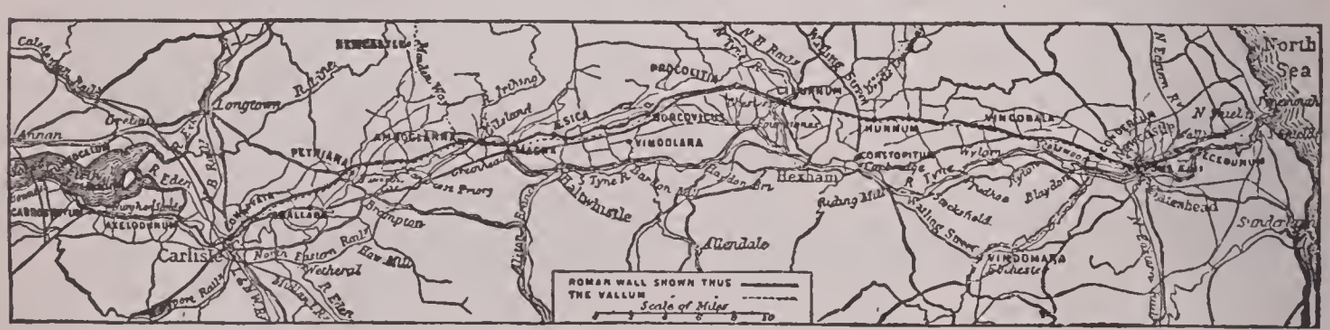
HADRIAN, WALL OF. It is under this heading that it seems most convenient to give a short account of the stone wall and other works erected by the Romans in the north of England between the Solway and the Tyne, and commonly known as the Roman Wall. As will be afterwards seen, those who have written on the subject are by no means agreed that the name of Hadrian ought to be exclusively associated with this great fortification. But before touching on the question, it is necessary to describe the works themselves.

Viewed as a whole the Roman Wall, when entire, consisted of three parts:—(1) a stone wall, strengthened by a ditch or fosse, at a short distance from its northern base; (2) three parallel earthen walls, with a ditch sloping down from the northern side of the second of these lines; (3) stations, castles, and turrets, placed at various intervals for the accommodation of troops, and communicating with one another by a military way.

The Murus or stone wall extended from Wallsend on the Tyne to Bowness on the Solway Firth, a distance of fully 73 English miles. No portion of it now remains as when finished, so that its original height cannot be accurately determined. Bede gives twelve feet, an estimate that our chief modern authority on the Wall, Dr. J. Collingwood Bruce, deems too low, for some parts of its course at least. Its thickness varies, being 6 feet in some places and 9½ in others.

The northern face of the Wall was continuous, but the southern had numerous outsets and insets, as if portions of the work had been carried on at the same time but without definite instructions as to a uniform breadth. In this way when sections met differences in width often showed themselves, though the junction was so managed that the irregularity was confined to one face. It is not improbable that a similar discretion was allowed as regards height. Both sides consisted of blocks of freestone 8 or 9 inches thick, 10 or 11 broad, and from 15 to 20 long. These had been sometimes quarried near the spot, sometimes brought from considerable distances. The interior was filled with rubble firmly cemented with mortar of a peculiar tenacity. In pursuing its course from sea to sea, the Wall seldom deviated from the shortest and straightest course it could follow, and then only with the evident design of seizing neighboring elevations that would otherwise have commanded its position. Along the whole length of its northern base, and adding greatly to its strength as a defensive work, was drawn a ditch or fosse of varying breadth and depth, 36 and 15 feet respectively being probably its average dimensions. In some places the difficulties to be overcome by its excavators, owing to the rocky nature of the soil, must have been enormous in an age when blasting with gunpowder was unknown. But none of them have been shunned.

South of the Murus ran the earth wall or Vallum, consisting, as has been already stated, of three ramparts and a ditch. Of these mounds the most northerly was raised at a distance from the base of the stone wall varying, according to the nature of the country, from 30 yards to half a mile. Time and the spoiler have dealt so hardly with it that its original dimensions cannot now be accurately stated. It seems, however, to have been about 20 feet broad at the base and at least ten feet high. The materials of which it was made up consisted of earth largely intermixed with fragments of stone of all sizes and shapes. 24 feet or so further south was a ditch apparently somewhat inferior in breadth and depth to the ditch of the Murus, though otherwise of the same character. On its southern edge was a



Plan of Hadrian's Wall.

rampart much smaller in size than the one just noticed, while the series was completed by a third mound, approaching in its dimensions the larger of the other two, and raised at nearly the same distance as it from the centre of the included ditch.

Along the wall, at intervals averaging 4 miles, were stationary camps strongly fortified. According to the *Notitia Utriusque Imperii*, which contains a brief record of the civil and military arrangement of the empires of the East and West, and is supposed to have been compiled in the beginning of the 5th century of our era, there were 23 such stations. The names given are as follows:—Segedunum (Wallsend), Pons Ælii (Newcastle), Condercum (Benwell Hill), Vindobala (Rutchester), Hunnum (Halton Chester), Cilurnum (Chesters), Procolitia (Carrawburgh), Borcovicus (Housesteads), Vindolana (Chesterholm), Æsica (Great Chesters), Magna (Carvoran), Amboglanna (Birdoswald), Petriana, Aballaba, Congavata, Axelodunum, Gabrosentum, Tunocelum, Glannibanta, Alionis, Bremetenracum, Olenacum, and Virosidum. It is somewhat strange that not a trace of one of these names survives in the local vocabulary of the present day, though the exact positions of a number of the stations have been identified beyond all doubt by other means. The sites had been chosen with great care, and much labor must have been expended in their construction. They were in fact military cities, "suited," to use the words of Dr. Bruce, "to be the residence of the chief who commanded the district, and providing secure lodgment for the powerful body of soldiery he had under him." It is not clear, however, that more than 18 of the 23 were situated *per lineam valli*, the others being probably supporting stations. The Wall was further strengthened

by quadrangular buildings called mile-castles as well as by smaller watch-towers or sentry-boxes of stone; while connecting the whole was a military way made in Roman fashion and protected by the other parts of the fortification. By means of this road the garrisons of the different stations could be quickly and safely concentrated on any point along the line that was threatened by an enemy. "It is sometimes asked," remarks the authority just quoted, "How long would the Wall be in building? From calculations that have been made, founded upon the experience gained by the construction of the vast works connected with modern railways, it is considered that, in the existing circumstances of the country at the time, the *Vallum* and the *Murus* could not be reared in a shorter period than 10 years. The cost of it in our present currency would be about £1,000,000. Above 10,000 men would be required to garrison its stations" (*Wallet Book of the Roman Wall*, p. 37).

Several of the ancient writers allude to ramparts and lines of forts raised by the Romans across the island during the time they had a footing on it. Of these notices some refer to the barrier on the isthmus of the Forth and Clyde (see ANTONINUS, WALL OF, vol. ii. p. 122); the others probably apply to the more important works now described. In his *Agricola* Tacitus states that the Roman general during his operations in the north of England (79 A. D.) compelled many states hitherto hostile to lay down their arms and surrounded them with garrisons and castles. A hundred years later two contemporary historians, Dion Cassius (as abridged by Xiphiline) and Herodian, writing of events in Britain that occurred in their own day, both notice—the former in two places—the existence of a wall in Britain, separating the Roman territory from the unconquered tribes that dwelt beyond; but neither of them mentions when or by whom it was built. Another century onwards and Spartian, one of the *Scriptores Historiæ Augustæ*, states that the emperor Hadrian was the first to rear a wall across Britain (*circa* 120 A. D.) as a defence against the northern barbarians. It was, he adds, 80 miles in length. The same author in his life of Severus tells us that emperor also raised a wall from sea to sea (*circa* 208 A. D.). Aurelius Victor, who flourished about the year 360 A. D., ascribes to Severus the building of a wall in Britain, employing almost the words of Spartian; while his contemporary, Eutropius, makes a similar statement, adding, however, that this rampart was 32 (according to another reading, 132) miles long, and erected for the defence of certain portions of the country, which Severus had reconquered for Rome. Another possible wall-builder is introduced to us in the early years of the 5th century by the poet Claudian, who represents Britain as indebted to Stilicho, the successful general of the emperors Theodosius I. and Honorius, for some protection of this nature against the attacks of the Scots, Picts, and Saxons. Lastly, Gildas, our earliest native historian, asserts that the Britons themselves built a wall to aid them in warding off the assaults of the Picts and Scots, and that another was constructed by the Romans with native assistance, just before their final abandonment of the island. Both statements are repeated by Bede, who identifies the former of these structures with Antonine's wall and the latter with the more famous fortification near his own monastery of Jarrow.

Founding on such unsatisfactory if not conflicting data, modern writers have been led to give various answers to the questions—When and by whom was the Roman Wall built? The limits of the present article do not admit of any discussion of the subject, and those who wish to see these questions fully examined, as well as to read an account of the inscriptions and other antiquities discovered from time to time along the line of the Wall, are referred to the list of works given below, more especially to Dr. J. C. Bruce's exhaustive treatise. For others the following summary may be sufficient.

Gordon, to whom we owe one of the earliest surveys of the Wall, is of opinion that the Vallum was the work of Hadrian, and the Murus of Severus. Horsley believed that the stations and the northern rampart of the Vallum were raised by Agricola, the ditch of the Vallum and its remaining mounds by Hadrian, and the stone wall with its castles, towers, and its great military way by Severus. Dean Merivale, while admitting that camps and mounds may have been erected on the isthmus by Hadrian and Severus, supposes that the stations were faced with masonry and the work planned as well as partly executed by Theodosius, his designs being afterwards fully carried out about 400 A. D. by Stilicho, in orders issued from Gaul. But others, and foremost among them Dr. Bruce, see in the fortification a unity of design that points it out as the work of one period and one mind, and have come to the conclusion that Hadrian was the builder of the whole. This view, as it does not exclude the probability that his engineers worked to some extent on lines already laid down by Agricola, and that Severus, before entering on his unfortunate campaign against the Caledonians, or after its close, repaired and strengthened the works of his predecessors, seems most consistent with the statements of ancient writers, with the testimony of inscriptions, and with the appearances presented by the relative position of the component parts of the fortification itself.

See Gordon's *Itinerarium Septentrionale*, London, 1727; Horsley's *Britannia Romana*, London, 1732; Hutton's *History of the Roman Wall*, London, 1813; Hodgson's *Roman Wall, etc.*, Newcastle, 1841; M'Lauchlan's *Survey of the Roman Wall*, made in the years 1852–54; Bruce's *Roman Wall*, 3d ed., London, 1863.

(J. M'D.)

HADRUMETUM, or ADRUMETUM (the name appears in the Greek writers in a great variety of forms—Ἀδρύμη, Ἀδρύμης, Ἀδρύμητος, Ἀδρούμιττος, Ἀδράμητος), a city on the African coast of the Mediterranean on the Sinus Neapolitanus or Gulf of Hamamet. A Phœnician colony of earlier date than Carthage, in course of time it became subservient to the imperial city, and fell along with it under the power of the Romans. On the subdivision of the Roman province of Africa Propria, it became the capital of Byzacium. By Trajan it was made a colony, as is evidenced by the grandiloquent inscriptions preserved by Gruter—*Col. Concordia Ulpia Trajana Augusta Frugifera Hadrumetina.* From the devastation inflicted by the Vandals it was restored by Justinian, and in consequence it bore for some time the name of Justinianopolis.

The identification of Hadrumetum is a matter of some difficulty. Most modern authorities agree in fixing it at Susa, but others contend that Hamamet is the true site. Hitherto no inscription has been discovered which satisfactorily settles the point in favor of either; for the fragments that are appealed to for the identification of Hamamet with Saigitis may possibly have been brought to the place of their discovery. The arguments in favor of each may be thus summarized. Susa agrees remarkably well, as Maltzan elaborately maintains, with the position assigned to Hadrumetum by the *Notitia* and other ancient works in which the distances from place to place are given. The remains of ancient buildings, though few, prove undoubtedly that Susa is the site of some city of considerable importance, and the ruins now known as Makluba or the Fallen may be those of a great temple. We know that in the time of El-Bekri Susa still possessed a cothon or inner harbor (one of the chief features of Hadrumetum as described by the author of the *African War*), which may be recognized in the existing sandy plain 1500 feet wide between the two ancient moles, now distinguished as the Quarantine Molo and Pointe du Mole. The figures found by M. Daux (*Journ. Asiat.*, 1868) would of themselves have suggested that Susa was a Phœnician colony. Barth suggests that the name Susa is probably a corruption of Σώζουσα. In favor of Hamamet Mr. J. E. Davis argues that the scenery near Susa agrees with that of Ruspina described by the author of the *African War*; that the absence of ruins at Hamamet is accounted for by the clouds of sand swept down upon the site; that there are clear traces of a cothon at Hamamet; and that the modern name Haimamot or Tent of Death corresponds exactly with the hypothetical Hedermot or Chamber of Death of the Phœnicians. On the whole the argument appears to be on the side of Susa.

For further details see Barth, *Wanderungen durch die Küstenländer des Mittelmeeres*, 1840; Guérin, *Voyage archéologique dans la Régence de Tunis*, 1862; Nathan Davis, *Ruined Cities*, 1862; Maltzan, *Reise in der Regentschaften Tunis und Tripoli*, 1870.

HÆMORRHOIDS (from *αἷμα*, blood, and *ῥέω*, to flow), commonly called piles, a frequent and distressing malady. Two varieties are described. They are named from their situation external and internal, as they are without or within the opening of the anus. The external pile is an overgrowth of the thin dark-colored skin around the opening; there is most frequently more than one present; the skin, lax and redundant, hangs in folds. The internal pile lies altogether within the opening, although it may appear externally protruding through the anus when any pressure from above is applied, as when the patient strains at stool. It is covered by, and composed of an overgrowth of, the

mucous membrane lining the bowel. There may be several internal piles. The internal pile is sessile or pedunculated. The external pile is of a pale color. The internal pile is moist, vascular, and of a cherry-red color; it is apt to inflame, and the inflammation is associated with heat, pain, and general uneasiness. Ulceration and bleeding are common symptoms of the internal pile, hence the term "bleeding" or "bloody piles." Both varieties are probably due to the same primary cause—an enlargement of the veins in this region. Any cause which, by pressing on the large abdominal veins, retards the upper flow of blood to the heart will give rise to piles; such are constipation, disease of the liver, pregnancy. General weakness involving a want of tone in the blood-vessels may act as a predisposing cause. The exciting cause is frequently exposure to damp, as from sitting on the wet ground. Piles are only a symptom, and in their treatment this should be kept in view; remove the cause and the piles will disappear. The local treatment is palliative or radical. The palliative treatment consists in attention to the state of bowels, cold bathing, astringent injections, lotions, and ointments. The radical treatment consists in their removal; the external pile is cut off, the internal pile is tied or clamped and cauterized. Both methods have their advocates; the radical treatment should not be undertaken until palliative treatment has failed. When in a state of inflammation the treatment consists in hip baths, hot fomentations, and poultices. The introduction of a morphia suppository often relieves the uneasiness. Both varieties are often met with in the same individual; when this is the case both should be removed by operation at one time. The internal piles are apt to return if the predisposing cause is still in existence. Piles are apt to be confounded with other surgical diseases in this region, as fissure or ulcer, prolapse, polypus, or cancer. This is not the place to point out the distinguishing features of these different maladies; the patient should consult a surgeon. There is a form of pile situated just at the verge of the anus, where the skin joins the mucous membrane: its onset is sudden, and due to the rupture of a blood-vessel; the blood is extravasated and clots; a small, tense, painful swelling of a bluish color is seen at the edge of the anus. This may be relieved by hot fomentations, or the pile may be laid open and the clot turned out by gentle pressure.

HÁFIZ. Muhammed Shamsuddin, better known by his *takhallus* or "nom de plume" of Háfiz, was one of the most celebrated writers of Persian lyrical poetry. He was born at Shiraz, the capital of Fars, in the early part of the 8th century of the Mahometan era, that is to say, in the 14th of our own. The exact date of his birth is uncertain, but he is known to have attained a ripe old age and to have died in 791 A. H. (1388 A. D.). This is the date given in the chronogram which is engraved on his tomb, although several Persian biographers give a different year. Very little is actually known about his life, which appears to have been passed in quiet retirement and literary ease in his native city of Shiraz, of which he always speaks in terms of affectionate admiration. He was a subject of the Muzaffar princes, who ruled in Shiraz, Yazd, Kirman, and Ispahan, until the dynasty was overthrown by Timur-lang (Tamerlane). Of these princes his especial patrons were Shah Shujá' and Shah Mansúr. He early devoted himself to the study of poetry and theology, and also became learned in mystic philosophy, which he studied under Shaikh Mahmúd 'Attár, chief of an order of dervishes. Háfiz afterwards enrolled himself in the same order and became a professor of Koranic exegesis in a college which his friend and patron Haji Kiwam-uddin, the vizier, specially founded for him. This was probably the reason of his adopting the *sobriquet* of Háfiz, which means "one who remembers," and is technically applied to any person who has learned the Koran by heart. The restraints of an ascetic life seem to have been very little to Háfiz's taste, and his loose conduct and wine-bibbing propensities drew upon him the severe censure of his monastic colleagues. In revenge he satirizes them unmercifully in his verses, and seldom loses an opportunity of alluding to their hypocrisy and religious pretensions. Háfiz's fame as a poet was soon rapidly spread throughout the Mahometan world, and several powerful monarchs sent him presents and pressing invitations to visit them. Amongst others he was invited by Mahmúd Shah Bahmani, who reigned in the south of India, and set off with the intention of sojourning at the court of that sovereign. After crossing the Indus and passing through Lahore he reached Hurmuz, and embarked on board a vessel sent for him by the Indian prince. He seems, however, to have been a bad sailor, and, having invented an excuse for being put ashore, made the best of his way back to Shiraz. Some biographies narrate a story of an interview between Háfiz and the invader Timur. The latter sent for him and asked angrily, "Art thou he who was so bold as to offer my two great cities Samarcand and Bokhara for the black mole on thy mistress's cheek," alluding to a well-known verse in one of his odes. "Yes, sire," replied Háfiz, "and it is by such acts of generosity that I have brought myself to such a state of destitution that I have now to solicit your bounty." Timur was so pleased at the ready wit displayed in this answer that he dismissed the poet with a handsome present. Unfortunately for the truth of this story Timur did not capture Shiraz till 1393 A. D., while the latest date that can be assigned to Háfiz's death is 1391. Of his private life little or nothing is known. One of his poems is said to record the death of his wife, another that of a favorite unmarried son, and several others speak of his love for a girl called *Shákh i Nabat*, "Sugar-cane branch," and this is almost all of his personal history that can be gathered from his writings. He was, like most Persians, a Shiah by religion, believing in the transmission of the office of Imám, or head of the Muslim Church in the family of Ali, cousin of the prophet, and rejecting the *Hadith*, or traditional sayings of Mahomet, which form the Sunneh or supplementary code of Mahometan ceremonial law. One of his odes which contains a verse in praise of Ali is engraved on the poet's tomb, but is omitted by Sudi, the Turkish editor and commentator, who was himself a rigid Sunni. The same sectarian bigotry has influenced many other editors, and it is no unusual thing to find an Indian edition of the *Díván* emasculated by the excision of all the passages which can be construed as having the slightest allusion to the objects of Shiah veneration. That his tendencies were towards a rather extravagant and heretical form of theosophy may be deduced from his writings, and in one verse he even goes so far as to speak in terms of admiration of one Mansúr of Hallâj who was hanged, after being put to the most horrible tortures, on a charge of blasphemy, 309 A. H. This person professed a creed nearly approaching pure pantheism, and went about asserting that he was himself an incarnation of the omnipresent divinity, saying, *Ana 'l Hakk*, "I am the Truth!" Háfiz in allusion to this says that his only fault was that he revealed the mystery. These heretical opinions and the dissipated life of the poet caused difficulties to be raised by the ecclesiastical authorities on his death as to his interment in consecrated ground. The question was at length settled by Háfiz's own works, which had then already begun to be used as they are now throughout the East for the purposes of divination, in the same manner as Virgil was employed in the Middle Ages for the divination called *Sortes Virgilianæ*. Opening the book at random after pronouncing the customary formula asking for inspiration, the objectors hit upon the following verse—"Turn not away thy foot from the bier of Háfiz, for though immersed in sin, he will be admitted into Paradise." He was accordingly buried in the centre of a small cemetery at Shiraz, now included in an enclosure called the Háfiziyeh.

His principal work is the *Díván*, that is, a collection of short odes or sonnets called *ghazals*, and consisting of from five to sixteen *baits* or couplets each, all the couplets in each ode having the same rhyme in the last hemistich, and the last couplet always introducing the poet's own *nom de plume*. The whole of these are arranged in alphabetical order, an arrangement which certainly facilitates reference but makes it absolutely impossible to ascertain their chronological order, and therefore deteriorates from their value as a means of throwing light upon the growth and development of his genius or the incidents of his career. These "orient pearls at random strung," as a version of a passage from Háfiz in Sir William Jones's grammar calls them, are often held together by a very slender thread of continuous thought, and very few editions agree exactly in the order of the couplets which form the individual ghazals. Still, although they often appear at first sight extremely disconnected, a careful study of them, especially from the point of view indicated by the Sufistic system of philosophy, will always show that a single idea does run throughout the whole. The nature of these poems has been the subject of much discussion in the West, some scholars seeing in their

anacreontic utterances nothing but sensuality and materialism, while others, following the Oriental school, maintain that they are wholly and entirely mystic and philosophic. Something between the two would probably be nearer the truth. It must be remembered that Háfiz was a professed dervish and Súfi, and that his ghazals were in all probability published from a *takia*, and arranged with at least a view to Sufiistic interpretation. At the same time it is ridiculous to suppose that the glowing imagery, the gorgeous and often tender descriptions of natural beauties, the fervent love passages, and the roystering drinking songs were composed in cool blood or with deliberate ascetic purpose. The beauty of Háfiz's poetry is that it is natural. It is the outcome of a fervent soul and a lofty genius delighting in nature and enjoying life; and it is the poet's misfortune that he lived in an age and amongst a people where rigid conventionality demanded that his free and spontaneous thoughts should be recast into an artificial mould.

The system of philosophy professed by Persian poets and dervishes, and in accordance with which the poems of Háfiz are allegorically interpreted, is called Sufiism (*Tasawwúf*). It is derived usually from the word *súf*, which in Arabic means wool, and is supposed to refer to the woollen robes worn by the dervishes, although it is in all probability connected with the Greek σοφός. It is the ultimate outcome of the protest of the conquered Aryan nations against the laws, ceremonials, and ideas of their Semitic conquerors, which first found expression in the schism of the Shiahs, that is, of the Persian party who sided with the family of Ali Ibn Abi Talib, cousin and son-in-law of Mahomet, against the claims of Moawiyeh, who at the head of the Arab party claimed and held the caliphate. Forced by events to accept el Islam, and compelled to forsake the Magian and Zoroastrian faiths, the Persian Shiahs rapidly developed a system which, while teaching openly the unity of God according to Moslem doctrine, secretly theorized and refined it away, until Pantheism became the esoteric religion of the sect. It teaches that God is the only real existence and that all other existences are hypothetical, that God existed alone and created the universe merely by His Will and by the utterance of the word "Be." The "Will" or "Order" and the "Be" are closely allied to the "Spirit" and "Word" of Christian theology. Man, the highest purpose of this creation, is therefore part and parcel of the Deity, and when sufficiently purified from the lower and grosser elements returns to his source again. The circle of existence thus imagined is looked upon as a road which all must travel, and this image is kept up throughout the terminology of the sect. Thus the doctrine is *tarîkat* (the road), the student or disciple is the *sálik* (wayfarer), and the different stages of perfection are *manzilhá* (road-side stations or inns). And since all differences in sect and religion are as nothing to the illuminated philosopher who is initiated into this mystery, and as the contemplation of the divinity of his own existence and of his ultimate resumption of his place as part and parcel of the Deity produces ecstasy and mental exaltation, and inasmuch as everything that is beautiful, lovable, and pure is a purer and clearer manifestation of the Deity that runs through all—therefore the Sufis speak of their real worship as paganism, their real devotion as love and drunkenness, and see a divine mystery in every phase of beauty in humanity or inanimate nature.

Besides the *Díván*, Háfiz wrote a number of other poems; the Leipsic edition of his works contains 573 *ghazals* (forming the *Dîwán*) 42 *kitâhs* or fragments, 69 *rubáiyát* or tetrastiis, 6 *masnaviyát* or poems in rhyming couplets, 2 *kasâïd*, idylls, or panegyries, and one *mukhammes* or poem in five-line strophes. Other editions contain several *tarji-band* or poems with a refrain. His works have never been completely translated into English; a few rhyming versions of single poems by Sir William Jones, Nott, Hindley, Falconer, etc., are to be found scattered through the pages of the *Oriental Miscellany* and other periodicals, and a fine edition containing a verse rendering of the principal poems by the late H. Bicknell is published by Trübner & Co. (London, 1875). A prose version of a hundred selected odes was also published anonymously by Williams & Norgate (London, 1875). On the Continent the principal versions are by Von Hammer Purgstall; a rhyming and rhythmical translation of a large portion of Háfiz's works by Von Rosenzweig of Vienna (3 vols. 8vo, Vienna, 1858), which contains also the Persian text and notes; *Der Divan des Schemseddin Muhammed Háfis*, by Nesselmann (Berlin, 1875), in which the rhyming system of the original is imitated. Besides these, the reader may consult D'Herbelot, *Bibliothèque Orientale*, article "Hafiz;" Sir William Ouseley's *Oriental Collection* (3 vols. 4to. London, 1797–98); *Specimens of Persian Poetry, or odes of Hafiz*, by John Richardson (London, 1802); *Biographical Notices of Persian Poets*, by Sir Gore Ouseley (Oriental Translation Fund, 1846); and an excellent article by Professor E. B. Cowell in *Macmillan's Magazine* (No. 177, July, 1874). The best edition of the text is perhaps that edited by Hermann Brockhaus[1] of Leipsic, 1854, which is based on the recension of the Turkish editor Sudi, and contains his commentary in Turkish on a considerable portion of the *Díván*. (E. H. P.)

HAGEDORN, Friedrich von (1708–1755), one of the most distinguished German poets in the earlier half of last century, was born April 23, 1708, at Hamburg, where his father was Danish minister at the court of Lower Saxony. The father, a man of scientific and literary tastes, possessed a valuable library of French literature, and dabbled also in the science of alchemy. Having by this and other means lost a great part of his fortune, he died in 1722, leaving in poor circumstances a widow and two sons, of whom the poet was the elder. He was educated at the gymnasium of Hamburg, and went later (1726) to study jurisprudence at Jena. Shortly after his return to Hamburg in 1729, he obtained the appointment of private secretary without salary to the Danish ambassador in London, where he lived till 1731, and published two small works in English. His return to Hamburg was followed by a period of great poverty and hardship, a scanty income being derived from the posts which he held in the Hamburg cathedral and among the mining population in Klausthal. In 1733 Hagedorn became secretary to the so-called "English court" in Hamburg, a trading company founded in the 13th century, and formerly known as "Die Societät der Aventurier Kaufleute." He shortly afterwards married, and from this time, with a settled income and sufficient leisure to pursue his literary occupations, led a pleasant and congenial existence, surrounded by friends and admirers, till his death, at the early age of forty-seven, October 28, 1755.

Hagedorn is known as the author of satirical, didactic, and moral verses, epigrams, odes, fables, and songs. His popularity during his lifetime was great. Although he held himself aloof from any poetical school, he nevertheless exercised an important influence on the German poetry of his time; for, besides being a learned man and well-read in the ancient and modern classics, he was a special admirer of French literature, the study of which gained for him an ease and mobility before unknown in German versification. He has been called the originator in Germany of the modern song, and some of his *Lieder* were set to music by the favorite composers of his day. His popularity, however, is now long past. His learning and his style have been eclipsed by later and greater poets, and he who was at one time the "allgemeine Bewunderung von Deutschland" now ranks only among the secondary German classics.

The first collection of Hagedorn's poems was published at Hamburg shortly after his return from Jena in 1729, under the title *Versuch einiger Gedichte, oder erlesene Proben poetischer Nebenstunden*. In 1738 appeared *Versuch in poetischen Fabeln und Erzählungen;* in 1747 a collection of his lyric poems, under the title *Sammlung neuer Oden und Lieder;* and his *Moralische Gedichte* in 1750. A collection of his entire works was published at Hamburg after his death in 1756, and a smaller edition in 1767. The best is Eschenburg's edition, 5 vols., 1800, republished, with Hagedorn's correspondence, in 1825. See C. H. Schmid, *Biographie von Hagedorn*.

HAGEN, a town of Prussia, at the head of a circle in the Arnsberg government of Westphalia, is situated at the confluence of the Empe with the Volme, and at the junction of several railways, 26 miles W. S. W. from Arnsberg. It is the seat of a provincial office, a circle court, a chamber of commerce, a state railway commission, and an agricultural union. It has two Evangelical churches, a Catholic church, an Old Catholic church, a synagogue, a real-school of the first order, a royal provincial trade school, a higher female school, and two infirmaries. Hagen is one of the most flourishing commercial towns in Westphalia, and possesses puddling works for iron and steel, iron foundries, cast-steel works, a large cotton print works, woollen and cotton factories, manufactures of leather, paper, tobacco, and iron and steel wares, breweries, and distilleries. There are large limestone quarries in the vicinity, and also an

[1] Son (1806–77) of F. A. Brockhaus (*q. v.*), professor of Sanskrit at Leipsic, translator, and an editor of Ersch and Gruber's *Encyklopädie*.—Am. Ed.

alabaster quarry. The population according to the census of 1905, was 77,567.

HAGEN, Friedrich Heinrich von der (1780–1856), distinguished for his researches in Old German literature, was born at Schmiedeberg in Brandenburg, 19th February, 1780. After studying law at the university of Halle, he obtained a legal appointment in the state service at Berlin, but in 1806 he resigned this office in order to devote himself exclusively to the study of his choice. In 1810 he was appointed professor extraordinarius of German language and literature in the university of Berlin, in the following year was transferred to a similar professorship in Breslau, and in 1821 returned to Berlin as professor ordinarius. He died at Berlin, 11th June, 1856. To Hagen belongs the chief merit of awakening an interest in Old German poetry, of which he published several collections.

His principal publications are the *Nibelungenlied*, of which he issued four editions, the first in 1810 and the last in 1842; the *Minnesinger*, Leipsic, 1838–52, 5 vols.; *Lieder der ältern Edda*, Berlin, 1812; *Altnordische Lieder und Sagen*, Breslau, 1814; a collection of Old German tales under the title *Gesammtabenteuer*, Stuttgart, 1850, 3 vols. He also published *Ueber die ältesten Darstellungen der Faustsage*, Berlin, 1844; and from 1835 he edited the *Jahrbuch der Berlinischen Gesellschaft für deutsche Sprache und Alterthumskunde*.

HAGENAU, the chief town of a circle and canton in Alsace-Lorraine, Germany, district of Lower Alsace, is situated in the middle of the Hagenau Forest, on the Moder, and on the railway from Strasburg to Weissenburg, 10 miles N. N. E. of the former town. It has two ancient Catholic churches, one dating from the 12th the other from the 13th century, a gymnasium, a reformatory for boys, a female penitentiary, a public library, a hospital, and a theatre. The principal industries are wool and cotton spinning, and the manufacture of porcelain, earthenware, soap, leather, oil, and beer. There is also considerable trade in hops, vegetables, and wine. Population (1905), 18,737.

Hagenau dates from the beginning of the 12th century, and owes its origin to the erection of a hunting lodge by the dukes of Swabia. Frederick Barbarossa surrounded it with walls and gave it a constitution. On the site of the hunting lodge he founded an imperial palace, in which were preserved the jewelled imperial crown, sceptre, imperial globe, and sword of Charlemagne. Subsequently the town obtained imperial rights, and after the extinction of the Hohenstaufens it remained the capital of the bailiwick of Lower Alsace. In 1648 it came into the possession of France, and in 1673 Louis XIV. caused the fortifications to be razed. In 1675 it was captured by imperial troops, but in 1677 it was retaken by the French and nearly all destroyed by fire. In 1871 it came, along with the rest of Alsace-Lorraine, into the possession of Prussia.

HAGENBACH, Karl Rudolf (1801–1874), distinguished as a church historian and as an expounder of the so-called "Vermittelungstheologie," or mediation theology of Germany, was born March 4, 1801, at Basel, where his father, a man of considerable talent and scientific repute, was a practising physician. His preliminary education was received at a Pestalozzian school, and afterwards at the gymnasium, whence in due course he passed to the newly reorganized local university. Carefully brought up within a church in which the strictest orthodoxy still continued to hold undisputed sway, familiar at the same time from boyhood with his father's expressions of approval of the principles of the French Revolution, himself of an ardent, sympathetic, inquiring, and devout temperament, he early devoted himself to theological studies and to the service of the church, while at the same time cherishing and developing broad "humanistic" tendencies which found expression in many ways and especially in an enthusiastic admiration for the writings of Herder. The years 1820–23 were spent first at Bonn, where Lücke exerted a powerful influence on the formation of his opinions, and afterwards at Berlin, where Schleiermacher, and still more Neander, became permanently his masters. Returning in 1823 to Basel, where De Wette had recently been appointed to a theological chair, he distinguished himself greatly by his "habilitations-schrift" or trial-dissertation, entitled *Observationes historico-hermeneuticæ circa Origenis methodum interpretandæ sacræ Scripturæ;* in the following year he became professor extraordinarius, and in 1829 professor ordinarius of theology. Apart from his special academic labors during many years in connection with the history of dogma and of the church (which first owed to him their recognition as distinct branches of study at Basel), he lived a life of great and varied usefulness as a theologian, a preacher, and a citizen; and at his "jubilee" in 1873, not only the university and town of Basel but also the various churches of Switzerland united to do him honor. He died at Basel, June 7, 1874.

Hagenbach was a voluminous author in many departments (as will be seen from the list of his works which is given below), but it is as a writer on church history that he is specially distinguished, and is likely to be longest and most widely known. Though neither so learned and condensed as the contributions of Gieseler, nor so original and profound as those of Neander, his lectures are written with remarkable clearness and attractiveness, and are deservedly appreciated at once for their warm glow of sympathy with his subject and for their entire freedom from narrow sectarian prejudice. In dogmatics, while avowedly a champion of the "mediation theology" based upon the fundamental conceptions of Herder and Schleiermacher, he was much less revolutionary in his aims and in his results than were many others of his school. To the last he sought to maintain the old confessional documents, and to make the objective and churchly prevail over the purely subjective manner of viewing theological questions. But he himself was aware that in the endeavor to do so he was not always successful, and that his delineations of Christian dogma often betrayed a vacillating and uncertain hand. His works include a remarkably clear *Tabellarische Uebersicht der Dogmengeschichte* (1828); *Encyclopädie u. Methodologie der theol. Wissenschaften* (1833); *Vorlesungen über Wesen u. Geschichte der Reformation u. des Protestantismus* (1834–43); *Lehrbuch der Dogmengeschichte* (1840–41, 5th ed., 1867; English transl., 1850); *Vorlesungen über die Geschichte der alten Kirche* (1853–55); *Vorlesungen über die Kirchengeschichte des Mittelalters* (1860–61); *Grundlinien der Homiletik u. Liturgik* (1863); also biographies of Œcolampadius and Myconius and a *Geschichte der theol. Schule Basels* (1860). His *Predigten* have been published in nine volumes (1858–75), and he is also author of two volumes of poems entitled *Luther u. seine Zeit* (1838), and *Gedichte* (1846). The lectures on church history under the general title *Vorlesungen über die Kirchengeschichte von der ältesten Zeit bis zum 19ten Jahrhundert* have been recently reissued in seven volumes (1868–72).

HAGERSTOWN, a city and township of Maryland, United States, capital of Washington county, is situated near the west bank of Antietam creek, 20 miles from its confluence with the Potomac river, and at the junction point of three railways, 86 miles W. N. W. by rail from Baltimore. It is a well-built town with very few wooden houses, and possesses a fine new court-house, a male and a female academy, and a national and a state bank. It depends for its prosperity chiefly on agriculture, and has flour-mills, bone-mills, machine shops, and a tannery, and considerable trade in agricultural produce. The population in 1850 was 3,884; in 1860, 4,132; and in 1900, 13,591, of whom 869 were colored.

HAG-FISH, Glutinous Hag, or Borez (*Myxine*), a marine fish which forms with the lampreys one of the lowest orders of vertebrates (*Cyclostomata*). Similar in form to a lamprey, it is usually found within the body of dead cod or haddock, on the flesh of which it feeds after having buried itself in the abdomen. When caught, it secretes a thick glutinous slime in such quantity that it is commonly believed to have the power of converting water into glue. It is occasionally found in the North Atlantic and other temperate seas of the globe.

HAGGAI, the tenth in order of the minor prophets. The name Haggai (חַגַּי, Greek Ἀγγαῖος, whence Aggeus in the English version of the Apocrypha) is usually held to be an adjective meaning *festive*. But Wellhausen[1] is probably right in taking the word as a contraction for Hagariah (*Jehovah hath girded*), just as Zaccai (Zacchæus) is known to be a contraction of Zechariah (*cf.* Derenbourg, *Histoire de la Palestine*, pp. 95, 150).

The book of Haggai contains four short prophecies delivered between the first day of the sixth month and the twenty-fourth day of the ninth month—that is, between September and December—of the second year of Darius the king. The king in question must be Darius Hystaspis, who came to the throne 521 B. C. Scaliger, Drusius, and other older writers think of Darius Nothus (*acc.* 424 B. C.); but this is impossible, since in chap. ii. 3 Haggai speaks of old men as still alive who had seen the first temple in its

[1] In Bleek's *Einleitung*, 4th ed., p. 434.

splendor before 587 B. C.[1] The language of the prophet suggests the probability that he was himself one of those whose memories reached across the seventy years of the captivity, and that his prophetic work began in extreme old age. This supposition agrees well with the shortness of the period covered by his book, and with the fact that Zechariah, who began to prophesy in the same autumn and was associated with Haggai's labors (Ezra v. 1), afterwards appears as the leading prophet in Jerusalem (Zech. vii. 1–4). We know nothing further of the personal history of Haggai from the Bible. Later traditions may be read in Carpzov's *Introductio*, pars 3, cap. xvi. On the mention of Haggai in the titles of several psalms in the Septuagint (Psalms cxxxvii., cxlv.–cxlviii.) and other versions, see Koehler's *Weissagungen Haggai's*, p. 32. These titles are without value, and moreover vary in MSS. Eusebius did not find them in the Hexaplar Septuagint.[2]

In his first prophecy (i. 1–11) Haggai addresses Zerubbabel and Joshua, rebuking the people for leaving the temple unbuilt while they are busy in providing panelled houses for themselves. The prevalent famine and distress are due to God's indignation at such remissness. Let them build the house, and God will take pleasure in it and acknowledge the honor paid to Him. The rebuke took effect, and the people began to work at the temple, strengthened by the prophet's assurance that the Lord was with them (i. 12–15). In a second prophecy (ii. 1–9) delivered in the following month, Haggai forbids the people to be disheartened by the apparent meanness of the new temple. The silver and gold are the Lord's. He will soon shake all nations and bring their choicest gifts to adorn His house. Its glory shall be greater than that of the former temple, and in this place He will give peace. A third prophecy (ii. 10–19) contains a promise, enforced by a figure drawn from the priestly ritual, that God will remove famine and bless the land from the day of the foundation of the temple onwards. Finally, in ii. 20–23, Zerubbabel is assured of God's special love and protection in the impending catastrophe of kingdoms and nations to which the prophet had formerly pointed as preceding the glorification of God's house on Zion. In thus looking forward to a shaking of all nations Haggai agrees with earlier prophecies, especially Isa. xxiv.–xxvii., while his picture of the glory and peace of the new Zion and its temple is drawn from the great anonymous prophet who penned Isa. xl. and lxvi. The characteristic features of the book are the importance assigned to the personality of Zerubbabel and the almost sacramental significance attached to the temple. The hopes fixed on Zerubbabel, the chosen of the Lord, dear to Him as His signet ring (*cf.* Jer. xxii. 24), are a last echo in Old Testament prophecy of the theocratic importance of the House of David. In the book of Zechariah Zerubbabel has already fallen into the background and the high priest is the leading figure of the Judean community.[3] The stem of David is superseded by the house of Zadok, the kingship has yielded to the priesthood, and the extinction of national hopes gives new importance to that strict organization of the hierarchy for which Ezekiel had prepared the way by his sentence of disfranchisement against the non-Zadokite priests.

If his attitude to Zerubbabel forms a link of connection between Haggai and the prophets before the captivity, his post-exile standpoint is characteristically marked in the central importance which he attaches to the temple. The prophets who spoke under the shadow of the first temple held quite another language.[4] To Isaiah and Jeremiah the religion of Israel and the holiness of Jerusalem have little to do with the edifice of the temple. The city is holy because it is the seat of Jehovah's sovereignty on earth, exerted in His dealings with and for the state of Judah and the kingdom of David. The proof that Jehovah's throne is in Jerusalem lies in the history of what He has done for His people, or, if a visible pledge is needed, it must be sought not in the temple but, in accordance with antique ideas, in the ark (Jer. iii. 16) or in the altar with its sacred flame (Isa. xxix. 1; xxxi. 9).[5] But, in the desolation of Jerusalem, the extinction of the political life with which all religion had till then been inseparably bound up gave a new meaning to the old prophetic doctrine that the service of Jehovah is the true vocation of Israel—a new significance to the ruined temple and all its ordinances of worship. "The holy and beautiful house where our fathers praised Thee" (Isa. lxiv. 11) was a chief thought of the sorrowing exiles (Lamentations, *passim*), and to one anonymous writer the Lord's vengeance on Babylon appears eminently as vengeance for His temple (Jer. l. 28). The great prophet of the captivity—the author of Isa. xl.–lxvi.—pictures the Israel of the restoration no longer as an earthly state but as a world-priesthood, a mediatorial people gathered round the sanctuary and holding forth amidst the nations the true pattern of the knowledge and service of the living God till all the ends of the earth shall look to Him and be saved. Under the limitations of the old dispensation neither seer nor people could separate the realization of this great conception from the restoration of the visible centre of Israel's worship in the temple at Jerusalem. The prophet had pointed to Cyrus by name as the rebuilder of Jerusalem and the founder of the temple (Isa. xliv. 28; lii. 11); and the captives whose hearts were touched by his burning words, and who availed themselves of the decree of that monarch (536 B. C.) to repeople the desolate places of Judah, looked for the speedy advent of the time when the glory of Jehovah displayed in His house on Zion should draw to Jerusalem the willing homage of all nations (Isa. lvi.; lx. 7; lxvi. 1–6). The actual experiences of the returning exiles fell as far short of these bright hopes as the Israel of Zerubbabel and Joshua fell short of the ideal regenerate nation to which the prophet had promised the heritage of Jehovah's glory. Scarcely was a settlement effected when difficulties and misfortunes began to thicken about the little colony. The anger of the Lord seemed still to rest on Jerusalem and the cities of Judah (Zech. i. 12), whose inhabitants soon ceased to find favor from the Persian court, and had to struggle with penury and famine as well as with the hostility of their neighbors. Amidst such discouragements the first zeal soon grew cool, and the work of rebuilding the sanctuary lay practically untouched till Haggai arose sixteen years later.

What had actually been effected during these years for the restoration of the temple is a question of some difficulty. It seems safest to start from the explicit contemporary evidence of Hag. ii. 18 (*cf.* ii. 15 and Zech. viii. 9) which gives the ninth month of the second year of Darius—after Haggai had begun to preach—as the date when the temple was founded by Zerubbabel and Joshua. On the other hand, the book of Ezra, in its present shape as edited and partly composed by the much later author who wrote Chronicles, conveys the impression that large gifts for the temple were offered by the leading Jews on their first return (Ezra ii. 68, 69), that the foundation of the house was laid by Joshua and Zerubbabel in the second year of the return (ch. iii.), and that the work was thereaftor interrupted by the opposition of the Jews' enemies till the reign of Darius. It appears probable, however, that the Chronicler has somewhat dislocated the order of events, especially by taking the official correspondence in ch. iv. to refer to the temple, whereas it really refers to the building of the city walls. This oversight might readily involve the antedating of the foundation ceremony described in iii. 8–13, which seems to be identical with that which Haggai speaks of, since the actors are the same, and the chief feature in the description which does not belong to the usual liturgical scenery of the Chronicler recalls Hag. ii. 3, Zech. iv. 7–10. Again, the verses Ezra ii. 68, 69 seem really to refer to a collection made in the time of Nehemiah, having been transcribed from a history of that period (part of which is preserved in the canonical book of Nehemiah) along with the ancient list which occupies the first part of Ezra ii. But they are not part of the list, as appears from a comparison of Ezra ii. 62–iii. 1 with Neh. vii. 64–viii. 1. If this criticism is just, the Tirshatha of Ezra ii. is Nehemiah, not Zerubbabel, and the usual arguments for identifying the latter with Sheshbazzar—whom Cyrus, according to an Aramaic source preserved in Ezra v., appointed governor and charged with the restoration of the temple—fall to the ground.[6] Sheshbazzar was presumably a Persian official; and the first hope of the Jewish colony, in accordance with Isa. xliv. 28, lx. 10, was, no doubt, that the Persians would effect the restoration without effort of theirs. This

[1] Darius Nothus was thought of because Ezra iv. 6–23 seems to require an Artaxerxes before him. But it is now generally admitted that these verses refer to the building of the wall of Jerusalem, and its chronological order should follow chaps. v., vi. The Rabbinical commentators with their usual ignorance on points of history make Darius the son of Ahasuerus and Esther.

[2] See the note on Ps. cxlv. i. in Field's *Hexapla*.

[3] After the foundation of the temple Zerubbabel disappears from history and lives only in legend, which continued to busy itself with his story, as we see from the apocryphal book of Esdras (*cf.* Derenbourg, *Hist. de la Palestine*, chap. i.).

[4] Compare for example Jer. vii.

[5] Haggai (ii. 14) attaches no value to altar and sacrifice so long as the temple is unbuilt.

[6] Ezra ii. 2 seems to show that at the return Zerubbabel was merely one of the Jewish elders. The opposite impression is due solely to the punctuation.

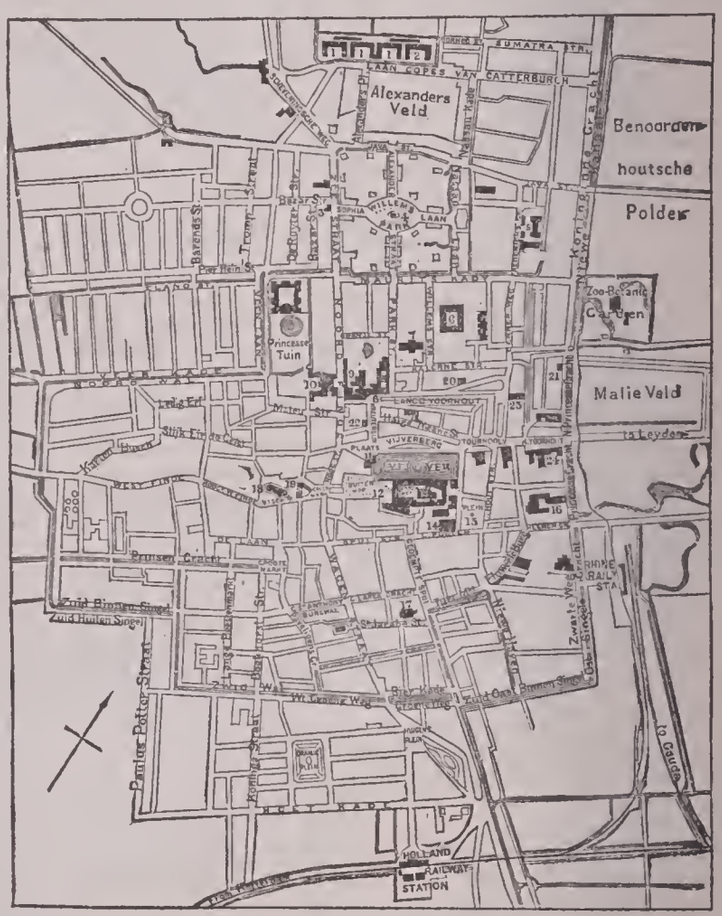
hope was frustrated, Sheshbazzar presumably having taken up his task with the usual conscientiousness of an Oriental governor, that is, having done nothing, though the work was nominally in hand all along (Ezra v. 16). The advancement of Zerubbabel to the govornorship may have given Haggai his opportunity.

In the confused state of the chronology of the book of Ezra it may also be a question when the Samaritans sought to join the Jews and were repulsed. That the relation of Ezra iv. 1–4 is historical seems to bo established against objections which have been taken to it by the reference to Esarhaddon, which A. v. Gutschmidt has vindicated by an ingenious historical combination with the aid of the Assyrian monuments (*Neue Beiträge*, p. 145). Compare also Jer. xli. 5 for the antiquity of the Samaritan claim to worship with the Jews. But from Ezra v., and especially from Zech. iii., it may be questioned whether the opposition of tho Samaritans arose before the time of Haggai and Zechariah. See on the whole question Schrader, "Die Dauer des zweiten Tempelbaues," in the *Studien und Kritiken*, 1867.

Such indifference to the undertaking which held a chief place in the first ardor of the returning exiles had a deeper significance than at once occurs to our modern habits of thought. The restoration of the temple and its worship was connected in every mind with the doctrine that the service of Jehovah was the true national vocation of Israel, and the apathy that Haggai rebukes showed the people to have forgotten in the struggle for material welfare their ideal calling as the nation of the true God. His reproofs touched the conscience of the Jews, and the book of Zechariah enables us in some measure to follow the course of a religious revival which, starting with the restoration of the temple, did not confine itself to matters of ceremony and ritual worship. On the other hand, Haggai's treatment of his theme, practical and effective as it was for the purpose in hand, moves on a far lower level than the aspirations of the great evangelical prophet who inspired the people at their first return. To the latter the material temple is no more than a detail in the picture of a work of restoration eminently ideal and spiritual, and he expressly warns his hearers against attaching intrinsic importance to it (Isa. lxvi. 1). To Haggai the temple appears so essential that he teaches that while it lay waste the people and all their works and offerings were unclean (Hag. ii. 14). In this he betrays his affinity with Ezekiel, who taught that it is by the possession of the sanctuary that Israel is sanctified (Ezek. xxxvii. 28). In truth the new movement of religious thought and feeling which started from the fall of the Hebrew state took two distinct lines, of which Ezekiel and the anonymous prophet of Isa. xl.–lxvi. are the respective representatives. While the latter developed his great picture of Israel the mediatorial nation, the systematic and priestly mind of Ezekiel had shaped a more material conception of the religious vocation of Israel in that picture of the new theocracy where the temple and its ritual occupy the largest place, with a sanctity which is set in express contrast to the older conception of the holiness of the city of Jerusalem (*cf.* Ezek. xliii. 7 *seq.* with Jer. xxxi. 40, Isa. iv. 5), and with a supreme significance for the religious life of the people which is expressed in the figure of the living waters issuing from under the threshold of the house (Ezek. xlvii.). It was the conception of Ezekiel which permanently influenced the citizens of the New Jerusalem, and took final shape in the institutions of Ezra. To this consummation, with its necessary accompaniment in the extinction of prophecy, the book of Haggai already points.

Exegetical Helps.—The elaborate and valuable German commentary of A. Köhler (Erlangen, 1860) forms the first part of his work on the *Nachexilische Propheten*. Reinke's *Commentary* (Münster, 1868) is the work of a Roman Catholic. Haggai has generally been treated in works on all the prophets, as by Ewald (2d ed., 1868; Eng. trans., vol. iii., 1878); or along with the other minor prophets, as by Hitzig (3d ed., Leipsic, 1863), Keil (1866; Eng. trans., Edinburgh, 1868), and Pusey (1875); or with the other post-exile prophets as by Koehler, Pressel (Gotha, 1870), Dods (1879), and others. The older literature will be found in books of introduction or in Rosenmüller's still useful *Scholia*. The learned commentary of Marckius may be specially mentioned. On the place of Haggai in the history of Old Testament prophecy, see Duhm's *Theologie der Propheten* (Bonn, 1875). (W. R. S.)

HAGUE, The (in Dutch, *'s Gravenhage* o. *den Haag*; in French, *La Haye*; and in modern Latin, *Haga Comitis*), a town of the Netherlands, in the province of South Holland, 13 miles N. W. of Rotterdam, 10 miles S. W. of Leyden, and 2 miles inland from the German Ocean. It is connected with both Rotterdam and Leyden by the "Holland Railway," and with Utrecht by the railway of the Rhine. Besides being the chief town of the province, the Hague is the usual residence of the court, and the seat of the Government, the states-general, the high council of the Netherlands, the council of state, the chamber of accounts, and various other administrative bodies. The characteristics of the town are quite in keeping with its political position. It is "the handsomest, the most fashionable, and the most modern-looking" town in the Netherlands D'Amicis rightly describes it in his *Olanda* as half Dutch half French. Broad and regular streets, extensive avenues and drives, and spacious squares well planted with trees. are the main features of its general plan; large and beautiful buildings are numerous; and the population consists for the most part of Government officials and members of



Plan of the Hague.

1. Cavalry Barracks.
2. Artillery do.
3. De Boer's Bazaar.
4. National Monument.
5, 6. Barracks.
7. St. James's Church.
8. Office of the Minister of Finance.
9. Palace of Prince of Orange.
10. Royal Palace.
11. Gevangenpoort.
12. Statue of William II.
13. Court Buildings.
14. Office of Minister of Justice.
15. Statue of William I.
16. The Academy of Music, etc.
17. Nieuwe Kerk.
18. Groote Kerk.
19. Town-Hall.
20. Library.
21. Museum Meermanno - Westreenianum.
22. Palace of Prince Alexander.
23. Palace of Prince Henry.
24. Palace of Prince Frederick.

the nobility, the army, and the navy. A good idea of the place is obtained by passing along the Vijverberg or Fish-pond Hill, which takes its name from the large basin of water which it skirts, the Voorhout, and the Willemspark, next through Java Street and Sumatra Street, and then the Buitenhof or Outer Court, the Binnenhof or Inner Court, the Plein, the Kneuterdijk, and the Groote Markt. Willemspark was laid out by King William II., and in 1869 it was chosen as the site of the national monument in memory of the recovery of independence in 1813, executed by Waaijen, Pietersen and Koelman. The Plein, a square bordered with the offices of the various ministers and the high council, is adorned with a statue of William I., the

"father of his people," by Louis Royer; an equestrian statue of the same prince, by the count of Nieuwerkerke, is placed in front of the royal palace; and there is a statue of William II. by Georges in the Buitenhof.

The centre of the Hague, both historically and topographically, is the buildings of the court. The oldest portion was founded by Count William II., "king of the Romans," in 1249. A handsome Gothic building, with towers at each corner of the façade, contains the great or knights' hall, a noble chamber 130 feet in length, 62 feet in breadth, and 69 in height, in which the states of the Netherlands, abjured their allegiance to Philip II. of Spain, and in front of which the gray-headed Olden-Barneveldt lost his life in 1619. To the south-east of the hall is the troonzaal, or throne room, in which the second chamber of the states-general holds its sittings; and to the west is the meeting-place of the first chamber. The archives of the kingdom and several Government offices are in the same range of buildings. The royal palace proper was purchased by the states of the Netherlands in 1595, rebuilt by Prince William III., and extended by King William I. The palace of the prince of Orange was founded about 1720 by Count Unico William of Wassenaar Twiekels; the palace of Prince Frederick of the Netherlands dates from 1825 to 1828; the palace of Prince Henry was erected in 1743 for the deputies of Rotterdam; and the palace of Prince Alexander was in the 17th century the house of John de Witt, pensionary of the council. Among the public institutions of the Hague, the following are the most important:—the royal library, with upwards of 100,000 volumes, and a collection of manuscripts, coins, and gems, erected between 1734 and 1738; the Museum Meermanno-Westreenianum, comprising books, manuscripts, maps, plates, pictures, antiquities, and curiosities; the royal picture gallery in the Prins-Mauritz-Huis, which was founded in 1633 by Prince John Maurice of Nassau-Siegen, governor of Brazil; the Vijverberg hôtel, with a collection of curiosities; the town museum of antiquities and modern art; the zoological gardens, founded in 1862; the royal school of design and music; and the new buildings for the arts and sciences, erected in 1874. Of the sixteen churches of the Hague five belong to the Dutch Reformed communion, six to the Roman Catholics, and one to the Old Catholics; one is Episcopalian, one German Evangelical and two Apostoolian. There are also two synagogues and one Greek chapel. Architecturally the Groote Kerk, under the patronage of St. James, is the most noteworthy; it is 300 feet long by 154 broad, and has a lofty tower and spire; in the interior are the sepulchral monuments of James Baron of Wassenaar Obdam, a Dutch naval hero, of Gerrit of Assendelft, and of Philip, landgrave of Hessen-Philipsthal. The Willemskerk was a present of William III. to the Reformed community of the Hague.

The principal industries of the town are iron-casting, copper and lead smelting, cannon-founding, the manufacture of furniture and carriages, silk-dyeing, liquor-distilling, lithographing, and printing. In 1622 the population of the Hague was only 17,430; in 1732 it was estimated at 34,000; in 1796, inclusive of the inhabitants of Scheveningen,—a watering-place now connected with the town by a tramway line,—it was 41,266; in 1811, 42,150; in 1830, 56,105; in 1840, 58,521; and in 1850, 66,329. In 1860 it was 78,405, and in 1870, 91,328. At the last date 52,600 belonged to the Dutch Reformed Church; 27,486 were Roman Catholics, 3471 Dutch Jews, and 148 Portuguese Jews. In 1906 the total was stated at 248,995.

The Hague, mentioned as early as 1097 in a document by Count Floris II., seems originally to have been a shooting lodge of the counts of Holland. Under William II. it became a residence of the court; and in the 15th century it begins to be called a town, though for long after, down even to the time of Louis Napoleon, it was as frequently described as a village. In 1479 the soldiers of Maximilian of Austria put the place to ransom; in 1525 it was the scene of the martyrdom of Johannes Pistorius (Jan de Bakker of Woerd); in 1528 it was plundered by the people of Guelderland; and in 1572, 1573, and 1574 it was laid waste by the Spaniards. Restored by William I. in 1576, it was in 1584 the seat of the sessions of the States of Holland. Fosses were construeted round the town in 1620. In 1672 it was the scene of the famous assassination of the brothers De Witt. It was at the Hague that the convention was arranged in 1710 between the German emperor, the king of Prussia, the emperor of Russia, and the maritime powers, for the maintenance of the neutrality of North Germany; it was at the Hague that the Triple Alliance of 1717 was concluded, and that the peace of the same year was signed between Spain, Savoy, and Austria. From 1782 to 1787 the town had its full share in the civil disturbances of the country. In 1808 it was made the seat of the Government administrative offices.

See *Guide ou Nouvelle Description de la Haye*, The Hague, 1785; *Description succincte de la ville de la Haye*, The Hague, 1823; *Morgen-wandelingen door en in den omtrek van 's Gravenhage*, The Hague, 1832; *Gezigten van 's Gravenhagen*, Amsterdam, 1845; *Petit Guide de la Haye*, The Hague, 1860; *La Haye et Scheveningue photographiés*, The Hague, 1860.

HAHN, August (1792–1863), German Protestant theologian, was born March 27, 1792, at Grossosterhausen near Eisleben, and after attending the Eisleben gymnasium, entered the university of Leipsic as a student of theology in 1810. After holding an educational appointment in Wittenberg for some time, he in 1819 was nominated professor extraordinarius of theology at Königsberg, and in the following year received a pastoral charge and a superintendency in that city. These posts, however, he soon resigned on his promotion in 1821 to be professor ordinarius. In 1826 he removed as professor of theology to Leipsic, where, hitherto distinguished only as editor of Bardesanes, Marcion, and Ephraem Syrus, he came into extraordinary prominence as the author of a treatise, *De rationalismi qui dicitur vera indole et qua cum naturalismo contineatur ratione* (1827), and also of an *Offene Erklärung an die Evangelische Kirche zunächst in Sachsen u. Preussen* (1827), in which he endeavored to convince the rationalists that it was their duty voluntarily and at once to withdraw from the national church. In 1833 Hahn was called to Breslau as theological professor and consistorial councillor, and in 1844 he became "general superintendent" of the province of Silesia. He died at Breslau on May 13, 1863. Though uncompromising in his "supranaturalism," he did not altogether satisfy the men of his own school by his own doctrinal system. The first edition of his *Lehrbuch des christlichen Glaubens* (1828) was freely characterized as lacking in consistency and as detracting from the strength of the old positions in many important points. Many of these defects, however, he is considered to have remedied in his second edition (1857). Among the other literary labors by which Hahn is best known are his edition of the Hebrew Bible (1833) and his *Bibliothek der Symbole und Glaubensregeln der apostolisch-katholischen Kirche* (1842; 2d ed. 1877). A volume of *Predigten* was published in 1852.

HAHN, Johann Georg von (1810–1869), an Austrian traveller, to whom we are indebted for most of our knowledge about the Albanians, was born at Jena in 1810. After travelling for some time under the auspices of the Vienna academy, he entered the Austrian consular service, in which he rose to be consul-general in Greece. He died at Jena 23d September, 1869. In his great work *Albanesischen studien* (Jena, 1854), he treats at once of the geography, the history, the archæology, the linguistic affinities, and the folk-lore of this remarkable country and people; and the book at once took rank as a scholarly and authoritative production. He had previously (1851) published *Bemerkungen über das Albanesische Alphabet* (Vienna, 1851). In 1858 he undertook a journey along with Major F. Zach from Belgrade to Saloniki (Thessalonica), for the purpose mainly of ascertaining the feasibility of constructing a railway from the Danube to the Ægean; and an account of their experiences was published in the *Denkschriften der Kaiserl. Akademie der Wissenschaften zu Wien, Phil. Hist. Klasse*, Bd. xi., Vienna, 1861. This paper, reprinted in 1871, contained valuable matter in regard to the Albanians, and especially in regard to their geographical distribution. Another journey undertaken in 1863 furnished material for a second contribution to the *Denkschriften* (*Phil. Hist. Klasse*, 1867)—"Reise durch die Gebiete des Drin und Wardar." Since the author's death a large work has appeared under the title of *Sagwissenschaftliche Studien* (Jena, 1872–73), in which he deals learnedly with numerous questions in comparative mythology.

HAHNEMANN, Samuel Christian Friedrich (1755–1843), the founder of the homœopathic system of medicine, was born at Meissen in Saxony, 10th April, 1755. He studied first at the "elector's school" of Meissen, and thereafter as a student of medicine at Leipsic and Vienna. He took the degree of M. D. at Erlangen in 1779, and after acting as physician at various places he returned in 1789 to Leipsic, where he largely occupied himself in the transla-

tion of medical works. While working at Cullen's *Materia Medica*, he was struck by the contradictory account given of the properties of Peruvian bark. He had previously meditated much on the unsatisfactory nature of the science of medicine; and, after much reflection and many experiments, he became convinced of the truth of the principle *similia similibus curantur* (see HOMŒOPATHY), *i. e.*, the cure for a disease is the very drug that would in a healthy person produce the symptoms of such disease. Further experiments convinced him that the conventional doses produced symptoms of unnecessary and dangerous violence, and this led to another principle, that of minimum doses, according to which the benefit to be derived from a medicine can be fully obtained by the administration of a very small quantity. Firmly convinced of the truth of these principles, Hahnemann spent the rest of his life in making them known to the world. He encountered much opposition, and in 1821 was forced to leave Leipsic, as he was not allowed to dispense his own prescriptions. The grand duke of Anhalt-Köthen, however, appointed him his physician, and at Köthen he resided until 1835 when he removed to Paris. He died 2d July, 1843. Hahnemann was a man of remarkable courage and perseverance. He not only sacrificed his immediate interests for the sake of his convictions, but made many painful experiments upon his own person.

Hahnemann's chief work, in which he expounds his system, is his *Organon der rationellen Heilkunde* (Dresden, 1810; 6th ed., Köthen, 1865; English translation by Dudgeon, London, 1849). His other important writings are *Fragmenta de viribus medicamentorum positivis* (2 vols., Leipsic, 1805); *Reine Arzneimittellehre* (6 vols., Dresden, 1811); *Die chronischen Krankheiten* (4 vols., Dresden, 1828–30). His smaller writings have been edited by Stapf (2 vols., Dresden and Leipsio, 1829–34). See also Albrescht's *Hahnemann's Leben und Wirken* (2d ed., Leipsic, 1875).

HAIDARÁBÁD. See HYDERABAD.

HAIDINGER, WILHELM VON (1795–1871), a mineralogist, geologist, and physicist of considerable note, was born at Vienna, February 5, 1795. His father, Karl Haidinger, contributed largely to the development of mineralogical science in the latter half of the last century. Having studied at the normal school of St. Anne, and attended classes at the university, Wilhelm, at the age of seventeen, joined Professor Mohs at Gratz, and five years later accompanied the professor to Freiberg on the transfer of his labors to the mining academy of that Saxon El-Dorado. In 1822 Haidinger visited France and England with Count Breunner, and, journeying northward, took up his abode in Edinburgh. He translated into English, with additions of his own, Mohs's *Grundriss der Mineralogie*, published at Edinburgh in three volumes under the title *Treatise on Mineralogy*, 1825. After a tour in northern Europe, including the Scandinavian mining districts, he undertook the scientific direction of the porcelain works at Elnbogen, belonging to his brothers. In 1840 he was appointed counsellor of mines (Bergrath) at Vienna in the place of Professor Mohs, a post which included the charge of the imperial cabinet of minerals, etc. He devoted himself to the rearrangement and enrichment of the collections, and the cabinet became the first in Europe. Shortly after (1843) Haidinger commenced a series of lectures on mineralogy, which was given to the world under the title *Handbuch der bestimmenden Mineralogie* (Vienna, 1845; tables, 1846). On the establishment of the imperial geological institution, he was chosen director (1849); and this important position he occupied for seventeen years. On the completion of the geological survey of the Austrian dominions in 1862, he superintended the preparation of the maps which were issued. He was elected a member of the imperial board of agriculture and mines, and a member of the imperial academy of sciences of Vienna. He organized the society of the friends of natural sciences. As a physicist Haidinger ranked high, and he was one of the most active promoters of scientific progress in Austria. He was the discoverer of the interesting optical appearances which have been called after him "Haidinger's brushes." Knighted in 1865, the following year he retired to his estate at Dornbach near Vienna, where he died March 19, 1871.

In addition to the works already named, Haidinger published *Anfangsgründe der Mineralogie*, Leipsic, 1829; *Bericht über die Mineralien-Sammlung der K. K. Hofkammer im Münz- und Bergwesen*, Vienna, 1843; *Geognostische Uebersichtskarte der Oesterreich. Monarchie*, Vienna, 1847; *Ueber den Zusammenhang der Korperfarben und der Oberflächenfarben*, Vienna, 1852; *Bemerkungen über die Anordnung der kleinsten Theilchen in Christallen*, Vienna, 1853; *Niedrigste Höhe von Gewitterwolken*, Vienna, 1853; *Interferenzlinien am Glimmer*, Vienna, 1855; *Vergleichungen von Augit und Amphibol*, Vienna, 1855; *Die konische Refraction am Diopsid*, Vienna, 1855. He also edited the *Naturwissenschaftliche Abhandlungen*, Vienna, 1847; the *Berichte über die Mittheilungen von Freunden der Naturwissenschaften in Wien*, Vienna, 1847–51; and the *Jahrbuch* of the Vienna *K. K. Geologische Reichanstalt*, 1850, etc. Some of his papers will be found in the *Transactions* of the Royal Society of Edinburgh (vol. x.) and of the Wernerian Society (1822–23), *Edinburgh Phil. Journal*, *Brewster's Journal of Science*, and *Poggendorff's Annalen*.

HAIL. See METEOROLOGY.

HAILES, SIR DAVID DALRYMPLE, BART., LORD (1726–1792), an eminent Scottish lawyer and historian, was born at Edinburgh, October 28, 1726. His father, Sir James Dalrymple of Hailes, in the county of Haddington, Bart., auditor-general of the exchequer in Scotland, was a grandson of James, first Viscount Stair; and his mother, Lady Christian Hamilton, was a daughter of Thomas, sixth earl of Haddington. He received his school education at Eton, and thence proceeded to Utrecht for the study of law, being intended for the Scottish bar, to which he was admitted, shortly after his return to his native country, on the 24th of February, 1748. As a pleader he attained neither high distinction nor very extensive practice, but he rapidly established a well-deserved reputation for sound knowledge, unwearied application, and strict probity; and in 1766 he was elevated to the bench, when he assumed the title of Lord Hailes. Ten years later he was appointed a lord of justiciary. His death took place on the 29th of November, 1792.

His most important contribution to literature is the *Annals of Scotland*, of which the first volume, "From the accession of Malcolm III., surnamed Canmore, to the accession of Robert I.," appeared in 1776, and the second, "From the accession of Robert I., surnamed Bruce, to the accession of the House of Stewart," in 1779. It is, as Dr. Johnson justly described this work at the time of its appearance, a "Dictionary" of carefully sifted facts, in our language a new mode of history which tells all that is wanted and all that is known, but without any labored splendor of language or affected subtlety of conjecture. The other works of Lord Hailes include *Historical Memoirs concerning the Provincial Councils of the Scottish Clergy* (1769); *An Examination of some of the arguments for the High Antiquity of Regiam Majestatem* (1769); three volumes entitled *Remains of Christian Antiquity* ("Account of the Martyrs of Smyrna and Lyons in the second century," 1776; "The Trials of Justin Martyr, Cyprian, etc.," 1778; "The History of the Martyrs of Palestine, translated from Eusebius," 1780); *Disquisitions concerning the Antiquities of the Christian Church* (1783); and editions or translations of portions of Lactantius, Tertullian, and Minucius Felix. In 1786 he published *An Inquiry into the Secondary Causes which Mr. Gibbon has assigned for the Rapid Growth of Christianity*, a Dutch translation of which was published at Utrecht in 1793. Both by its acuteness in detailed argument and by its freedom from theological rancor this controversial work is entitled to rank as one of the most respectable of the very many replies which were made to the famous 15th and 16th chapters of the *Decline and Fall of the Roman Empire;* but it has too much the character of a collection of detached critical remarks. A "Memoir" of Lord Hailes is prefixed to the 1808 reprint of his *Inquiry into the Secondary Causes*.

HAINAN, or, as it is usually called in Chinese, *Kiung-chow-foo*, an island belonging to the Chinese province of Kwang-tung, and situated between the Chinese sea and the Gulf of Tong-king from 20° 8′ to 17° 52′ N. lat., and from 108° 32′ to 111° 15′ E. long. It measures 160 miles from N. E. to S. W., and the average breadth is about 90 miles. The area is estimated at from 1200 to 1400 square miles, or two-thirds the size of Sicily. From the peninsula of Lei-chow on the north it is separated by the straits of Hainan, which have a breadth of 15 or 20 miles.

With the exception of a considerable area in the north, and broad tracts on the north-east and north-west sides, the whole island is occupied by jungle-covered mountains, with rich valleys between. The central range bears the name of Li-mou Shan or Wu Tchi Shan (the Five-Finger Mountain), and attains a height of 6000 or 7000 feet. Its praises are celebrated in a glowing ode by Ch'in.

a native poet. The island appears to be well watered, and some of its rivers are not without importance as possible highways of commerce; but the details of its hydrography are very partially ascertained. A navigable channel extends in an irregular curve from the bay of Hai-kow in the north to Tan-chow on the west coast. Being exposed to the winter monsoon the northern parts of the island enjoy much the same sort of temperate climate as the neighboring provinces of the mainland, but in the southern parts, protected from the monsoon by the mountain ranges, the climate is almost or entirely tropical. Snow falls so rarely that its appearance in 1684 is reported in the native chronicles as a remarkable event. Earthquakes are a much more familiar phenomenon, having occurred, according to the same authority, in 1523, 1526, 1605, 1652, 1677, 1681, 1684, 1702, 1704, 1725, 1742, 1816, 1817, and 1822. Excellent timber of various kinds—eagle-wood, rose-wood, liquidambar, etc.—is one of the principal products of the island, and has even been specially transported to Peking for imperial purposes. The cocoa palm flourishes freely even in the north, and is to be found growing in clumps with the *Pinus sinensis*. Rice, cotton, sugar, indigo, cinnamon, betel-nuts, sweet potatoes, ground-nuts, and tobacco are all cultivated in varying quantities. The aboriginal inhabitants collect a kind of tea called tein-cha, or celestial tea, which looks like the leaves of a wild camellia, and has an earthy taste when infused. Lead, silver, copper, and iron occur in the Shih-luh Shan or "stone-green-hill;" the silver at least was worked till 1850, and the copper would probably pay for its exploitation. Gold and lapis lazuli are found in other parts of the island.

The ordinary cattle of Hainan are apparently a cross between the little yellow cow of South China and the zebu of India. Buffalos are common, and in the neighborhood of Nanleu at least they are frequently albinos. Horses are numerous but small. Hogs and deer are both common wild animals, and of the latter there are three species, *Cervus Eldi*, *Cervus hippelaphus*, and *Cervus vaginalis*. Among the birds, of which 172 species are described by Mr. Swinhoe in his paper in *The Ibis*, 1870, there are eagles, notably a new species *Spilornis Rutherfordi*, buzzards, harriers, kites, owls, goatsuckers, and woodpeckers. The *Upupa ceylonensis* is familiar to the natives as the "bird of the Li matrons," and the *Palæornis javanica* as the "sugar-cane bird."

Hainan, as already indicated, forms a foo or department of the province of Kwang-tung, though strictly it is only a portion of the island that is under Chinese administration, the remainder being still occupied by unsubjugated aborigines. The department contains three *chow* and ten *hsien* districts,—Kiung-chow-hsien, in which the capital is situated; Ting-an-hsien, the only inland district; Wen-ch'ang-hsien, in the north-east of the island; Hui-tung-hsien, Lo-'hui-hsien, Ling-shui-hsien, Wan-chow, Ai-chou (the southmost of all), Kan-en-hsien, Chang-hua-hsien, Tan-chow, Lin-kao-hsien, and Chang-mui-hsien. The capital Kiung-chow-foo is situated in the north about 10 li (or 3 miles) from the coast on the river. It is a well-built compact city, and its temples and examination halls are in good preservation. The population is frequently stated at 200,000, but, according to C. C. Stuhlmann in the *Globus* for 1876, it is only 100,000. Carved articles in cocoa-nuts and scented woods are its principal industrial product. In 1630 it was made the seat of a Roman Catholic mission by Benoit de Mathos a Portuguese Jesuit, and the old cemetery still contains about 113 Christian graves. The port of Kiung-chow-foo at the mouth of the river, which is nearly dry at low water, is called simply Hoi-how, or in the court dialect Hai-Kow, *i. e.*, sea-port. The two towns are united by a good road, along which a large traffic is maintained partly by coolie porters but more frequently by means of wheelbarrows, which serve the purpose of cabs and carts. The net value of the trade of the port, that is, the foreign and native imports minus the re-exports and the native imports of local origin, rose from 684,772 Hk. taels in 1876 to 1,215,056 in 1878. Out of 182 vessels engaged in the foreign trade in 1878 with a tonnage of 87,290 tons, 152 were British, with a tonnage of 70,078 tons. The exports comprised leather, hides, skins and tallow, sugar to the value of 204,427 taels, hemp, galangal, lung-ngan pulp, grass cloth, and silk, and sesamum to the value of 41,936 taels.

The inhabitants of Hainan may be divided into three classes, the Chinese immigrants, the civilized aborigines or Shu-li, and the wild aborigines or Sheng-li. The Chinese were for the most part originally from Keang-se and the neighboring provinces, and they speak a peculiar dialect of which a detailed account by Mr. Swinhoe is given in *The Phœnix, a Monthly Magazine for China, etc.*, 1870. The Shu-li as described by Mr. Taintor are almost of the same stature as the Chinese, but have a more decided copper color, higher cheek-bones, and more angular features, while their eyes are not oblique. Their hair is long, straight, and black, and their beards, if they have any, are very scanty. They till the soil and bring rice, fuel, timber, grass-cloth, etc., to the Chinese markets. The Sheng-li or Li proper, called also La, Le, or Lauy, are probably connected with the Laos of Siam, and the Lolos of China. Though not gratuitously aggressive, they are highly intractable, and have given great trouble to the Chinese authorities. Among themselves they carry on deadly feuds, and revenge is a duty and an inheritance. Though they are mainly dependent on the chase for food, their weapons are still the spear and the bow, the latter being made of wood and strung with bamboo. In marriage no avoidance of similarity of name is required. The bride's face is tattooed according to a pattern furnished by the bridegroom. The funeral mourning consists of abstaining from drink and eating raw beef, and they use a wooden log for a coffin. When sick they sacrifice oxen. In the spring time there is a festival in which the men and women from neighboring settlements move about in gay clothing hand in hand and singing songs. The whole population of the island is estimated at about 2½ millions. At its first conquest 23,000 families were introduced from the mainland. In 1300 the Chinese authorities assign 166,257 inhabitants; in 1370, 291,000; and in 1617, 250,524; and in 1900, 2,000,000.

It was in 111 B.C. that Lu-Po-Teh, general of the emperor Wuti, first made the island of Hainan subject to the Chinese, who divided it into the two prefectures, Tan-urh or Drooping Ear in the south, so-called from the long ears of the native "king," and Chu-yai or Pearl Shore in the north. During the decadence of the elder branch of the Han dynasty the Chinese supremacy was weakened, but in 43 A. D. the natives were led by the success of Ma-yuan in Tong-king to make a new tender of their allegiance. About this time the whole island took the name of Chu-yai. In 627 A. D. the name of Kiung-chow came into use. On its conquest by the generals of Kublai Khan in 1278 the island was incorporated with the western part of the province of Kwang-tung in a new satrapy Hai-peh Hai-nan Tao, *i. e.*, the circuit north of the sea and south of the sea. It was thus that Hai-nan-Tao, or district south of the sea or strait, came into use as the name of tho island, which, however, has borne the official title of Kiung-chow-foo, probably derived from the kiung-shan or Jade Mountains, ever since 1370, the date of its erection into a department of Kwang-tung. For a long time Hainan was the refuge of the turbulent classes of China and the place of deportation for delinquent officials. It was there, for example, that Su-She or Su-Tung-po was banished in 1097. From the 15th to the 19th century pirates made the intercourse with the mainland dangerous, and in the 17th they were considered so formidable that merchants were allowed to convey their goods across only by the narrow channel from Sen-wen. Since 1863 the presence of English men-of-war has put an end to this evil. According to the treaty of Tientsin, the capital Kiung-chow and the harbor Hai-Kow were opened to European commerce; but it was not till 1876 that advantage was taken of the permission.

See Taintor in *Notes and Queries on China and Japan*, 1868; Mayers, "Hist. and Stat. Sketch of the Island of Hainan," in *Journ. of N., China Branch of Roy. As. Soc.*, new ser., No. vii. (1871–2); Dr. F. Hirth, "Die Chinesische Provinz Kuang-tung," in Petermann's *Mittheilungen*, 1873; *The China Review*, Hong-Kong, 1876; *Report on the newly-opened ports of Kiung-chow (Hoihow) in Hainan and of Hai-phong in Tonquin*, by N. B. Dennys, Hong-Kong, 1876. (H. A. W.)

HAINAU (officially HAYNAU), a town in the Prussian province of Silesia, circle of Goldberg-Hainau and government district of Liegnitz, is situated on the Rapid Deichsel and on the railway from Breslau to Dresden, 12 miles N.W. of Liegnitz. It has an Evangelical and a Roman Catholic church, and manufactories of woollen and cotton cloth, gloves, leather, locks, and tin ware. Near Hainau the Prussian cavalry inflicted a defeat on the French rearguard, 26th May, 1813. The population of the town in 1905 was 10,119.

HAINAULT, one of the nine provinces of the kingdom of Belgium, bounded E. and N. by Namur, Brabant, and Flanders, which are also Belgian provinces, and to the S.

and W. by the French département du Nord. The name[1] is doubtless derived from the little river Haine, which runs nearly due east and west past the town of Mons, and falls into the Scheldt not far from Condé. Hainault is well-wooded and hilly in the east and south-east, where it is partly covered by the Ardennes; the rest of the province is a pleasantly diversified, fertile, and well-cultivated plain-land, which produces all kinds of cereal crops, flax, tobacco, chicory, and beetroot. The long and narrow coal-field which, with some breaks, stretches from Aix-la-Chapelle to the sea near Boulogne, passes through the middle of Hainault, underlying a district of about 190,000 acres; its centre is about Mons, whence it extends westward to Valenciennes, eastward to Charleroi. At this latter town, named after Charles II. of Spain, who built it in 1666, are iron and copper works; marble and building-stone are also largely quarried in Hainault; the manufactures of the province are vigorous and good; ironware and cutlery, woollen and linen goods, glass, porcelain, and a variety of other articles are made, and are exported largely into France. Hainault, with a population of 1,142,954 inhabitants in 1900 (the largest in this respect of all the provinces), has an area of 1437 square miles, and is therefore somewhat thickly peopled; for administrative purposes it is divided into six arrondissements, of which that of Mons is the chief; the others are Tournai, Charleroi, Ath, Soignies, and Thuin; these again are subdivided into thirty-two cantons.

Formerly the county was nearly twice as large as the present province. In Cæsar's days it was inhabited by the Nervii, and did not get its present name till the 7th century, before which time it had become a county under its own lords. This dignity, at first more or less elective, became hereditary in the 9th century. Throughout the early Middle Ages Hainault was a purely agricultural district, owned by a numerous and very quarrelsome and disagreeable nobility; it possessed also no less than fifteen abbeys. It was famous in legend and history as the chosen land of chivalry, and Froissart, himself a native of Valenciennes, faithfully reflects the character of his fatherland. In the 11th century Baldwin V. of Flanders occupied it, and Baldwin VI., by marrying the heiress to the county, permanently added it to the territories of his house. It was his descendant Baldwin IX., count of Flanders and Hainault, who proclaimed himself first Latin emperor of Constantinople in 1204. In 1300 John of Avennes, count of Hainault, became also count of Holland by right of his mother Adelaide, sister of William II. of Holland; it was his granddaughter Philippa who in 1326 married the Prince of Wales, afterwards Edward III. Hainault went with Flanders, till it was occupied by Philip "the Good" of Burgundy in the war which lasted from 1424 to 1427. It finally fell to the house of Burgundy on the death of the unfortunate Jacoba in 1436. With the other territories of Charles the Bold it passed with Mary of Burgundy in 1477 to the house of Austria, and remained theirs till the peace of the Pyrenees in 1659, when part of the southern portion of the county was ceded to Louis XIV.—a cession confirmed and enlarged at Nimwegen in 1678. Thenceforth there are two Hainaults, the French and the Austrian, the latter answering to the present Belgian province. French Hainault (now a part of the département du Nord) had as its ancient capital Valenciennes; its other towns are Condé, Cambrai, Maubeuge, Le Quesnoy, Landrécies, Avesnes, Givet, Charlemont. Philippeville, which owes its name to Philip II. of Spain, having been transmuted out of a village called Corbigny into a town by Charles V. in 1555, was restored to the Netherlands in 1815. Austrian Hainault was overrun by the French in 1793, and annexed to France as the department of Jemmapes in 1794; in 1814 it was made part of the kingdom of the Netherlands; and in 1830, as a matter of course, in the division of that kingdom, it became one of the provinces of the Belgian half.

The chief authorities are the Baron de Reiffenberg's *Monuments pour servir à l'histoire des Provinces de Namur, de Hainault, et de Luxembourg*, 1844–1848, and Jacques de Guise's *Antiquitéz du pays de Haynault*.

HAINBURG, or HAIMBURG, a town of Austria, in the circle of Bruck, situated on the Danube 27 miles E.S.E. of Vienna, is the seat of a district court of justice and of a tax-office. It occupies part of the site of the old Celtic town Carnuntum, destroyed 251 A.D. Since the fire of 1827 Hainburg has been much improved, and is now a handsomely built town. It is still surrounded by ancient walls, and has a gate guarded by two old towers. There are numerous Roman remains, among which may be mentioned the altar and tower at the town-house, on the latter of which is a statue, said to be of Attila. A Roman aqueduct is still used to bring water to the town. Hainburg has a military school for engineers. The two important manufactures are tobacco, employing about 1700 hands, and needles, of which about 80 millions are annually turned out. On the neighboring Hainberg is an old castle, built of Roman remains, which appears in German tradition under the name of Heimburc: it was wrested from the Hungarians in 1042 by the emperor Henry III. At the foot of the same hill is a castle of the 12th century, where Ottocar, of Bohemia, was married to Margaret of Austria in 1252; earlier it was the residence of the dukes of Babenberg. Outside the town, on an island in the Danube, is the ruined castle of Röthelstein or Rothenstein, held by the Knights Templars. Hainburg was besieged by the Hungarians in 1477, was captured by Matthias Corvinus in 1482, and was sacked, and its inhabitants massacred, by the Turks in 1683. Population in 1900, 14,142.

HAINICHEN, a town of Saxony, in the circle of Leipsic and the prefecture of Döbeln, is situated on the Little Striegis, 15 miles N.E. of Chemnitz by railway. It is the seat of a royal court of justice, and has cigar and leather manufactories and a school of weaving. Its most important industry is the manufacture of flannels, baize, and similar fabrics; indeed it may be called the centre of this industry in Germany. The special whiteness and excellence of the flannel made in Hainichen is due to the peculiar nature of the water used in the manufacture. There are 22 spinning-mills in the town and environs, with about 2500 looms, of which between 300 and 400 are mechanical. There are also large dye-works and bleaching establishments. Large quantities of both wool and cotton are spun and woven, and yarn spun elsewhere is brought to Hainichen to be woven. About 3,850,000 lb of raw wool, worth about £600,000, is annually worked into material, some of which is exported to South America and eastern Asia. Coal is found in the neighborhood, but does not repay the expense of working. Hainichen is the birthplace of Gellert, to whose memory a bronze statue was erected in the market-place in 1865. The Gellert institution for the poor was erected in 1815. Population in 1905, 7,752.

HAIR is a substance which, from its various properties, and differences in stoutness, length, and strength, enters into a considerable variety of manufactures. Bristles are the stout elastic hairs obtained from the backs of certain breeds of pigs. The finest qualities, and the greatest quantities as well, are obtained from Russia, where a variety of pig is reared principally on account of its bristles. The best and most costly bristles are used by shoemakers, secondary qualities being employed for toilet and clothes-brushes, while inferior qualities are worked up into the commoner kinds of brushes used by painters and for many mechanical purposes. For artists' use and for decorative painting, brushes or pencils of hair from the sable, camel, badger, polecat, etc., are prepared. The hair of various animals which is too short for spinning into yarn is utilized for the manufacture of felt. For this use the hair of rabbits, hares, beavers, and of several other rodents is largely employed, especially in France, in making the finer qualities of felt hats. Cow hair, obtained from tanneries, is used in the preparation of roofing felts, and felt for covering boilers or steam-pipes, and for other similar purposes. It is also largely used by plasterers for binding the mortar of the walls and roofs of houses; and of late years it has to some extent been woven up into coarse friezes, horse-cloths, railway rugs, and inferior blankets. The tail hair of oxen is also of value for stuffing cushions and other upholstery work, for which purpose, as well as for making the official wigs of law officers, barristers, etc., the tail and body hair of the yak or Thibet ox is also sometimes imported into Europe. The tail and mane hair of horses is in great demand for various purposes. The long tail hair is especially valuable for weaving into hair-cloth, mane hair and the short tail hair being, on the other hand, principally prepared and curled for stuffing the chairs, sofas, and couches which are covered with the cloth manufactured from the long hair. The horse hair used in Great Britain is principally obtained from South America, Germany, and Russia, and its sorting, cleaning, and working up into the various manufactures dependent on the material are industries of some importance. In addition to the purposes already alluded to, horse hair is woven into crinoline for ladies' bonnets, plaited into fishing lines, woven into

[1] In German, *Hennegau*; Flemish, *Henagouwen*; French, *Hainaut*; the *Comitatus Henegavensis* or *Hannonia* of Latin chroniclers.

bags for oil and cider pressers, and into straining cloths for brewers, etc., and for numerous other minor uses. The manufactures which arise in connection with human hair are more peculiar than important, although occasionally fashions arise which cause a large demand for human hair. The fluctuations of such fashions determine the value of hair; but at all times long tresses are of considerable value. Gray, light, pale, and auburn hair are distinguished as extra colors, and command much higher prices than the common shades. The value of hair also increases very rapidly with increase in length. Thus while 8-inch hair sells at about 1s. per oz., 36-inch hair will command a price as high as 30s. per oz. Lengths beyond 36 inches are exceptional and command fancy prices, the standard length in the hair trade being 18 inches. The light-colored hair is chiefly obtained in Germany and Austria, and the south of France is the principal source of the darker shades. In the south of France the cultivation and sale of heads of hair by peasant girls is a common practice; and hawkers attend fairs for the special purpose of engaging in this traffic. Hair 5 and even 6 feet long is sometimes obtained. Scarcely any of the "raw material" is obtained in the United Kingdom except in the form of ladies' "combings." Bleaching of hair by means of peroxide of hydrogen is now extensively practised, with the view of obtaining a supply of golden locks, or of preparing white hair for mixing to match gray shades; but in neither case is the result very successful. Human hair is worked up into a great variety of wigs, scalps, artificial fronts, frizzets, and curls, all for supplementing the scanty or failing resources of nature. The plaiting of human hair into articles of jewelry, watch guards, etc., forms a distinct branch of trade. For structure, properties, etc., of the human hair see ANATOMY, vol. i. pp. 788, 789.

HAIRBELL. See HAREBELL.

HAIR-TAIL (*Trichiurus lepturus*), a marine fish, with a long band-like body terminating in a thread-like tail, and with strong prominent teeth in both jaws. Several species are known, of which one, common in the tropical Atlantic, not rarely reaches the British Islands.

HAITI. See HAYTI.

HAJDÚK, sometimes corrupted into HEYDUKE, is the plural form of the Magyar word Hajdú, and was formerly used as the collective name of the undermentioned towns (along with Vámos-Pércs, population 3000) of the old privileged Hajdúk district of Hungary, now included in the county of Hajdú.

HAJDÚ BÖSZÖRMÉNY, the second town in importance of Hajdú county, lies about 11 miles to the N.W. of Debreczin, 47° 41′ N. lat., 21° 31′ E. long. It is the seat of a royal court of law, and was formerly the capital of the Hajdúk district. Among the principal buildings are the old district court-house, a Greek Catholic and two Calvinist churches, a Protestant gymnasium, the post and telegraph offices, and the savings bank. The fairs periodically held in the town attract people from a considerable distance. Population in 1900, 21,238.

HAJDÚ-DOROG is a market-town situated about 10 miles to the N. of Böszörmény, with a Greek Catholic and a Calvinist church. At Dorog the Magyar adherents of the Greek Catholic Church are met with in great numbers. Population 9,911.

HAJDÚ-HADHÁZ is a corporate town lying about 10 miles N. of Debreczin. It has a Calvinist church, post and telegraph offices, and a station on the railway from Nyiregyháza to Debreczin. Population 8,953.

HAJDÚ-NÁNÁS is a market-town, about 24 miles N.N.W. of Debreczin, with a large Calvinist church, a high school for girls, and a Protestant gymnasium. The surrounding country, although on the whole productive, assumes in the west a generally swampy character. Population 15,884.

HAJDÚ-SZOBOSZLO is a corporate town, 12 miles to the S.W. of Debreczin, with which it is connected by railway. Among the principal buildings are a Calvinist church and school, and a royal law-court. Population 15,451.

The Hajdúk district was made over to the Hajdúks in 1605, with special privileges and the rights of nobility, by the Transylvanian prince Stephen Bocskay, as a reward for military service rendered him in his revolutionary campaigns. The inhabitants were confirmed in their possession by the diet of 1613. From 1849 to 1860 the district was united to the county of North Bihar, but it afterwards received a separate cantonal organization. It now forms the principal portion of the new county of Hajdú, constituted in 1876, and including, along with the old Hajdúk district, portions of the neighboring counties of Szabolcs and Bihar. Debreczin is the capital, and the population is computed at about 163,000, mostly Magyars.

HÁJÍPUR, a municipal town in Muzaffarpur district, Bengal, situated on the east bank of the Gandak, a short distance above its confluence with the Ganges opposite Patná, 25° 40′ 50″ N. lat., 85° 14′ 24″ E. long. It is said to have been founded about 500 years ago by one Hájí Ilyás, the supposed ramparts of whose fort, enclosing an area of 360 *bighás*, are still visible. Hájípur figures conspicuously in the history of the struggles between Akbar and his rebellious Afghán governors of Bengal, being twice besieged and captured by the imperial troops, in 1572 and again in 1574. Its command of water traffic in three directions makes the town a place of considerable commercial importance. Within the limits of the old fort is a small stone mosque, very plain, but of peculiar architecture, and attributed to Hájí Ilyás. Two other mosques and a small Hindu and Buddhist temple are in the town or its immediate vicinity. Besides the ordinary courts, the town contains a school, post office, charitable dispensary, and distillery. The population in 1872 numbered 22,306, of whom 18,765 were Hindus and 3510 Mahometans.

HAJJI KHALFA. Mustafa 'bn Abdallah Kátib Chelepí (*c.* 1600–1658), commonly known as Haji (or Hadji) Khalfa (more properly Hájjí Khalífah), was the author of an encyclopædia in Arabic of Oriental biography and bibliography. He was born at Constantinople about the beginning of the 17th century of the Christian era, and after passing the earlier part of his life in military service, studied under Cadhizádeh Effendi, a learned doctor at the Ottoman capital, and made great progress in Arabic literary and linguistic studies. In June, 1633, he again accompanied the army to Syria, but while the troops were in winter quarters at Aleppo, he himself performed the pilgrimage to Mecca, whence he took the cognomen of Hajji, "Pilgrim." Returning in 1635 to Constantinople, he resumed his literary studies, and occupied himself with visiting all the libraries and book shops, and compiling an inventory of their contents, together with notices of the authors of the various works. In 1638 he attended the lectures of Sheikh A'raj Mustafazadah, whom he proposed to himself as an example to imitate in his future literary career. Besides his purely literary studies he also devoted himself assiduously to the sciences, and became well versed in logic, geometry, geography, astronomy, and the like. Nor were medicine and the occult sciences neglected by him, so that there were few of the subjects treated of in the works which he delighted to describe with which he was not more or less technically acquainted. About 1648 he was appointed assessor (khalífa) to the principal of the imperial college, whence he took the title of Khalfa, by which, with the prefix of Hajji (Pilgrim), he is commonly designated. He died in September, 1658.

Besides his great *Bibliographical Lexicon*, he composed several other works, chiefly geographical and historical; of these the best known are *Takwímu 'ttawárikh* or "Chronological Tables," *Tuhfat el Kubár fi asfári Bahár*, a work on the science of naval warfare, *Jehán Numá* or "Mirror of the World," and one or two treatises on miscellaneous literary subjects. The language in which he wrote is Arabic, and the style is that which the nature of his studies would lead us to expect,—correct and grammatical, fairly classical, and abounding in technical terms and phraseology. Of the amount of his learning and of his indefatigable application to study his *Lexicon* is a lasting memorial. There is scarcely a work in the whole range of Arabic, Persian, and Turkish literature, no matter on what subject or science, but it will be found described in this vast encyclopædia, with every piece of collateral information which it was possible to procure or useful to mention. When we remember that it is the Oriental habit to give fancy titles to books that often in no way indicate the nature of their contents, and that one is often obliged to read through pages of irrelevant matter before arriving either at the author's name or the subject of the work, the labor expended on the production of Hajji Khalfa's book appears absolutely incredible. The work has always enjoyed a well-deserved reputation in the East, and has attracted the attention of many European scholars, but we need only mention here the magnificent edition in seven thick 8vo volumes by the eminent Arabic scholar Gustavus Fluegel published at Leipsic in 1835–1858 for the Oriental Translation Fund of Great Britain and Ireland. This edition is accompanied by a Latin page-for-page translation, indices, and notes, and is an indispensable adjunct to every library in which a collection of Oriental books is found. The

Arabic title of the lexicon is *Kashfu zzunún 'an Asámt 'l Kutub wa 'l funún*, "The removal of doubts concerning the names of books and concerning sciences," and the Latin title adopted by Fluegel is *Lexicon Bibliographicum et Encyclopædicum Haji Khalfæ*. After a short preface and an introduction of five chapters comes the encyclopædia proper, the articles in which are arranged in the alphabetical order of the names of the works described. The title of each work is given, a concise account of its contents, the name of the author, and the date, when this could be ascertained; and in many cases the initial phrase is also added to facilitate its identification. Besides the general bibliography, Fluegel's edition contains several appendices of great value to Oriental scholars and librarians. Copious notes and indices complete this splendid edition, one of the finest monuments of Oriental learning which Europe has produced.

HAKE (*Merluccius vulgaris*), a fish belonging to the family of cod-fishes (*Gadidæ*), differing from the common cod in having only two dorsal and one anal fin. It is very common on the coasts of Europe and eastern North America, but its flesh is much less esteemed than that of the true *Gadi*. Specimens 4 feet in length are not scarce. A closely allied fish inhabits the coast of Chili and New Zealand.

HAKIM, or, as the full title runs, EL HÁKIM BI-AMRILLÁH ABOO 'ALEE MANSOOR (985–1020), the sixth of the Fatimite caliphs, and the third of that dynasty ruling in Egypt, founder of the sect of the Druses, was born in 985 A. D., was designated heir apparent in 993, succeeded in 996, and died in 1020. For the principal events of his life and the leading features of his character the reader is referred to the article EGYPT (vol. vii. p. 651). See also DRUSES (vol. vii. p. 418).

HAKLUYT, RICHARD (*c.* 1553–1616), geographer, was born of good family[1] in or near London about 1553. He was elected "one of her Maiesties scholars at Westminster," and it was while there that the bent of his future studies was determined by a visit to his cousin and namesake, Richard Hakluyt of the Middle Temple. His cousin's discourse, illustrated by "certain bookes of cosmographie, an universall mappe, and the Bible," had such an effect upon Hakluyt's mind that he resolved, if opportunity offered, to "prosecute that knowledge and kind of literature." Entering Christ Church, Oxford, in 1570, "his exercises of duty first performed," he fell to his intended course of reading, and by degrees perused all the printed or written voyages and discoveries that he could find. He took his degree of B. A. in 1573–74, and we learn from the Towneley MSS. that two years later he was selected twice in the same year to receive gifts of money.[2] It is highly probable that, shortly after taking his degree of M. A. (1577), he commenced at Oxford the first public lectures in geography that "shewed both the old imperfectly composed and the new lately reformed mappes, globes, spheares, and other instruments of this art."[3]

Hakluyt's first published work was his *Divers Voyages touching the Discoverie of America* (London, 1582, 4to). By reason of his great knowledge of these matters and his acquaintance with "the chiefest captaines at sea, the greatest merchants, and the best mariners of our nation," he was selected in 1583, at the age of thirty, to accompany Sir Edward Stafford, the English ambassador, to Paris in the capacity of chaplain. In accordance with the instructions of Secretary Walsingham, he occupied himself chiefly in collecting information of the Spanish and French movements, and "making diligent inquirie of such things as might yield any light unto our westerne discoverie in America." The first fruits of Hakluyt's labors in Paris are embodied in the most important production of his that has seen the light in modern times; it is entitled *A particuler discourse concerning Westerne discoveries written in the yere 1584, by Richarde Hackluyt of Oxforde, at the requeste and direction of the righte worshipfull Mr. Walter Raghly before the comynge home of his twoo barkes.*[4] This long-lost MS., after failing to find a resting-place in America, was finally acquired by Sir Thomas Phillipps, and is now the property of Rev. J. E. A. Fenwick of Thirlstane House, Cheltenham. The object of the *Discourse* was to recommend the enterprise of planting the English race in the unsettled parts of North America. Hakluyt's other works consist mainly of translations and compilations, relieved by his dedications and prefaces, which last, with a few letters, are the only material we possess out of which a biography of him can be framed.

Hakluyt returned to England in 1584, and during his short stay he had the honor of laying before Queen Elizabeth a copy of the *Discourse* "along with one in Latin upon Aristotle's *Politicks*," which won for him, two days before his departure again for Paris, the grant of the next vacant prebend at Bristol. In the spring of the following year, feeling anxious about the reversion of the prebend, he again visited England, and exhibited in person, on the 24th May, 1585, before the chapter of Bristol cathedral, the queen's mandate for the coveted vacancy already signed and sealed. Before the close of the year the reversion of it fell to him, and in 1586 he was admitted to the prebend, which he held, with his other preferments, till the time of his death.

While in Paris Hakluyt caused to be published the MS. journal of Laudonnière or *Histoire notable de la Florida*, edited by M. Bassanier (Paris, 1586, 8vo). This was translated by Hakluyt and published in London under the title of *A notable historie containing foure voyages made by certayne French Captaynes into Florida* (London, 1587, 4to). The same year *De Orbe Novo Petri Martyris Anglerii Decades octo illustratæ, labore et industria Richardi Hackluyti*, saw the light at Paris. This work contains the exceedingly rare copperplate map dedicated to Hakluyt and signed F. G. (supposed to be Francis Gualle); it is the first on which the name of "Virginia" appears.

In 1588 Hakluyt finally returned to England with Lady Stafford, after a residence in France of nearly five years. In 1589 he published *The Principall Navigations, Voiages, and Discoveries of the English Nation* (fol., London, 1 vol.). In the preface to this we have the announcement of the intended publication of the first terrestrial globe made in England by Molyneux (see GLOBE). On the 20th April, 1590, he was instituted to the rectory of Witheringsett-cum-Brockford, Suffolk. The magnum opus of Hakluyt is *The Principal navigations, Voyages, Traffiques, and Discoveries of the English Nation* (fol., London, 1598–1600, 3 vols.). Some few copies contain an exceedingly rare map,[5] the first on the Mercator projection made in England according to the true principles laid down by Edward Wright. Hakluyt's great work, though but little read, has been truly called the "prose epic of the modern English nation." It is an invaluable treasure of material for the history of geographical discovery and colonization, which has secured for its author a lasting reputation for research and industry.[6] In 1601 Hakluyt edited a translation from the Portuguese of Antonio Galvano, *The Discoveries of the World* (4to, London). On the 4th May, 1602 he was installed prebendary of Westminster, and in the following year elected archdeacon of Westminster. In the license of his second marriage (30th March, 1604) he is also described as one of the chaplains of the Savoy, and his will contains a reference to chambers occupied by him there up to the time of his death; in another official document he is styled D. D.[7] His last publication was a translation of Fernando de Soto's discoveries in Florida, entitled *Virginia richly valued* (London, 1609, 4to). This work was intended to encourage the young colony of Virginia, of which Hakluyt was so zealous a promoter, "to whom England is more indebted for its American possession than to any man of that age."[8]

A number of Hakluyt's MSS., sufficient to form a fourth volume of his collections of 1599–1600, fell into the hands of Samuel Purchas, who inserted them in an abridged form in his *Pilgrimes* (1625–26, fol.). Others are preserved at Oxford (Bib. Bod. MS., Seld. B. 8), which consist chiefly of notes gathered from contemporary authors. Hakluyt died

[1] The Hakluyts were a family of Welsh extraction, not Dutch, as has been supposed. They appear to have settled in Herefordshire as early as the 13th century. The family seat was at Eaton, 2 miles S. E. of Leominster. Hugo Hakelute was returned M. P. for that borough in the 32d parliament of Edward I., 1304–5. See *Return of Members of Parliament*, pt. i. p. 18.

[2] "To one Mr. Hakeluite, B. A. of Christ Colledge in Oxford the 12 of May (1575), by Dr. Humphrey (professor of divinity), 10s. To one Mr. Hackeluitt, the 4th of June, 2s. 6d." (Hist. MSS. Comm. 4th Report, Appendix, p. 614).

[3] That this was not in London is certain, as we know that the first lecture of the kind was delivered in the metropolis on the 4th of November, 1588, by Thomas Hood.

[4] Now first printed from a contemporary MS., with an introduction by Leonard Woods, LL.D., edited by Charles Deane, *Collections of Maine Hist. Soc.*, Camb. (Mass.), 1877, 8vo.

[5] Supposed to be the "new map" of the *Twelfth Night*, act iii., scene 2. See *Trans. of New Shakspere Soc.*, 1877–79, pt. i., 8vo.

[6] In 1809–12 was published a new edition of it by Woodfall & Evans in 5 vols. The last two contain pieces not comprised in the collection of 1598–1600.

[7] *Westminster Abbey Registers*, edited by J. L. Chester, 1876, pp. 113.

[8] Robertson, *Hist. of America*. vol. iv. p. 171, 10th ed.

in 1616, and was buried in Westminster Abbey (November 26); by an error in the abbey register it stands under the year 1626. His best monument is the society that flourishes under his name. Founded in 1846 for the purpose of printing rare and unpublished voyages and travels, "it aims at opening by this means an easier access to sources of a branch of knowledge which yields to none in importance, and is superior to most in agreeable variety." The fifty-seven volumes that have been published by the society since its formation have been edited with great discrimination and care, and have come to be regarded as the standard text-books upon their respective subjects. Some are out of print, and others have passed through two editions. The latest volume published is a reissue in a new form of *The Hawkins Voyages*, the first work published by the society. (C. H. C.)

HAKODADI, or HAKODATE, a seaport town of Japan, in the old province of Hokukaido, on the southern coast of the island of Yczo or Yesso, in 41° 49′ N. lat., and 140° 47′ E. long. Its general position, as has been frequently remarked, is not unlike that of Gibraltar, as the town is built along the north-western base of a rocky promontory (1100 feet in height) which forms the eastern boundary of a spacious bay, and is united to the mainland by a narrow sandy isthmus. At the time of Captain Perry's visit in 1851 few of the buildings of Hakodadi, with the exception of its temples and fire-proof warehouses, were more than one story high, and the roofs were made of slight shingles protected against the effects of wind-storms by heavy stones. Since that date the town has increased considerably in extent, and many of the more modern buildings, such as the new custom-house and the residences of the Government officials, have been erected in a more solid European style. In 1870 there were four European hotels. A new bund or embankment has been constructed along the shore, and several quarters of the town have been laid out in better fashion by the local authorities. Hakodadi is the residence of the governor of Yezo, and the seat of an arsenal. There are four Buddhist and three Shinto temples,—the most important of the former being the Zhioghen-zhi, or Country's Protector, built about 1830. A medical college is maintained in connection with the Government hospital, and in the neighborhood of the town an agricultural college has been erected since 1873. The Bay of Hakodadi, says Sir Rutherford Alcock, is completely land-locked, easy of access, and spacious enough for the largest navies to ride in it, with deep water almost up to the shore, and good holding-ground. The Russians have for a considerable time used it as a winter station for their ships, because their own harbors on the coast of Kamchatka are annually frozen up. Their establishment formerly comprised a handsome consular residence, a hospital, warehouses, and workshops, but the consulate was removed from the port in 1871. Hakodadi has a large local trade; but neither its exports nor its imports are very extensive, and as a commercial centre it will not improbably be superseded by Endermo. The exports comprise awabi, cuttlefish, sea-weed, bêche-de-mer (iriko), sea-otter skins, and deer horns; as many as 30,000 pairs of the last being sometimes shipped in a year. Lead and coal mines exist in the neighborhood. There is telegraphic communication with Tokio (Yedo); and a new road has been made to Sapporu (Satsuporu). The population of the town is estimated at 78,040; in 1872 the foreign settlement had 22 residents. Hakodadi, originally a fishing village belonging to a local daimio, was purchased by the Government and incorporated in the imperial fief of Matsmai. It was opened to American commerce in 1854; and there are now also Danish, German, and English consuls. In 1868 the town was taken by the rebel fleet, but it was recovered by the mikado in 1869.

HAL, a town of Belgium, province of South Brabant, is situated on the Senne and the Charleroi canal, 9 miles S. S. W. of Brussels. It has a beautiful Gothic church of the 14th century, very much resorted to by pilgrims on account of a famous miracle-working image of the Virgin. The church has been enriched by a large number of votive gifts, and contains a beautifully carved high altar of white marble. The principal industries are tanning, soap-boiling, the manufacture of paper, and salt-refining. The population in 1900 was 12,284.

HALA, or HALLA (formerly known as Murtizábád), a town in Hyderabad district, Sind, India, situated on the Alíganj canal and immediately connected with the Trunk Road at two points, 25° 48′ 30″ N. lat., 68° 27′ 30″ E. long. It was long famous for its glazed pottery and tiles, made from a fine clay obtained from the Indus, mixed with flints. The *súsis*, or trouser-cloths, for which the town is also celebrated, are manufactured to the value of £750 yearly. Hála was built about 1800 in consequence of old Hála, 2 miles distant, being threatened with encroachment by the Indus. Among the antiquities round which the new town has grown up are the tomb and mosque of a pír or saint, who died in the 16th century, and in whose honor a fair, largely attended by Mahometans from all parts of the province, is held twice a year. The local trade, chiefly of grain, piece goods, *ghí*, cotton, and sugar, is valued approximately at £3900; the transit trade (in the same articles) at about £700. Population (1872), 4096, including 2646 Mahometans and 1234 Hindus.

HALAS, a corporate town of Hungary, in the megye or county of Pest-Pilis-Solt-Kis-Kun, is situated about 76 miles S. S. E. from Budapest, in 46° 24′ N. lat. and 19° 31′ E. long. The most noteworthy buildings are the Calvinist and Roman Catholic churches, and the Jewish synagogue. Halas contains also a Protestant gymnasium, various literary institutions, and a local tribunal. The inhabitants of the town and neighborhood are mostly engaged in cattle-breeding and agricultural pursuits. Not far from Halas is a lake of the same name, containing an island which was once fortified, and served as a place of refuge to the inhabitants from the incursions of the Turks. Prior to 1876 Halas belonged to the old district of Little Cumania. In the spring of 1879 the town was much injured by floods. The population in 1900 amounted to 17,138, of whom the greater number were Magyars.

HALBERSTADT, the chief town of a circle in the government district of Magdeburg, Prussian province of Saxony, is situated in a beautiful and fertile country on the Holzemme, a tributary of the Bode, and at the junction point of four railways, 29 miles S. W. of Magdeburg. It has an antique appearance, and in a large number of the buildings the mediæval wood-architecture is still preserved. About a mile and a half distant from Halberstadt are the *Spiegel'sche Berge*, from which there is obtained a fine view of the surrounding country. The town possesses a cathedral in the Pointed style, dating from the 13th and 14th centuries, and restored between 1850 and 1871, containing a rich Gothic screen of the date of 1510, other interesting antiquities, beautiful glass windows, and several valuable paintings. Of the remaining churches the only one of special interest is the Liebfrauenkirche, a basilica in the later Romanesque style, dating from the 12th and 13th centuries, and restored in 1848, containing noteworthy wall paintings and figures in relief. Among the other old buildings may be mentioned the town-house, dating from the 14th century and restored in the 17th century; the town hall crypt, dating from the 15th century; and the Petershof, formerly the residence of the bishop, but now used as a custom house. The principal educational establishments are the gymnasium—the new buildings for which were opened in 1875—with a library of 30,000 volumes; the real-school of the first order; the normal school, connected with which there is a deaf and dumb institute; and the provincial trade school. Near the cathedral is a building called the temple of friendship which contains a collection of the portraits of the friends of the poet Gleim, who was a resident in the town, and whose house was the resort of a large circle of poets and scholars. In the same neighborhood a beautiful monument in the Early Pointed style has been erected to the memory of those who fell in the late Franco-German war. The principal manufactures of the town are linen and woollen cloth, leather, paper, gloves, wadding, cigars, soap, oil, sugar, chemical products, brandy, and liqueurs. The population in 1905 was 45,529.

Halberstadt owes its origin to the foundation in the 9th century of the bishopric of which it became the seat. It received town rights from Bishop Arnulf in 998. It was burnt down in 1113 by the emperor Henry V., and in 1179 by Henry the Lion. At the peace of Westphalia in 1648 the bishopric was united as a principality to Brandenburg. At the Tilsit peace in 1807 it was joined to Westphalia, but in 1813 it again came into the possession of Prussia.

See Lucanus, *Der Dom zu Halberstadt*, 1837, *Wegweiser durch Halberstadt*, 2d edition 1866, and *Die Liebfrauenkirche zu Halberstadt*, 1872; Scheffer, *Inschriften und Legenden Halberstädtischer Bauten*, 1864; Schmidt, *Urkundenbuch der Stadt Halberstadt*, Halle, 1878.

HALBERT, Halbard (French *Halebarde*), a weapon consisting of an axe-blade balanced by a pick and having an elongated pike-head at the end of the staff, which was usually about 5 or 6 feet in length. Various derivations have been suggested for the term, but M. Demmin seems to have hit the right one in the German *Halb-barthe*, "half battle-axe." The earliest halberts represented in the miniatures of the 14th century, or preserved in the collections of Switzerland and Germany, have the axe-blade often prolonged beyond the end of the staff, and thus resemble the English bill of the 15th century. Fauchet, in his *Origines des Dignitez*, printed in 1600, states that Louis XI. of France ordered certain new weapons of war called *hallebardes* to be made at Angers and other places in 1475. The Swiss had a mixed armament of pikes and halbards at the battle of Morat in 1476. We find the same mixture of billmen and halbardiers in the English army at the same period. In the 15th and 16th centuries the halbards became larger, and the blades were formed in many varieties of shape, often engraved, inlaid, or pierced in open work, and exquisitely finished as works of art. This weapon was in use in England from the reign of Henry VII. to the reign of George III., when it was still carried by sergeants in the guards and other infantry regiments. It is still retained as the symbol of authority borne before the magistrates on public occasions in some of the burghs of Scotland. The Lochaber axe may be called a species of halbert furnished with a hook on the end of the staff at the back of the blade.

HALDANE, James Alexander (1768–1851), whose disinterested labors in the cause of religion have secured for his name an honorable place in the ecclesiastical history of Scotland, was the younger son of Captain James Haldane of Gleneagles, Perthshire, and was born at Dundee on July 14, 1768. Educated first at Dundee and afterwards at the High School and university of Edinburgh, he shortly after the completion of his sixteenth year entered the service for which he had been from his childhood destined, by joining the "Duke of Montrose" East Indiaman as a midshipman. After four voyages to India he in the summer of 1793 was nominated to the command of the "Melville Castle;" but having, during a long and unexpected detention of his ship, begun a careful study of the Bible, he came under deep religious impressions and, somewhat abruptly resolving to quit the naval profession, returned to Scotland before his ship had sailed. About the year 1796 he became acquainted with the celebrated evangelical divine, Simeon of Cambridge, in whose society he made through Scotland more than one tour, in the course of which he endeavored by tract-distribution and other means to awaken others to somewhat of that interest in religious subjects which he himself so strongly felt. In May, 1797, he preached, at Gilmerton near Edinburgh, his first sermon with a success which was considered to be very encouraging; and during the next few years he made repeated missionary journeys, preaching wherever he could obtain hearers, and generally in the open air. Not originally disloyal to the Church of Scotland, he was gradually driven by the hostility of the Assembly and the exigencies of his position into a separatistic attitude; in 1799 he was ordained on the principles of Independency as pastor of a large congregation in Edinburgh, to which he continued gratuitously to minister for more than fifty years; and in 1808 he made public avowal of his conversion to Baptist views. As advancing years compelled him to withdraw from the more exhausting labors of itineracy and open-air preaching, he sought more and more to influence the discussion of current religious and theological questions by means of the press, and by numerous pamphlets took part in the controversies connected with the names of Edward Irving, Erskine of Linlathen, Campbell of Row, and others. His latest works were a treatise on the *Doctrine of the Atonement* (1845) and an *Exposition of the Epistle to the Galatians* (1848). He died on the 8th of February, 1851.

HALDANE, Robert (1764–1842), elder brother of the preceding, and intimately associated with him in many of his labors, was born in London on February 28, 1764. After attending classes in the Dundee grammar school and in the High School and university of Edinburgh he in 1780 joined H. M. S. "Monarch," of which his uncle Lord Duncan was at that time in command, and in the following year was transferred to the "Foudroyant," on board of which, during the night engagement with the "Pegase," he distinguished himself so much that Captain Jervis (afterwards Lord St. Vincent) wrote to Admiral Duncan predicting a brilliant future for his nephew. Haldane was afterwards present at the relief of Gibraltar, but at the peace of 1783 he finally left the navy, and soon afterwards settled on his estate of Airthrey, near Stirling. The earlier phases of the French Revolution as they occurred attracted his attention and at first excited his deepest sympathy, a sympathy which induced him, at the cost of making many enemies, to avow his strong disapproval of the war with France. As his bright and oversanguine visions of a new order of things to be ushered in by political change disappeared, he, unlike Wordsworth's "Solitary," began to direct his thoughts to religious subjects, and underwent a spiritual change which, while neither sudden nor violent, was decisive and complete. Resolving to devote himself and his means wholly to the advancement of Christianity, his first proposal for that end, made in 1796, was to organize a vast mission to Bengal, of which he was to provide the entire expense; with this view the greater part of his estate was sold, but after every arrangement had been well nigh completed, the East India Company refused to sanction the scheme, which therefore had to be reluctantly abandoned. In December, 1797, he joined his brother and some others in the formation of the "Society for the Propagation of the Gospel at Home;" and in building chapels or "tabernacles" for its congregations, in supporting its missionaries, and in maintaining institutions for the education of young men to carry on its work, he in the course of the twelve years which followed is stated on good authority to have expended upwards of £70,000. In 1816 he visited the Continent, and first at Geneva and afterwards in Montauban (1817) occupied himself in lecturing with surprising success to theological students, among whom were Malan, Monod, and Merle D'Aubigné. Returning to Scotland in 1819, he lived partly on his estate of Auchengray and partly in Edinburgh, and like his brother took an active part, chiefly through the press, in many of the religious controversies of the time. He died on the 12th of December, 1842.

In 1816 he published a work on the *Evidences and Authority of Divine Revelation*, and in 1819 the substance of his theological prelections in a *Commentaire sur l'Épître aux Romains*. Among his later writings, besides numerous pamphlets on what was known as "the Apocrypha controversy" and on the sabbatarian question, are a treatise *On the Inspiration of Scripture* (1828), which has passed through seven editions, and a later *Exposition of the Epistle to the Romans* (1835), which has been frequently reprinted, and has been translated into French and German. See *Memoirs of R. and J. A. Haldane*, by Alexander Haldane (1852).

HALE, Sir Matthew (1609–1676), lord chief-justice of England, was born on November 1, 1609, at Alderley in Gloucestershire, where his father, a retired barrister, had a small estate. His paternal grandfather was a rich clothier of Wotton-under-Edge; on his mother's side he was connected with the noble family of the Poyntzes of Acton. Both his parents having died before he was five years old, the future chief-justice was placed by his guardian under the care of Mr. Staunton, vicar of Wotton-under-Edge, through whose influence he became strongly imbued with puritanical principles. There he remained till he attained his sixteenth year, when he entered Magdalen Hall, Oxford, under the tuition of the puritanical but learned Obadiah Sedgwick. At Oxford Hale devoted himself for several terms to the study of Aristotle and Calvin with a view to holy orders, and manifested that steadiness and application which in after years secured his reputation and advancement. But suddenly there came a change. The diligent student, at first attracted by a company of strolling players, threw aside his studies, and plunged carelessly into gay society. He soon decided to change his profession; and resolved to trail a pike as a soldier under the prince of Orange in the Low Countries. Before going abroad, however, Hale found himself obliged to proceed to London in order to give instructions for his defence in a legal action which threatened to deprive him of his patrimony. His leading counsel was the celebrated Serjeant Glanville, who, perceiving in the acuteness and sagacity of his youthful client a peculiar fitness for the legal profession, succeeded, with much difficulty, in inducing him to renounce his military for a legal career, and on the 8th November, 1629, Hale became a member of the honorable society of Lincoln's Inn.

He immediately resumed his habits of intense application.

The rules which he laid down for himself, and which are still extant in his handwriting, prescribe sixteen hours a day of close application, and prove, not only the great mental power, but also the extraordinary physical strength he must have possessed, and for which indeed, during his residence at the university, he had been remarkable. During the period allotted to his preliminary studies, he read over and over again all the year-books, reports, and law treatises in print, and at the Tower of London and other antiquarian repositories examined and carefully studied the records from the foundation of the English monarchy down to his own time. Even the common-place book which he composed as the result of his study and research may, according to Lord Campbell, "be considered a *corpus juris* embracing and methodizing all that an English lawyer on any emergency could desire to know." But Hale did not confine himself to law. He dedicated no small portion of his time to the study of pure mathematics, to investigations in physics and chemistry, and even to anatomy and architecture; and there can be no doubt that this varied learning enhanced considerably the value of many of his judicial decisions.

Hale was called to the bar in 1637, and almost at once found himself in full practice. Though neither a fluent speaker nor bold pleader, in a very few years he was at the head of his profession. He entered public life at perhaps the most critical period of English history. Two parties were contending in the state, and their obstinacy could not fail to produce a most direful collision. But amidst the confusion Hale steered a middle course, rising in reputation, and an object of solicitation from both parties. Taking Pomponius Atticus as his political model, he was persuaded that a man, a lawyer, and a judge could best serve his country and benefit his countrymen by holding aloof from partisanship and its violent prejudices, which are so apt to distort and confuse the judgment. But he is best vindicated from the charges of selfishness and cowardice by the thoughts and meditations contained in his private diaries and papers, where the purity and honor of his motives are clearly seen. It has been said, but without certainty, that Hale was engaged as counsel for the earl of Strafford; he certainly acted for Archbishop Laud, Lord Maguire, Christopher Love, the duke of Hamilton, and others. It is also said that he was ready to plead on the side of Charles I. had that monarch submitted to the court. The parliament having gained the ascendency, Hale signed the Solemn League and Covenant, and was a member of the famous Assembly of Divines at Westminster in 1644; but although he would undoubtedly have preferred a Presbyterian form of church government, he had no serious objection to the system of modified Episcopacy proposed by Ussher. Consistently with his desire to remain neutral, Hale took the engagement to the Commonwealth as he had done to the king, and in 1653, already serjeant, he became a judge in the Court of Common Pleas. Two years afterwards he sat in Cromwell's parliament as one of the members for Gloucestershire. After the death of the Protector, however, he declined to act as a judge under Richard Cromwell, although he represented Oxford in Richard's parliament. At the Restoration in 1660 Hale was very graciously received by Charles II., and in the same year was appointed chief baron of the exchequer, and accepted, with extreme reluctance, the honor of knighthood. After holding the office of chief baron for eleven years he was raised to the higher dignity of lord chief-justice, which he held till February, 1676, when his failing health compelled him to resign. He retired to his native Alderley, where he died on December 25th of the same year. He was twice married, and survived all his ten children save two.

As a judge, Sir Matthew Hale discharged his duties with resolute independence and careful diligence. Lord Campbell says of him that "he is certainly to be considered the most eminent judge who ever filled the office [of chief baron]; and being promoted to be chief-justice of England, he gave new dignity to the supreme magistracy which had been illustrated by Gascoigne, by Fortescue, and by Coke." His sincere piety made him the intimate friend of Barrow, Tillotson, Wilkins, and Stillingfleet, as well as of the Nonconformist leader Baxter. He is chargeable, however, with the condemnation and execution of two poor women tried before him for witchcraft in 1664, a kind of judicial murder then falling under disuse. He is also reproached with having hastened the execution of a soldier for whom he had reason to believe a pardon was preparing.

Of Hale's legal works the only two of importance are his *Historia Placitorum Coronæ, or History of the Pleas of the Crown*, first published in 1739; and the *History of the Common Law of England, with an Analysis of the Law*, etc., 1713. Among his numerous religious writings the *Contemplations, Moral and Divine*, occupy the first place. Others are *The Primitive Origination of Man*, 1677; *Of the Nature of True Religion*, etc., 1684; *A Brief Abstract of the Christian Religion*, 1688. One of his most popular works is the collection of *Letters of Advice to his Children and Grandchildren*. He also wrote an *Essay touching the Gravitation and Nongravitation of Fluid Bodies*, 1673; *Difficiles Nugæ, or Observations touching the Torricellian Experiment*, etc., 1675; and a translation of the *Life of Pomponius Atticus*, by Cornelius Nepos. His efforts in poetry were inauspicious. He left his valuable collection of MSS. and records to the library of Lincoln's Inn. His life has been written by Burnet, 1682; by Williams, 1835; by Roscoe, in his *Lives of Eminent Lawyers*, in 1838; and by Lord Campbell, in his *Lives of the Chief Justices*, in 1849.

HALES, Stephen (1677–1761), physiologist and inventor, was born at Beckesbourn in Kent, on the 7th September, 1677. He was the sixth son of Thomas Hales, whose father, Sir Robert Hales, was created baronet by Charles II. in 1670. Of his early education little is known, but in June, 1696, he was entered as a pensioner of Bene't (now Corpus Christi) College, Cambridge, with the view of taking holy orders. On 16th April, 1702, he was elected and in February, 1703, admitted to a fellowship. He received the degree of master of arts in 1703, and of bachelor of divinity in 1711. While at college one of his most intimate friends was William Stukeley, with whom he studied anatomy, chemistry, etc. In 1710 Hales was presented to the perpetual curacy of Teddington in Middlesex, where he remained all his life, notwithstanding that he was subsequently appointed rector of Porlock in Somerset, and later of Farringdon in Hampshire. In March, 1717, he was elected fellow of the Royal Society, to whose *Transactions* he contributed many valuable papers. In 1732 he was named one of a committee for establishing a colony in Georgia, and the next year he received the degree of doctor of divinity. He was appointed almoner to the princess-dowager of Wales in 1750. On the death of Sir Hans Sloane in 1753, Hales was chosen foreign associate of the French Academy of Sciences. He died at Teddington, January 4, 1761.

Hales is celebrated as the inventor of a "ventilator," by means of which fresh air was introduced into jails, hospitals, mines, ships' holds, etc. In the four years (1749–52) after its introduction into the Savoy prison, only 4 prisoners died; while previously the mortality had been from 50 to 100 per annum. The invention met with immediate favor, especially in France. Hales was the designer of other inventions by means of which sea-water was distilled, corn cleaned and preserved, meat preserved on long voyages, etc.

His chief writings are his *Statical Essays* (see Chemistry, vol. v. p. 400), consisting of *Vegetable Staticks, or an Account of some Statical Experiments on the Sap in Vegetables* (1727), and *Hæmostaticks, or an Account of Hydraulick and Hydrostatick Experiments made on the Blood and Blood-vessels of Animals* (1733). His essay on *The Means of Dissolving the Stone in the Bladder*, etc., gained him the Copley gold medal in 1737. His *Admonition to the Drinkers of Gin, Brandy*, etc., appeared in 1734; the *Vegetable Staticks*, translated by Buffon, in 1735, and the *Hæmostaticks*, by M. de Sauvages, in 1744. For sketch of his life, with portrait, see *Gardener's Chronicle*, 1877, pp. 16–17.

HALÉVY, Jacques François Fromental (1799–1862), a celebrated French musician, was born May 27, 1799, at Paris. He studied at the Paris Conservatoire under Berton and Cherubini, and in 1819 gained the grand prix de Rome with a cantata called *Herminie*. In accordance with the conditions of his scholarship he started for Rome, where he devoted himself to the study of Italian music, and wrote an opera and various minor works. His first opera produced in Paris after his return from Italy was called *L'Artisan*, which saw the light at the Théâtre Feydeau in 1827, apparently without much success. Other works of minor importance, and now forgotten, followed, amongst which only a ballet named *Manon Lescaut*, produced in 1830, deserves mention. Five years later, in 1835, Halévy produced the tragic opera *La Juive* and the comic opera *L'Éclair*, and on these works his immortality is

mainly founded. Both have kept the stage to the present day, and will probably survive changes of taste even greater than those which music has undergone in France during the last forty years. *The Jewess* is in every way representative of the French *grand-opéra*, the modern outgrowth of Gluck's music-drama with a strong admixture of the Italian element and of an excess of spectacular splendor wholly strange to the classic simplicity of the original. It is curious that the *grand-opéra*, although an essentially national product of France, was both initiated and brought to its highest perfection by two Germans—Gluck and Meyerbeer. The genius of the latter was fatal to Halévy's fame. By the side of the *Huguenots* the merits of *La Juive* appear in almost diminutive proportions. At the same time Halévy's work ought not to be treated with contempt. It is full of fine dramatic features, and especially the introduction of the Jewish element—with which Halévy, himself a Jew, was well acquainted—gives a peculiar interest on this score. *L'Éclair* is a curiosity of musical literature. It is written for two tenors and two soprani, without a chorus, and displays the composer's mastery over the most refined effects of instrumentation and vocalization in a favorable light. After these two works, to which Halévy owed his fame and his seat at the Institute, he wrote numerous operas of various *genres*, amongst which only *La Reine de Chypre*, a spectacular piece analyzed by Wagner in one of his Paris letters (1841), and *La Tempesta*, in 3 acts, written for Her Majesty's Theatre, London (1850), need be referred to. In addition to his productive work Halévy also rendered valuable services as a teacher. He was professor at the Conservatoire from 1827 till his death—some of the most successful amongst the younger composers in France, such as Gounod, Victor Massé, and Georges Bizet, the author of *Carmen*, being amongst his pupils. Halévy also tried his hand at literature, and there exists an agreeable volume of *Souvenirs et Portraits* from his pen.[1] He died at Nice, March 17, 1862.

HALIBURTON, Thomas Chandler (1796–1865), long a judge of Nova Scotia, and a popular literary satirist, was born at Windsor, Nova Scotia, in 1796, and received his education there, at King's College. He was called to the bar in 1820, and took part in the legislature of his native province as a member of the House of Assembly. He distinguished himself as a barrister, and in 1828 was promoted to the bench as a chief-justice of the common pleas. But it is as the brilliant humorist and satirist that he is now remembered; for his labors alike as a barrister and a member of parliament were limited to his own province, and could scarcely beget anything beyond a local reputation. Yet confined as he thus was to so narrow a sphere, a true estimate of its disadvantages is necessary in order to do justice to the vigorous individuality of his writings. He was a native of what was then a small and isolated maritime province, detached from Canada. Its exports consisted chiefly of lumber and the produce of its fisheries; and with those trade was carried on with Great Britain, the West Indies, and the United States. Its entire population at the time when Haliburton was called to the bar, including Indians, African refugees from the States, and the Acadian descendants of the original French population, did not amount to 97,000. The English settlers were largely composed of refugees from the former British colonies, animated by the strong Conservative sympathies of the old colonial loyalists. The French Acadians were Roman Catholics, and their national traditions and religion equally tended to alienate them from the neighboring republic.

In politics Haliburton adhered through life to the Conservative party; and the influence of his early associations is traceable in most of his writings. He was still at the bar when he wrote *An Historical and Statistical Account of Nova Scotia*, in 2 vols. Canada, it will be remembered, then consisted of Upper and Lower Canada only, and, with the French population of the latter and nearer province, was even stranger to the Nova Scotian than the New England States. The leisure which judicial duties secured admitted of literary relaxations in which Judge Haliburton's fine sense of the humorous had free play; and in 1835 he contributed anonymously to a local paper a series of letters professedly depicting the peculiarities of the genuine Yankee. These sketches, which abounded in clever picturings of national and individual character, drawn with great satirical humor, were collected in 1837, and published under the title of *The Clockmaker, or Sayings and Doings of Samuel Slick of Slickville*. A second series followed in 1838, and a third in 1840. *The Attaché, or Sam Slick in England* (2 vols. 8vo), was the result of a visit there in 1841. This also was followed up by a second series in 1844. His other works include—*The Old Judge, or Life in a Colony; The Letter Bag of the Great Western; Rule and Misrule of the English in America; Traits of American Humor* and *Nature and Human Nature*.

While the judge was thus diligent in such literary recreations, he continued to secure popular esteem in his judicial capacity. In 1840 he was promoted to be a judge of the supreme court; but within two years he resigned his seat on the bench, removed to England, and after a time entered parliament as the representative of Launceston, in the Conservative interest. His literary reputation awoke expectations which were not fulfilled. The bar has rarely proved to be an apt school for training the parliamentary debater, and he was too far advanced in life to adapt himself to the novel requirements of the English House of Commons. The last time he spoke he was listened to with interest on the Canadian defences. But the tenure of his seat for Launceston was brought to an end by the dissolution of the parliament in 1865, and he did not again offer himself to the constituency. His death followed in the month of August of the same year, at Gordon House, Isleworth, when he was in his seventieth year.[2]

HALIBUT. See Holibut.

HALICARNASSUS, an ancient Greek city on the south-western coast of Asia Minor, built on a picturesque and advantageous site at the northern end of the Ceramic Gulf or Gulf of Cos. It originally occupied only the small island of Zephyria, close to the shore, but in course of time this island was united to the mainland and the city extended so as to incorporate Salmacis, an older town of the Leleges and Carians. About the foundation of Halicarnassus various traditions were current; but they agree in the main point as to its being a Dorian colony, and the figures on its coins, such as the head of Medusa or Minerva, the head of Neptune, or the trident, give support to the statement that the mother cities were Trœzen and Argos. The inhabitants appear to have accepted as the legendary founder Anthes, mentioned by Strabo, and were proud of the title of Antheadæ. At an early period Halicarnassus was a member of the Doric Hexapolis, which included Cos, Cnidus, Lindus, Camirus, and Ialysus; but one of the citizens, Agasicles, having taken home the prize tripod which he had won in the Triopian games instead of dedicating it according to custom to the Triopian Apollo, the city was cut off from the league. In the time of Xerxes we find Halicarnassus under the sway of a certain Artemisia, who made herself famous by the assistance she rendered to the great Persian invader. Pigres, her brother or son, was the reputed author of the *Batrachomyomachia*. Of Pisindalis, her son and successor in the sovereignty, little is known; but Lygdamis, who next attained to power, is notorious for having put to death the poet Panyasis and caused Herodotus, the greatest of the Halicarnassians, to leave his native city (*c.* 457 B. C.). About the close of the 5th century B. C., the power of Athens became predominant over Halicarnassus and other Dorian cities of Asia, but the peace of Antalcidas in 387 made them subservient to Persia; and it was under Mausolus, a Persian satrap of almost independent authority, that Halicarnassus attained its highest prosperity. Struck by the natural strength and beauty of its position, Mausolus removed thither from Mylasa, and increasing its population by the inhabitants of six towns of the Leleges, devoted himself to its embellishment and defence. On his death he was succeeded by his widow and sister, Artemisia, whose military ability was shown by the stratagem by which she captured the Rhodian vessels attacking her city, and whose magnificence and taste have been perpetuated to all time by the "Mausoleum," the monument she erected to her husband's memory. In the execution of this wonderful enterprise she employed the architects Satyrus and Pythius,

[1] [His brother Léon (1802–83), poet and dramatist, translator into French of Greek drama and modern European poetry, had a son, Ludovic (born 1834), a prolific composer of light operas, a popular novelist, and an Academician.—Am. Ed.]

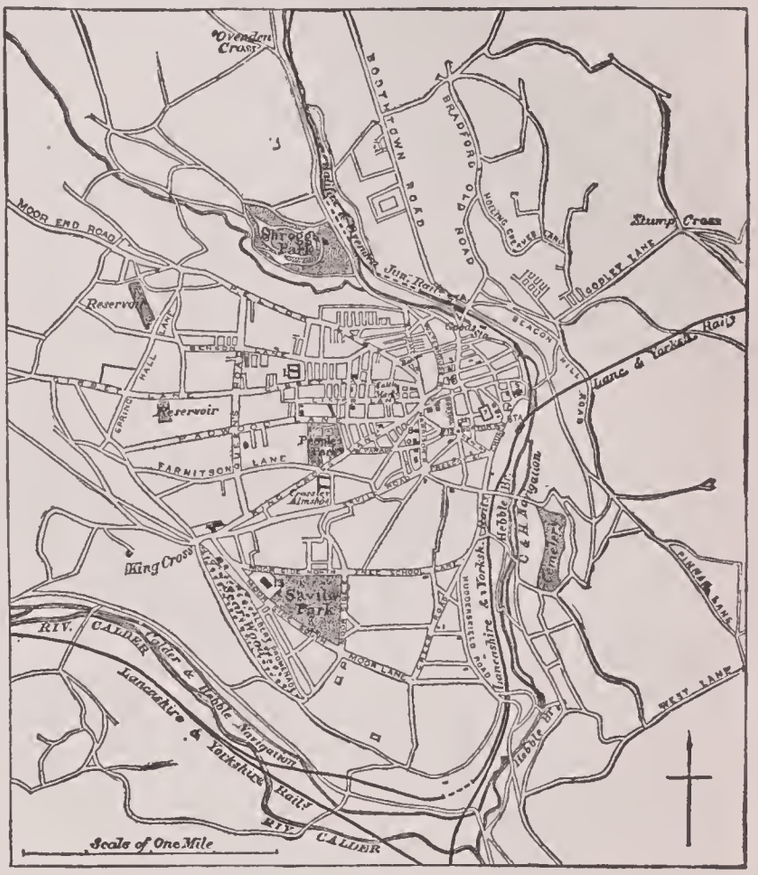
[2] Judge Haliburton was descended from the branch of the Newmains and Merton family which figures in the genealogical memorials of the Haliburtons in their relation to that of Sir Walter Scott, whose paternal grandmother was Barbara Haliburton. The note of all the families of the name drawn up by the father of the poet and novelist was prepared in reply to inquiries of the father of Judge Haliburton, with a view to the establishment of his claims to certain family property. Of a younger branch of the Newmains family that went to Jamaica, one member removed to Massachusetts. A son of his, the father of the judge, migrated to Nova Scotia, and there, in 1790, he revived old hereditary rights, and reclaimed relationship with the original Scottish stock.

and the sculptors Scopas, Leschares, Bryaxis, and Timotheus; and though she died before its completion, they continued it with all the enthusiasm of artists. In the history of Halicarnassus the next important events were connected with the conquests of Alexander the Great. Memnon, satrap of the west coast, having taken refuge within its walls after the battle of Granicus, it was besieged by the Macedonians, captured, and plundered, Not long afterwards we find the citizens receiving the present of a gymnasium from Ptolemy, and building in his honor a stoa or portico; but the city never recovered altogether from the disasters of the siege, and Cicero describes it as almost deserted. The site is now occupied by the town of Budrun, but the ancient walls can still be traced in nearly all their circuit, and the position of several of the temples and public buildings can be fixed with considerable certainty.

From the ruins of the Mausoleum sufficient has been recovered by the excavations carried out in 1867 by C. T. Newton to enable a fairly complete restoration of its design. According to Mr. Pullan, Mr. Newton's collaborator, the building consisted of five parts—a basement or podium, a pteron or enclosure of columns, a pyramid and pedestal, and a chariot group. The basement, probably 51 feet in height, and covering an area of 114 feet by 92, was built of blocks of greenstone and cased with marble, the monotony of the plain-courses being possibly broken by one or more belts of frieze. The pteron, 37½ feet in height, consisted (according to Pliny) of thirty-six columns of the Ionic order, enclosing a square *cella*, the walls of which were relieved by friezes. From the portions that have been recovered it appears that the principal fricze of the pteron represented combats of Greeks and Amazons. "Throughout," says Mr. Newton, "there is a skilful opposition of nude and draped male and female forms; but the groups and figures are much less intermixed than in the Parthenon and Phigalian friezes. The whole surface was colored, the ground of the relief being ultramarine and the flesh a dim red, while the drapery and armor were picked out with various hues." Fragments have been found of two other friezes of doubtful position in the monument, one representing a chariot race and the other a centaur fight. Above the pteron rose the pyramid, approximately 108 feet long and 86 feet wide at the base, and mounting by 24 steps to an apex or pedestal, which possibly had a length of 25 feet 6 inches and a breadth of 20 feet. On this apex stood the quadriga or chariot with the figure of Mausolus himself and an attendant deity acting as his charioteer. The height of the statue of Mausolus—it has happily been preserved and forms part of the treasures of the British Museum—is 9 feet 9½ inches without the plinth. The hair rising from the forehead falls in thick waves on each side of the face and descends nearly to the shoulder; the beard is short and close, the face square and massive, the eyes deep set under overhanging brows, the mouth well formed with settled calm about the lips. The drapery, consisting of a chiton and mantle, is grandly composed. Such are the main features of the great Mausoleum which deservedly ranked among the wonders of the world. The minor edifices and sculptural remains of Halicarnassus are of secondary moment. Of well-preserved inscriptions the number is comparatively few; but one or two (such as that containing the names of Lygdamis and Panyasis) are of no small interest to the archæologist.

For further details see Rose, *Reise durch den Inseln Griechenlands;* Hamilton's *Researches in Asia Minor;* and Newton's *History of Discoveries at Halicarnassus*, 1862–3, and his *Travels in the Levant*, 1865.

HALIFAX, a municipal and parliamentary borough and market-town of England, in the northern division of the West Riding of Yorkshire, is situated on a gentle acclivity almost surrounded by hills, on the small river Hebble near its junction with the Calder, 7 miles south-west of Bradford. Originally its streets were narrow and irregular, but many of the older houses have been pulled down and new streets opened up, while the constant additions made to it through the rapid increase of population have completely changed its appearance. The principal buildings are the parish church of St. John, the restoration of which was completed in 1879 at a cost of £16,000, a structure in the Perpendicular style, of different dates, and having the western tower 117 feet in height; All Souls Church, begun in 1859 from the designs of Sir Gilbert Scott, and erected at the expense of Mr. Edward Akroyd, in the Early Decorated style, very richly ornamented with statues and carvings in Italian marble, serpentine, and alabaster, and consisting of nave, aisles, transepts, and chancel, with a very graceful tower and spire at the north-west angle 236 feet in height, and a sacristy at the north-east; the Square Church, erected by the Congregationalists in 1857 at a cost of £16,000, an ornate cruciform building with a tower and elaborate crocketed spire rising to a height of 235 feet; the town-hall, completed in 1863 after the designs of Sir Charles Barry at a cost of £40,000; the infirmary, a large and elegant building in which medical and surgical aid is afforded to outdoor as well as indoor patients; the Waterhouse charity school, a handsome set of buildings forming three sides of a quadrangle, erected in 1855; the Crossley almshouses, erected and endowed by Sir



Plan of Halifax.

1. Workhouse.
2. Oddfellows' Hall.
3. Town Hall.
4. Mechanics' Institute.
5. St. John's Church.
6. Square Church.
7. Piece Hall.
8. Post-Office.
9. Museum.
10. Infirmary.
11. Theatre.
12. Prince Albert's Monument.
13. Crossley Orphan Home.

Francis and Mr. Joseph Crossley; the piece-hall, a large quadrangular structure occupying more than 2 acres of ground, erected in 1799 for the lodgment and sale of piece goods, but now used as a market for fish and vegetables; the free grammar school, founded in 1585 under royal charter for instruction in the classical languages; the Crossley orphan home and school, built by the Crossley brothers at a cost of £46,000; the museum, the oddfellows' hall, the working men's college, the mechanics' institute, the assembly and concert rooms, and the theatre. There are three public parks, viz., Savile Park, 50 acres in extent; the People's Park, 12½ acres, laid out in a highly ornamental style from the designs of Sir Joseph Paxton, and presented to the town in 1858 by Sir Francis Crossley; and the Shrogg's Park, 25 acres, opened in 1877. The North Bridge, a fine structure of iron, spans the Hebble valley in two arches. Halifax derives its importance from its manufactures of cloth, which began in the 15th century. It ranks in Yorkshire with Leeds, Bradford, and Huddersfield as a seat of the woollen and worsted manufacture. The principal staples are carpets, cashmeres, orleanses, coburgs, merinoes, lastings, alpacas, damasks, baizes, broad and narrow cloths, kerseymeres, blankets, muslin-de-laines, shalloons, and figured vestings. A considerable number of persons are employed in iron-works, machine works, and chemical works, and in the neighboring coal-mines and stone quarries. The borough sends two members to parliament. The parish is the largest in Great Britain, embracing 79,200 acres. The population of the municipal and parliamentary borough in 1861 was 37,014, and in 1901 (with an extended area of 3704 acres) 104,933.

Two derivations are given for the name Halifax. According to Camden it means "holy hair," and he accounts for the origin of the name from the fact that the head of a virgin who had been murdered by a wicked clerk was suspended on a tree in the neighborhood, which came to be much resorted to by pilgrims. According to another account, the name means "holy face," and is derived from an image of St. John once preserved in a neighboring hermitage. The first mention of the town is in the 12th century, when its church was granted by William, earl of Warren, to the priory of Lewes in Sussex. When its manufactures commenced in the beginning of the 15th century the number of its houses was only 15, but they had increased in 1540 to 520. It is said to have received a considerable accession to its inhabitants and impulse to its prosperity from the merchants who fled from the Netherlands to escape the persecution carried out under the auspices of the duke of Alva. In 1642 it was garrisoned by the forces of the parliament, and near it at a place still called the Bloody Field an engagement took place between them and the royalists. In the forest of Hardwick, then coextensive with the parish of Halifax, there at one time existed a custom called the "Gibbet Law," according to which any person suspected to be in the unlawful possession of goods to the value of 13½d. was tried by the frithburghers of the liberty, and if condemned was executed on a market day by a kind of axe resembling the modern guillotine. The last execution took place in 1650. A number of eminent men have been born in the town or neighborhood of Halifax, including the mathematician Henry Briggs, Archbishop Tillotson, Sir Henry Savile, and John Foster. Daniel Defoe resided for some time in the town.

HALIFAX, a city and seaport of British North America, capital of Nova Scotia, is situated on the south-east coast of the province on the declivity of a hill about 250 feet in height, rising gradually from the south-west side of Chebucto Bay or Halifax harbor, a deep inlet of the sea. The hill is commanded by a citadel about a mile in circumference and of great strength, and the harbor is defended by several forts and batteries. Originally the houses were chiefly of wood plastered or stuccoed, but the frequent recurrence of fires has led to a more general use of stone or brick as building materials. Many of them have an imposing and elegant appearance; and the streets are spacious and regularly laid out, crossing each other at right angles. Including its suburbs the city is from 2 to 3 miles long and about 1 mile broad. The principal buildings are the Government house, the official residence of the lieutenant-governor of Nova Scotia, a solid sombre-looking structure at the south of the town; the provincial building, near the centre of the town, 140 feet long by 70 feet broad, with a fine Ionic colonnade, and comprising the Government offices, the post-office, the city library and the provincial museum; the parliament building, the court-house, the admiralty house, the exchange, the Roman Catholic cathedral of St. Mary, the rooms of the young men's Christian association, the Wellington barracks, the military hospital, the lunatic asylum, the workhouse, the jail, and the penitentiary. The educational establishments include the Dalhousie college and university, the St. Mary's Roman Catholic college, the Presbyterian theological college, the High School, the almshouse of industry for girls, two orphan asylums, a blind asylum, a lunatic asylum for the Lower Provinces, two industrial schools, and nearly twenty public schools. A lighthouse has been erected on the west side of the entrance to the harbor on a small island off Sambro Cape. After passing Sambro the course for large vessels is to the west of M'Nab's Island, on which a lighthouse has also been erected; but there is also a passage sufficient for small vessels to the east of the island. Recently a lighthouse has been erected on the west side of St. George's Island opposite the city. Halifax is the seat of a considerable fishery. Its principal trade is with Great Britain, the British colonies, and the United States. In 1878 the number of ships that entered was 887, with a tonnage of 347,336. The value of imports was $4,991,205, and of exports $4,102,335. The imports are chiefly manufactures from England, manufactures and produce from the United States, and sugar, molasses, rum, and other products from the West Indies; the chief exports are dried and pickled fish, timber, cattle, agricultural and dairy produce, fur, and whale and seal oil. Halifax is now used instead of Portland in the State of Maine as the winter port (the St. Lawrence being closed with ice) for the Dominion of Canada. The principal industries of Halifax are ironfounding, brewing, distilling, sugar-refining, and the manufacture of woollen and cotton goods, paper, leather, tobacco, gunpowder, agricultural and musical instruments, carriages, machinery candles, and soap. On account of its fine air and the beautiful scenery of the neighborhood, Halifax has a high reputation as a watering-place. An abundant supply of water for the city is obtained from two lakes 2 miles distant. The city is the seat of an Anglican bishop and a Roman Catholic archbishop. Nearly one-third of the population is Roman Catholic. It is named after the earl of Halifax, and was founded by Governor Cornwallis in 1749. In 1790 it contained only 700 houses and 4000 inhabitants. It was declared a free port in 1817, at which time the number of houses was 1200. The population in 1861 was 25,026, and in 1901, 40,832.

HALIFAX, CHARLES MONTAGUE, EARL OF (1661–1715), English statesman and poet, fourth son of the Honorable George Montague, who was fifth son of the first earl of Manchester, was born at Horton, Northamptonshire, on the 16th April, 1661. In his fourteenth year he was sent to Westminster school, where he was chosen king's scholar in 1677, and distinguished himself in the composition of extempore epigrams made according to custom upon theses appointed for king's scholars at the time of election. In 1682 he entered Trinity College, Cambridge, where he acquired a solid knowledge of the classics and surpassed all his contemporaries at the university in logic and ethics. Latterly, however, he preferred to the abstractions of Descartes the practical philosophy of Sir Isaac Newton; and he was one of the small band of students who assisted Newton in forming the Philosophical Society of Cambridge. But it was his facility in verse-writing, and neither his scholarship nor his practical ability, that first opened up to him the way to fortune. His clever but absurdly panegyrical poem on the death of Charles II., which was published in the *Book of Condolence and Congratulation* presented by the university to James II., secured for him the notice of the earl of Dorset, who invited him to town and introduced him to the principal wits of the time; and in 1687 his joint authorship with Prior of the *Town and Country Mouse*, a happy parody of Dryden's *Hind and Panther*, not only increased his literary reputation but directly helped him to political influence. In 1688, through the patronage of the earl of Dorset, he entered parliament as member for Maldon, and sat in the convention which resolved that William and Mary should be declared king and queen of England. About this time he married the countess-dowager of Manchester, and it would appear, according to Johnson, that it was still his intention to take orders; but after the coronation he purchased a clerkship to the council. On being introduced by Earl Dorset to King William, after the publication of his poetical *Epistle occasioned by his Majesty's Victory in Ireland*, he was ordered to receive an immediate pension of £500 per annum, until an opportunity should present itself of "making a man of him." In 1691 he was chosen chairman of the committee of the House of Commons appointed to confer with a committee of the Lords in regard to the Bill for regulating trials in cases of high treason; and he displayed in these conferences such tact and debating power that he was made one of the commissioners of the treasury and called to the privy council. It was during these debates that he had recourse to the peculiar oratorical device of losing his presence of mind, in order to give a practical illustration of the necessity of allowing the privilege of counsel to criminals before a court of justice. But his success as a politician was less due to his oratorical gifts than to his skill in finance, and in this respect he soon began to manifest such brilliant talents as completely eclipsed the painstaking abilities of Godolphin. Indeed it may be affirmed that no other statesman has initiated schemes which have left a more permanent mark on the financial history of England. Although perhaps it was inevitable that England should sooner or later adopt the Continental custom of lightening the annual taxation in times of war by contracting a national debt, the actual introduction of the expedient was due to Montague, who on the 15th December, 1692, proposed to raise a million of money by way of loan. Previous to this a Scotchman named William Paterson had submitted to the Government his plan of a national bank, and when in the spring of 1694 the prolonged contest with France had rendered another large loan absolutely necessary, Montague introduced a Bill for the incorporation of the Bank of England. The bill after some opposition passed the House of Lords in May, and immediately after the prorogation of parlia-

ment Montague was rewarded by the chancellorship of the exchequer. In the following year he was triumphantly returned for the borough of Westminster to the new parliament, and succeeded in passing his celebrated measure to remedy the depreciation which had taken place in the currency on account of dishonest manipulation. To provide for the expense of recoinage, Montague, instead of reviving the old tax of hearth money, introduced the window tax, and the difficulties caused by the temporary absence of a metallic currency were avoided by the issue for the first time of exchequer bills. His other expedients for meeting the emergencies of the financial crisis were equally successful, and the rapid restoration of public credit secured him a commanding influence both in the House of Commons and at the board of the treasury; but although Godolphin resigned office in October, 1696, the king hesitated for some time between Montague and Sir Stephen Fox as his successor, and it was not till 1697 that the former was appointed first lord. In 1698 and 1699 he acted as one of the council of regency during the king's absence from England. When in February of the former year he had been accused of peculation in connection with the issue of exchequer bills, not only had he been triumphantly acquitted but the House had declared that for his good services to the Government he had deserved his Majesty's favor; and his reputation was still further increased in the same year by the extraordinary popularity of his project for a new East India Company. With the accumulation of his political successes his vanity and arrogance became, however, so offensive that latterly they utterly lost him the influence he had acquired by his administrative ability and his masterly eloquence; and when his power began to be on the wane he set the seal to his political overthrow by conferring the lucrative sinecure office of auditor of the exchequer on his brother in trust for himself should he be compelled to retire from power. For some time after this in attempting to lead the House of Commons he had to submit to constant mortifications, often verging on personal insults, and after the return of the king in 1699 he resigned his offices in the Government and succeeded his brother in the auditorship. On the accession of the Tories to power he was removed in 1701 to the House of Lords by the title of Lord Halifax. In the same year he was impeached for malpractices along with Lord Somers and the earls of Portland and Orford, but all the charges were dismissed by the Lords; and in 1703 a second attempt to impeach him was still more unsuccessful. He continued out of office during the reign of Queen Anne, but in 1706 he was named one of the commissioners to negotiate the union with Scotland; and after the passing of the Act of Settlement in favor of the house of Hanover, he was appointed ambassador to the elector's court to convey the insignia of order of the garter to George I. On the death of Anne (1714) he was appointed one of the council of regency until the arrival of the king from Hanover; and after the coronation he received the office of first lord of the treasury in the new ministry, being at the same time created Earl of Halifax and Viscount Sunbury. He died on the 15th May of the following year, and left no issue. His nephew succeeded to the barony, and was raised to the earldom; he left it to his son George Dunk, a statesman of some eminence, with whose death without issue in 1771 the Halifax titles became extinct.

Montague's association with Prior in the travesty of Dryden's *Hind and Panther* has no doubt largely aided in preserving his literary reputation; but he is perhaps indebted for it chiefly to his subsequent influential position and to the fulsome flattery of the men of letters who enjoyed his friendship, and who, in return for his liberal donations and the splendid banqueting which they occasionally enjoyed at his villa on the Thames, "fed him," as Pope says, "all day long with dedications." That, however, his beneficence to needy talent, if sometimes attributable to an itching ear for adulation, was at others prompted by a sincere appreciation of intellectual merit, is sufficiently attested by the manner in which he procured from Godolphin a commissionership for Addison, and also by his life-long intimacy with Newton, for whom he obtained the mastership of the mint. The small fragments of poetry which he left behind him, and which were almost solely the composition of his early years, display a certain facility and vigor of diction, but their thought and fancy are never more than commonplace, and not unfrequently in striving to be eloquent and impressive he is only grotesquely and extravagantly absurd. In administrative talent he was the superior of all his contemporaries, and his only rival in parliamentary eloquence was Somers; but the skill with which he managed measures was superior to his tact in dealing with men, and the effect of his brilliant financial successes on his reputation was gradually almost nullified by the affected arrogance of his manner and by the eccentricities of his sensitive vanity. So eager latterly was his thirst for fame and power that perhaps Marlborough did not exaggerate when he said that "he had no other principle but his ambition, so that he would put all in distraction rather than not gain his point."

Among the numerous notices of Halifax by contemporaries may be mentioned the eulogistic reference which concludes Addison's account of the "greatest of English poets;" the dedications by Steele to the second volume of the *Spectator* and to the fourth of the *Tatler;* Pope's laudatory mention of him in the epilogue to his *Satires* and in the preface to the *Iliad,* and his portrait of him as "Full-blown buffo" in the *Epistle to Arbuthnott.* Various allusions to him are to be found in Swift's works and in Marlborough's *Letters.* See also Burnet's *History of his Own Times; The Parliamentary History;* Howell's *State Trials;* Johnson's *Lives of the Poets;* and Macaulay's *History of England.* His *Miscellaneous Works* were published at London in 1704; his *Life and Miscellaneous Works* in 1715; and his *Poetical Works,* to which also his "Life" is attached, in 1716. His poems were reprinted in the 9th volume of Johnson's *English Poets.*

HALIFAX, George Savile, Marquis of (*c.* 1630–1695), English statesman and author, son of Sir William Savile, a Yorkshire baronet of ancient family, and of Anne, daughter of the lord-keeper Coventry and sister of the wife of the first earl of Shaftesbury, was born about 1630. He succeeded to the baronetcy on the death of his father, and, having taken an active part in the Restoration, he was in 1667 created Baron Savile and Viscount Halifax. Subsequently his political conduct gave deep offence to the king, but although, on his being mentioned in 1672 for a seat in the privy council, Charles at first "kicked at the name," the necessities of the political situation induced him to yield to the solicitations of his advisers, whose arguments for the admission of Halifax were based upon "his family, his abilities, his state and credit, as well as talent to ridicule and unravel whatever he was spited at." Already he was known as one of the most brilliant orators in the House of Lords, and although his political opinions seemed to be shifting and uncertain, the fascination of his manner aided his formidable talents in gradually securing him the permanent favor of the king. In June, 1672, he was sent to negotiate terms of peace with France, but he was kept in ignorance of the agreement between Charles and Louis in regard to the establishment of popery in England. He strenuously opposed the Test Bill introduced by Lord Danby in 1675, but continued to sit at the council board till the following year when, having provoked Lord Danby by a witticism in reference to his mild manner of refusing a bribe, the latter procured his dismissal. In 1679 he was, however, created an earl, and having become a member of the new council after the fall of Danby, he differed from the earl of Shaftesbury and his other colleagues in reference to the Exclusion Bill, and by an extraordinary manifestation of nearly all the resources of oratory was instrumental in causing its rejection by the Lords. On this account an address was presented by the Commons praying his "dismissal from the king's person and councils for ever;" but the king, whose confidence he had now completely won, retained him in the council, and in 1682 he was created a marquis and became lord privy seal. Although, however, chiefly instrumental in securing the duke of York's succession, his proposed limitations of James's authority when the crown should devolve upon him, as well as his subsequent leaning to Whig principles, awakened the duke's settled hostility, and this was further deepened by his exposure of the malversation of the earl of Rochester. After the accession of James he was accordingly removed from the office of privy seal to that of president of the council, a less important position; and when in 1685 he refused to give his vote for the repeal either of the Test Act or of the Habeas Corpus Act, he was dismissed from the cabinet. But though made privy to the negotiations entered into with the prince of Orange, Halifax, notwithstanding his political humiliation, was opposed to armed intervention.

and endeavored to obtain such concessions from the king as would render this unnecessary. Even after the landing of the prince he consented to act as one of the three commissioners appointed to treat with him, and it was only the cowardly and traitorous flight of James that induced him finally to abandon his cause and to take measures for raising William to the throne. In the Convention Parliament he was chosen speaker of the Lords, and strongly opposed the motion for a regency. On the accession of William he was made lord privy seal, but the disasters of the Irish campaign gave such a plausible color to the arguments of his opponents against his competency, and to their insinuations regarding his political honesty, that, though still retaining the office of privy seal, he in October, 1689, ceased to take part in the councils of the king. He succeeded before the committee of the House of Lords in clearing himself from all guilt in connection with the murder of Russell and Sidney, but shortly afterwards resigned his office. Irritated doubtless by the bitter animosity of the Whigs and by the coldness of William, he now at first joined himself to the opposition, and even went so far as to hold communications with St. Germains; but either because his anger had cooled or because he had become convinced of the hopelessness of the fortunes of the Stuarts, he gradually veered back to the support of the Government. He died somewhat suddenly, 20th April, 1695. He was succeeded by his son William, with whose death in 1699 the title became extinct in his family. A daughter by his second marriage was the mother of the fourth and celebrated earl of Chesterfield; and from his natural son, Henry Carey the dramatist, was descended the celebrated Edmund Kean.

Halifax is portrayed in Dryden's *Absalom and Achitophel* as—

> "Jotham of piercing wit and pregnant thought,
> Endued by nature and by learning taught
> To move assemblies."

Of his speeches not the smallest fragment remains, but it is admitted that his highest efforts far excelled in effect even those of Shaftesbury, who was his only rival. "Old men," says Macaulay, "who lived to admire the eloquence of Pulteney in its meridian and that of Pitt in its splendid dawn, still murmured that they had heard nothing like the great speeches of Lord Halifax on the Exclusion Bill." The key to the greater part of his political conduct is to be found in the pamphlet *On the Character of a Trimmer*, of which he was undoubtedly the author. He was a trimmer, but a trimmer in the best sense of the term; for though not insensible to worldly advantages, and, notwithstanding his philosophical professions, a lover of pomp and external honors, he was remarkably uncontaminated by the political corruption then almost universally prevalent, and was so emancipated both from party prejudice and selfish ambition as to be able generally to guide his political course by a regard to the best interests of the nation. His sudden changes from one side in politics to another, so far from indicating a loose political morality, were in reality due to the very opposite reason; for in times so unsettled violent and dangerous oscillations were apt to result from a tendency to extremes in both parties. But though his peculiar mental constitution enabled him to play a more important and beneficent part in the politics of his time than any of his contemporaries, it unfitted him for achieving success as a minister of the crown, and rendered his political career a seeming failure. His bent was philosophical rather than practical, and, notwithstanding his great prudence and judgment in several important emergencies, he was apt to be timid and indecisive when the chief burden of responsibility rested upon himself. His writings are neither large nor numerous; but their pure, polished, and nervous English, acute reasoning, mature if somewhat worldly wisdom, apt and varied illustration, and clever and genial wit, fairly entitle them to a place among English classics. Privately he was, according to Burnet, "a man of great and ready wit, full of life and very pleasant, much given to satire." He had the reputation of holding atheistical opinions, but on his deathbed "professed himself a sincere Christian."

He was the author of *The Anatomy of an Equivalent*, printed in the collection of *State Tracts*, vol. ii.; *A Letter to a Dissenter*; an *Essay upon Taxes*; *Advice to a Daughter*; *The Character of a Trimmer*, published anonymously; *Maxims of State applicable to all Times*; *Character of Bishop Burnet*; *A Seasonable Address to both Houses of Parliament*; *Cautions for Choice of Parliament Men*; *A Rough Draught of a New Model at Sea*; *Observations upon the Reigns of Edward I., II., III., and Richard II.*; and *A Character of King Charles the Second, and Political, Moral, and Miscellaneous Thoughts and Reflections*, first published in 1750. His *Miscellanies*, consisting of seven of the above pamphlets, appeared in 1700. A notice by the Hon. Hugh F. Elliot of a "New Manuscript of George Savile, first marquis of Halifax," will be found in *Macmillan's Magazine* for October, 1877. He also left *Memoirs of his Life*, which were destroyed. See besides the histories of Hume, Fox, Lingard, and Macaulay; Birch's *Lives*; Burnet's *History of his Own Times*; Chesterfield's *Memoirs*; Walpole's *Royal and Noble Authors*; Courtenay's *Life of Sir William Temple*; and Seward's *Anecdotes*, vol. ii.

HALL, a town in northern Tyrol, Austria, government district of Innsbruck, is picturesquely situated between two mountains on the left bank of the Inn, which is navigable there, and on the railway from Rosenheim to Innsbruck, 5 miles east of the latter. It is the seat of a district court, of a board of salt-works, and of a provincial board of mines. The beautiful Gothic parish church, dating from the 13th century, contains an altar-piece by a pupil of Rubens and the copy of a Christ by Albert Dürer. The principal other public buildings are several monasteries, the gymnasium, the deaf and dumb institute, and the lunatic asylum. The prosperity of the town depends chiefly upon its salt-works, which are supplied by pipes from the mines at Salzberg, 9 miles distant; the annual yield of salt is from 15,000 to 16,000 tons. A considerable number of invalids visit the town on account of its salt-water baths. The principal other industries are the manufacture of woollen cloth, thread, paper, and substitutes for coffee. Hall obtained town rights in 1303. It suffered considerably from earthquakes in 1663 and 1670. In 1809 the patriot Speckbacher on three separate occasions succeeded in storming the position of the Bavarians on the bridge which crosses the Inn at this point. The population in 1900 was 6,191.

HALL (generally known as Swabian Hall), a town of Würtemberg, circle of Jagst, is situated in a deep valley on both sides of the Kocher, and on the railway from Heilbronn to Krailsheim, 35 miles N. E. of Stuttgart. It is surrounded by strong walls, and possesses seven churches, one of them dating from the 15th century and having fine mediæval carving; a town-house, a lyceum, a real-school of the second order, a hospital, and a house of correction. A short distance south from the town is the old castle of Komburg, now used as a garrison for invalid soldiers, with a richly adorned Benedictine church dating from the 12th century. The town is chiefly known for its extensive salt-works, supplied by means of a pipe from Wilhelmsglück mine, 5 miles distant. Connected with the salt-works there is a salt-bath and whey-diet establishment. The other industries of the town are cotton-spinning and weaving, and the manufacture of leather, soap, starch, sago, brushes, pencils, machines, carriages, and metal wares. The population in 1905 was 9,400.

Hall originally belonged to the counts of Westheim, and later to the Knights Templars. It was made a free imperial city in the 14th century, and was afterwards included in the different leagues of the cities, knights, and counts. In 1802 it came into the possession of Würtemberg.

HALL, Basil (1788–1844), British traveller and miscellaneous writer, was born at Edinburgh, December 31, 1788. His father, Sir James Hall of Dunglass, was author of an essay on *Gothic Architecture*, and contributed to the Royal Society of Edinburgh, of which he for a time was president, several ingenious papers on geology, in support of Hutton's theory as against that of Werner. His mother was Helen, daughter of Dunbar, fourth earl of Selkirk. Basil Hall was educated at the High School of Edinburgh, and in 1802 entered the navy, where he rose to the rank of post-captain in 1817. By observing the ethnological as well as the physical peculiarities of the countries he visited, he collected the materials for a very large number of scientific papers, which he contributed to various journals and encyclopædias. In 1816 he commanded the sloop "Lyra," which accompanied Lord Amherst's embassy to China; and in this vessel he performed the cruise which he describes in the most popular and perhaps the most interesting of his works —*An Account of a Voyage of Discovery to the West Coast of Corea and the Great Loo-choo Island in the Japan Sea* (London, 1818). In 1820 he held a command on the Pacific coast of America, and in 1824 published two volumes of

Extracts from a Journal written on the coasts of Chili, Peru, and Mexico in the years 1820–21–22. Retiring on half-pay in 1824, Hall in 1825 married a daughter of Sir John Hunter, and in her company travelled (1827–1828) through the United States. In 1829 he published his *Travels in North America in the years 1827 and 1828*, a book almost as popular as his first, less from its intrinsic merit than from the violence with which it was assailed by the American press for its views of American society. *Schloss Hainfeld, or a Winter in Lower Styria* (1836), is partly a romance, partly a description of a visit paid by the author to the castle of the Countess Purgstall. *Spain and the Seat of War in Spain* appeared in 1837. The *Fragments of Voyages and Travels* (9 vols.) were issued in three detachments between 1831 and 1840. Captain Hall was a fellow of the Royal Societies of London and Edinburgh, and a member of the Astronomical Society of London, and has left a number of scientific and miscellaneous writings besides those mentioned. His last work, a collection of sketches and tales under the name of *Patchwork* (1841), had not been long published before its author was seized with insanity, from which he was only released by his death, in Haslar Hospital, Portsmouth, September 11, 1844.

HALL, Charles Francis (1821–1871), an Arctic explorer, was born at Rochester, New Hampshire, United States, in 1821. After following the trade of blacksmith he became a journalist in Cincinnati, but his enthusiasm for Arctic exploration led him in 1859 to volunteer to the American Geographical Society to "go in search of the bones of Franklin." With the proceeds of a subscription he was equipped for his modest expedition, and obtained a passage in May, 1860, on board a New London whaling vessel commanded by Captain Buddington, the same who had picked up the English search-ship "Resolute." The whaler having become blocked up with ice, Hall took up his abode with the Eskimo, living with them for two years, adopting their habits and acquiring their language, making special friends of two natives, man and wife, who had been in England and knew something of our language. He wandered about with the Eskimo in the region to the north of Hudson's Bay, acquiring much information, especially about the people. He published an account of his experiences in 1864, under the title of *Arctic Researches, and Life among the Esquimaux.* Having learned little or nothing, however, about the fate of the Franklin expedition, he returned in 1864, remaining among the Eskimo till 1869. Unfortunately the full journal he kept of his five years' wanderings has never been published. The expedition which brought Hall most prominently into notice was fitted out in 1871 in the steamer "Polaris," which was sent out at the expense of the United States Government, its object being to reach the supposed open Polar Sea, and if possible attain the Pole. Hall was in command, while Buddington was sailing master. There was a modest but competent scientific staff, and among the crew were Hall's two old Eskimo friends, who had become devoted to him. On June 29, 1871, the "Polaris" left New York, and making a remarkably rapid passage up Davis Straits and Smith Sound, reached on August 30 the lat. of 82° 16′ N., until the last English expedition the highest northern latitude reached of which there is any authentic report. Hall and most of the officers and crew were for proceeding onwards, but they were overruled by Buddington, and went into winter quarters in a sheltered cove on the Greenland coast, named Polaris Bay, in 81° 38′ N. On October 24th Hall returned from a successful sledge expedition to the north, and was suddenly seized by an illness of which he died on November 8th. As there were some suspicions of poison, an inquiry was made by the Navy Department, who found that there was no proof of foul play. Captain Buddington, on whom the command devolved, determined in August of next year to return, but the "Polaris" was greatly hampered by the ice. The danger became so great that on October 15th boats and stores were put on the ice, on which nineteen of the crew had disembarked. Suddenly the ship broke away, and the party on the ice drifted slowly southwards for 195 days, and were picked up off the coast of Labrador, in 53° 35′ N., by a whaling steamer 2000 miles from where they had parted with the "Polaris." The party in the ship reached Littleton's Island, where they passed the winter, building two boats from the boards of the vessel, in which they set sail southwards in June, 1873. On the 23d of that month they were picked up by a Dundee whaler, and were brought to that town, from which they ultimately reached the United States. The scientific results of the unfortunate Hall's last expedition were of considerable importance, and have been published by the United States Government, as also has an independent account in German by Dr. Bessels, one of the scientific staff.

HALL, or Halle, Edward (*ob.* 1547), an English lawyer who takes high rank among the earlier narrators of his country's history, was born in London about the close of the 15th century and died in 1547, the year of the death of King Henry VIII. Though his name has all the appearance of a purely English word, it is none the less of foreign origin, John Hall of Northall, in Shropshire, our author's father, tracing his lineage back to Frederick of Halle in Tyrol, natural son of Albert of Austria. From Eton Edward Hall passed to Cambridge, and according to some accounts it would appear that at a later date he was also a student at Oxford. Entering Gray's Inn he was duly called to the bar; and we find him afterwards filling the offices of common sergeant, under-sheriff of the city of London, summer reader of Gray's Inn (1533), double reader in Lent (1540), and judge of the sheriff court. The date of the first appearance of his chronicle has been matter of question; but it is generally agreed that there was no such edition as that of 1542 assigned by the older bibliographers to Berthelette. The real *editio princeps* is almost certainly that issued by Grafton in 1548, the year after Hall's death, with a continuation compiled mainly from the author's MSS.; it is remarkable, says Mr. Hazlitt (*Collections and Notes*), as having probably more variations in the copies than any book in the language. A reprint was published in 1809 under the supervision of Sir Henry Ellis, who, however, furnished neither introduction nor comment.

Hall's work deserves a higher title than that of chronicle; partly, perhaps, by a happy accident, but partly also by the author's judicious management, it possesses no small unity of theme and construction. Beginning with the famous combat at Coventry between Henry of Hereford and Thomas Mowbray, it follows the tragic progress of the strife between York and Lancaster till it is brought to a close by the marriage of Henry VII. with Margaret of York, and then it shows England united and at rest under Henry VIII. The policy of this monarch is presented under a very favorable light, and in the religious question the author sides emphatically and intolerantly with Protestantism. For all kinds of ceremonial in utterance and action he has all a lawyer's respect, and his pages are often adorned and encumbered with the pageantry and material garniture of his story. In his style he unites the redundant reduplication and painful particularization of his profession with that evident effort after balance of clauses and fanciful and forcible phraseology which not long afterwards resulted in "Euphuism." On the whole the work is not only valuable but attractive. To the historian it furnishes what is evidently the testimony of an eye-witness on several matters of interest which are neglected by other narrators; and to the student of literature it has the exceptional charm of being one of the prime sources of Shakespeare's historical plays. Compare James Gairdner, *Early Chroniclers of Europe: England,* London, 1879.

HALL, James (1793–1868), an American judge and the author of a number of books chiefly relating to the Western States, was born at Philadelphia, August 19, 1793. After for some time prosecuting the study of law, he in 1812 joined the army, and in the war with Great Britain distinguished himself in engagements at Lundy's Lane, Niagara, and Fort Erie. On the conclusion of the war he accompanied an expedition against Algiers, but in 1818 he resigned his commission, and continued the study of law at Pittsburg. In 1820 he removed to Shawneetown, Illinois, where he commenced practice at the bar and also edited the *Illinois Gazette.* Soon after he was appointed public prosecutor of the circuit, and in 1824 legislature judge. On the abolition of the latter office four years afterwards he was appointed State treasurer, but he continued at the same time his legal practice and also edited the *Illinois Intelligencer.* Subsequently he became editor of the *Western Souvenir,* an annual publication, and of the *Illinois Monthly Magazine,* afterwards the *Western Monthly Magazine.* He died near Cincinnati, July 5, 1868.

The following are his principal works:—*Letters from the West,* originally contributed to the *Portfolio,* and collected and published in London in 1828; *Legends of the West,* 1832; *The Soldier's Bride and other Tales,* 1832; *The Harpe's Head, a Legend of Kentucky,* 1833; *Sketches of the West,* 2 vols., 1835;

Tales of the Border, 1835; *Notes on the Western States*, 1838; *History of the Indian Tribes*, in conjunction with T. L. M'Keeney, 3 vols., 1838–44; *The Wilderness and the War-Path*, 1845; *Romances of Western History*, 1857.

HALL, Joseph (1574–1656), bishop of Norwich, one of the wittiest as well as wisest writers of his century, was born at Bristow Park, parish of Ashby-de-la-Zouch, Leicestershire, July 1, 1574. Designed from infancy for the church, he received his early education at the school of his native place, whence in his fifteenth year he passed to Emmanuel College, Cambridge. After being chosen for two years in succession to read the rhetoric lectures in the public schools, Hall became a fellow of his college in 1595, and in the following year received the degree of master of arts. Having taken holy orders, he in 1601 became rector of Halstead in Suffolk, near Bury St. Edmunds. Two years later he married; and in 1605 he accompanied Sir Edmund Bacon to the Spanish Netherlands. In 1612 Hall was presented to the curacy of Waltham-Holy-Cross in Essex, and about the same time received the degree of doctor of divinity. Meanwhile his talents as a preacher, and the ability shown in his controversial writings, had brought him into notice at court. He was appointed chaplain to Prince Henry and prebendary of Wolverhampton. The latter dignity he soon resigned. In 1616 Hall accompanied the earl of Carlisle on his mission to France, but was compelled by illness to return; in 1617 he went with James I. into Scotland, and in 1618 was appointed by him one of the English deputies to the synod at Dort; but he was again forced by sickness to return before the business of the assembly was finished. The year before (1617) he had been appointed dean of Worcester. In the years that followed Hall preached frequently before the court and took an active part in the controversies of the day, especially in that between the Arminian and Calvinistic parties in the Church of England, to the latter of which he belonged. In 1624 he refused the see of Gloucester, but in 1627 became bishop of Exeter. In this position, by his toleration of lecturings and his Calvinistic mode of preaching and administering his diocese, he incurred the suspicion of disaffection to episcopacy, and on three occasions appeared on his knees before the king, to answer for his puritanical practices. Hall felt bitterly these undeserved charges of Laud, and threatened to "cast up his rochet" rather than be subject to them. No better proof of his attachment to the Church of England is needed than his *Episcopacy by Divine Right Asserted*, written in 1640 at the suggestion of Laud. In 1641 Hall was translated to the see of Norwich. The same year he joined eleven other bishops in presenting to parliament a protest against all laws passed in their enforced absence. Upon this the bishops were accused of high treason and thrown into the Tower. Hall in his *Hard Measure* relates the trials he underwent both at this time and afterwards. The accusation fell to the ground, and in six months the bishops were released (June, 1642) only, however, on each finding security for £5000. Hall proceeded to Norwich, which he had not yet visited, and set about his pastoral duties; but in April, 1643, his revenues and personal property were sequestrated by parliament, a nominal allowance of £400 a year being made for his maintenance. Mrs. Hall with great difficulty obtained a fifth of her husband's property. The bishop was next ejected from his palace, and the cathedral was dismantled. Having retired to a small estate at Higham near Norwich, which he had been able to buy, he there, with his books, bought for him by a friend, spent the rest of his life, writing and preaching "till he was first forbidden by men, and at last disabled by God." He died 8th September, 1656, in his eighty-third year.

The great bulk of Bishop Hall's writings is controversial, and therefore of comparatively ephemeral interest; but some of them continue to deserve attention. His satires, published under the name of *Virgidemiarum Sixe Bookes*, consist of three bookes of *Toothlesse Satyrs*, subdivided into (1) Poetical, (2) Academicall, and (3) Morall, published in 1597, and three bookes of *Byting Satyrs*, published in 1598. They appeared together in 1599. Hall claims to be the first English satirist, though Hallam disputes his title, and at the same time rather disparages the satires, which have on the other hand been very highly praised by Campbell and Warton. In his *Epistles* (1608–11) Hall claims to be the introducer of that style of prose composition also into English; but both Ascham and Howell anticipated him. The *Contemplations upon the Principal Passages of the History of the New Testament* (1612–15), a devout and pious work, one by which perhaps Hall is most generally known, are happily distinguished from most compositions of the class to which they belong by a shy and racy wit which not unfrequently puts the reader in mind of Thomas Fuller. *Mundus Alter et Idem*, a species of allegorical romance, published in 1643, was translated into English by John Healey, under the title of *Discovery of a New World*. Other writings of this "English Seneca," as Sir Henry Wotton called him, are *Explication of Hard Texts* (1633–34), *Christian Meditations* (1640), and *Henochismus, sive Tractatus de modo ambulandi cum Deo*, translated in 1769. An edition of his works was published in 1808 at London, in 10 vols., by the Rev. Josiah Pratt; and a later and better one, in 12 vols., at Oxford (1837–39), by the Rev. Peter Hall. A life of Bishop Hall by the Rev. John Jones appeared in 1826.

HALL, Marshall (1790–1857), the discoverer of the "Diastaltic nervous system," was born at Basford, Notts, February, 18, 1790. His father, Robert Hall, a cotton manufacturer at that place, is well known as the introducer of the modern processes of bleaching on a large scale. Having attended Blanchard's academy at Nottingham, where Kirke White was educated, Marshall Hall commenced in 1809 his studies for the medical profession at Edinburgh university. In 1811 he was elected senior president of the Royal Medical Society; the following year he took the M. D. degree, and was immediately appointed resident house physician to the Royal Infirmary, Edinburgh. This appointment he resigned after two years, when he visited Paris and its medical schools, and, on a walking tour, those also of Berlin, Göttingen, etc. In 1817, taking up his abode at Nottingham, he published his *Diagnosis*, in which he insisted that, before treatment, the exact nature of a malady should be ascertained. He rapidly acquired an extensive country practice, his improved method in puerperal cases and his disuse of the venesection then popular attracting many patients. In 1818 he wrote the *Mimoses*, a work on the affections denominated bilious, nervous, etc. The next year he was elected a fellow of the Royal Society of Edinburgh, and in 1825 he became physician to the Nottingham general hospital. In 1826 he removed to London, and in the following year he published his *Commentaries* on the more important diseases of females. He pursued his studies of the effects of bloodletting, and his *Researches* (issued in 1830) were acknowledged by the medical profession to be of vast practical value. Much practical good also resulted from his warning against mistaking exhaustion for inflammation. Hall married in 1829, and the same year he made the discovery which placed him in rank with Harvey. It is described in *A Critical and Experimental Essay on the Circulation of the Blood in the Capillary Vessels*, in which he showed that the blood-channels intermediate between arterics and veins serve the office of bringing the fluid blood into contact with the material tissues of the system. About this time he made his original investigations on quantity of respiration, detailed in *The Inverse Ratio which subsists between the Respiration and Irritability in the Animal Kingdom*, a work which led to the treatises on hibernation. In 1831 he proposed a simple and bloodless operation for the removal of vascular nævus. His most important discovery in physiology was the "diastaltic spinal system," his views being embodied in a paper on *The reflex Function of the Medulla Oblongata and the Medulla Spinalis*, 1832, in which year he was elected fellow of the Royal Society, London. This paper was supplemented in 1837 by another *On the True Spinal Marrow, and the Excito-motor System of Nerves*, in which he explained the real classification and distribution of the entire nervous system. The "reflex function" excited great attention in Germany and Holland, and M. Flourens described it as "a great epoch in physiology." Hall thus became the authority on the multiform deranged states of health referable to an abnormal condition of the nervous system, and he made plain the obscure class of convulsive affections. The action of strychnia as a spinal tonic or excitant, the relief of the epileptic, tracheotomy in laryngismal epilepsy, and the "ready method" in asphyxia, were among the later objects of his investigation. His "ready method"—sometimes called Marshall Hall's method—for resuscitation in drowning and other forms of suspended respiration—is perhaps the most popular of his discoveries; by it innumerable lives have been preserved. Dr. Hall lectured at various medical schools, at the college of physicians, and also at New York during his American tour. His papers in medical and scientific journals, including the

Comptes Rendus, are remarkable for lucidity and brevity. He died at Brighton of a throat affection, aggravated by lecturing, August 11, 1857. A list of his works, most of which have been translated into foreign languages, and details of his "ready method," etc., are given in his *Memoirs* by his widow, London, 1861.

HALL, Robert (1764–1831), one of the greatest of English pulpit orators, was born May 2, 1764, at Arnsby near Leicester, where his father, a man whose cast of mind in some respects resembled closely that of the son, was pastor of a Baptist congregation. Robert was the youngest of a family of fourteen. In infancy his physical powers were so feeble that until two years of age he was unable to walk, and, although his expression and gestures indicated great mental vivacity, he was equally slow to acquire the faculty of articulate speech. It even appears that he had learned to read before he was able to imitate spoken sounds, his nurse having taught him the letters of the alphabet and the formation of words from the inscriptions on the tombstones of a churchyard adjoining his father's dwelling-house. When once the interest in this exercise had loosened his reluctant tongue his progress was remarkably rapid, and before he had attained his third year the fluency of his talk gave some indications of his future oratorical eminence. While still at the dame's school his passion for books absorbed the greater part of his time, and in the summer it was his custom after school hours to retire to the churchyard with a volume which he continued to peruse there till nightfall, making out the meaning of the more difficult words with the help of a pocket dictionary. From his sixth to his eleventh year he attended the school of Mr. Simmons at Wigston, a village 4 miles from Arnsby. There his precocity assumed the exceptional form of an intense interest in metaphysics, partly perhaps on account of the restricted character of his father's library; and before he was nine years of age he had read and re-read Jonathan Edwards's *Treatise on the Will* and Butler's *Analogy*. This incessant study at such an early period of life seems, however, to have had an injurious influence on his health, and may have been partly the cause of the disease from which he experienced such suffering in after life, and symptoms of whose existence began at this time to manifest themselves. Occasionally he was already troubled with intense pain in the back, and after he left Mr. Simmons's school his appearance was so sickly as to awaken fears of the presence of consumption. In order therefore to obtain the benefit of a change of air, he stayed for some time in the house of a gentleman near Kettering, who with an impropriety which Hall himself afterwards referred to as "egregious," prevailed upon the boy of eleven to give occasional addresses at prayer meetings. As his health seemed rapidly to recover, he was sent to a school at Northampton conducted by the Rev. John Ryland, where he remained a year and a half, and "made great progress in Latin and Greek." On leaving school he for some time studied divinity under the direction of his father, and in October, 1778, he entered the Bristol academy for the preparation of students for the Baptist ministry. Here the self-possession which had enabled him in his twelfth year to address unfalteringly various audiences of grown-up people seems to have strangely forsaken him; for when, in accordance with the arrangements of the academy, his turn came to deliver an address in the vestry of Broadmead Chapel, he broke down on two separate occasions and was unable to finish his discourse. On the 13th August, 1780, he was set apart to the ministry, but he still continued his studies at the academy; and in 1781, in accordance with the provisions of an exhibition which he held, he entered King's College, Aberdeen, where he took the degree of master of arts in March, 1785. At the university he was without a rival of his own standing in any of the classes, distinguishing himself alike in classics, philosophy, and mathematics. He there formed the acquaintance of Mackintosh (afterwards Sir James), who, though a year his junior in age, was a year his senior as a student, and who became attached to him "because he could not help it." While they remained at Aberdeen the two were inseparable, reading together the best Greek authors, especially Plato, and discussing, either during their walks by the sea-shore and the banks of the Don or in their rooms until early morning, the most perplexed questions in philosophy and religion. The interest of their conversation seems to have lain more in the difference than the agreement of their opinions; but their controversies, so far from causing any even temporary estrangement, tended only to cement more closely their friendship, and to deepen in each the respect for the mental and moral qualities of the other.

During the vacation between his last two sessions at Aberdeen, Hall acted as assistant pastor to Dr. Evans at Broadmead Chapel, Bristol, and three months after leaving the university he was appointed classical tutor in the Bristol academy, an office which he held for more than five years. Even at this period his extraordinary eloquence had excited an interest beyond the bounds of the denomination to which he belonged, and when he preached the chapel was generally crowded to excess, the audience including many persons of intellectual tastes. It would appear, however, that, in the case of Mr. Fuller, Dr. Ryland, and other theological authorities, his exuberant intellectual energy and his outspoken expression of tolerance for certain aspects of Socinianism caused trembling to be greatly mingled with their admiration; and ultimately, suspicions in regard to his orthodoxy having in 1789 led to a misunderstanding with his colleague and a part of the congregation, he in July, 1790, accepted an invitation to make trial of a congregation at Cambridge, of which he became pastor in July of the following year. From a statement of his opinions contained in a letter to the congregation which he left, it would appear that, while a firm believer in the proper divinity of Christ, he had at this time disowned the cardinal principles of Calvinism—the federal headship of Adam, and the doctrine of absolute election and reprobation; and that he was so far a materialist as to "hold that man's thinking powers and faculties are the result of a certain organization of matter, and that after death he ceases to be conscious till the resurrection." It was during his Cambridge ministry, which extended over a period of fifteen years, that his oratory was most brilliant and most immediately powerful. At Cambridge the intellectual character of a large part of the audience supplied a stimulus which was wanting at Leicester and Bristol, but besides this his physical powers were then at their best, and were still unaffected by the constant pain which already so severely tested his powers of endurance and rendered the discharge of his duties such a marvellous triumph of will. Above all, it was not till near the close of this period that his intellectual pathway was crossed by the shadow of mental derangement, and an element of weakness and uncertainty introduced into his career which for some time clouded the horizon of his hopes and perhaps placed a permanent check on his highest form of intellectual enterprise. While at Cambridge he gave to the world some of the more important of the few and small publications which, although those who were his constant hearers have affirmed that several of his imperfectly reported sermons convey a juster impression of the usual character of his oratory, are the only correct and properly authenticated records of his style of thought and composition. His first published compositions had a political origin. In 1791 appeared *Christianity consistent with the Love of Freedom*, in which he defended the political conduct of dissenters against the attacks of the Rev. John Clayton, minister of Weighhouse, and gave eloquent expression to his hopes of great political and social ameliorations as destined to result nearly or remotely from the subversion of old ideas and institutions in the maelstrom of the French Revolution. In 1793 he expounded his political sentiments in a powerful and more extended pamphlet entitled an *Apology for the Freedom of the Press*, which at once obtained an extensive circulation, and doubtless to some extent aided in the formation of that public opinion which has given birth in England to the present remarkable era of gradual and unswerving political progress. On account, however, of certain asperities into which the warmth of his feelings had betrayed him, and his conviction that he had treated his subject in too superficial a manner, he refused to permit the publication of the pamphlet beyond the third edition, until the references of political opponents and the circulation of copies without his sanction induced him in 1821 to prepare a new edition, from which he omitted the attack on Bishop Horsley, and to which he prefixed an advertisement stating that his political opinions had undergone no substantial change. His other publications while at Cambridge were three sermons—*On Modern Infidelity* (1801), *Reflections on War* (1802), and *Sentiments proper to the present Crisis* (1803). From his first attack of insanity,

which occurred in November, 1804, he recovered so speedily that he was able to resume his duties in April, 1805, but a more severe recurrence of the malady rendered it advisable for him on his second recovery to resign his pastoral office, which he did in March, 1806. On leaving Cambridge he paid a visit to his relatives in Leicestershire, and then for some time resided at Enderby, preaching occasionally in some of the neighboring villages. Latterly he ministered to a small congregation in Harvey Lane, Leicester, from whom at the close of 1806 he accepted a call to be their stated pastor. In the autumn of 1807 he changed his residence from Enderby to Leicester, and in 1808 he married the servant of a brother minister. His proposal of marriage had been made after an almost momentary acquaintance, and, according to the traditionary account, in very abrupt and peculiar terms; but, judging from his subsequent domestic life, his choice did sufficient credit to his penetration and sagacity. His writings at Leicester embraced various tracts printed for private circulation; a number of contributions to the *Eclectic Review*, among which may be mentioned his articles on "Foster's Essays" and on "Zeal without Innovation;" several sermons, including those *On the Advantages of Knowledge to the Lower Classes* (1810), *On the Death of the Princess Charlotte* (1817), and *On the Death of Dr. Ryland* (1825); and his pamphlet on *Terms of Communion*, in which he advocated intercommunion with all those who acknowledged the "essentials" of Christianity. In 1819 he published an edition in one volume of his sermons formerly printed. On the death of Dr. Ryland, Hall was invited to return to the pastorate of Broadmead Chapel, Bristol, and as the peace of the congregation at Leicester had been to some degree disturbed by a controversy regarding several cases of discipline, he resolved to accept the invitation, and removed there in April, 1826. About this period the malady—renal calculus—which had for many years rendered his life an almost continual martyrdom, and whose influence he had triumphed over with such marvellous fortitude, began to show signs of indirectly obtaining the mastery over his vigorous constitution; and henceforth increasing infirmities and sufferings, which rest and change of scene could do little to alleviate, surrounded with deepening external gloom the spirit whose cheerfulness and peace they seemed to leave almost totally uninjured. Gradually the inability to take proper exercise, by inducing a plethoric habit of body and impeding the circulation, led to a diseased condition of the heart, which resulted in his death, February 21, 1831.

The private manners of Hall were remarkably simple and unaffected; and if his method of expressing his opinions was frequently impetuous, and occasionally somewhat brusque and imperious, this was owing rather to his constitutional energy and straightforward impulsive honesty than to an overbearing and dogmatic temper. Though exercising his sarcastic powers with great unconstraint, he reserved his severity chiefly for errors which implied some kind of moral culpability, and he was always careful to be respectful to true worth even when concealed or deformed by many superficial defects, or conjoined with humble rank or weak mental capacity. In reality few were more unassuming or unselfish or more continuously actuated by feelings truly charitable and benevolent. His mental absorption led to the contraction of many minor eccentricities, one of which was a frequent obliviousness to the flight of time and a consequent inability to remember his engagements. Towards the close of his Cambridge ministry he acquired the habit of smoking, and from that time his pipe was his almost constant companion and one of his principal solaces in his bodily suffering. Indeed talk and tobacco may be said to have supplied his chief means of recreation. In his conversation the calibre and idiosyncrasies of his genius were better displayed than in any of the writings he has left us; and it is said to have exercised an even more captivating charm than did his finest orations. Its most striking characteristics were keen, biting, and original wit, and wild and daring imaginative flights.

Both physically and mentally Hall possessed a rare combination of qualities fitting him to excel as a public speaker. He did not attain success without effort and discipline, but the faults which hampered his capabilities were not of a formidable character. He was of powerful and athletic build, and his great breadth of chest, while it lent an impression of massiveness to his bearing, indicated abundaut capacity to sustain the kind of physical exertion which oratory entails. His voice was deficient in strength and volume, but exceptionally pure and melodious, and capable of being thoroughly interpenetrated by emotion. Its inadequacy in tone was also compensated for by its great flexibility, which enabled him by the momentum of rapid utterance to obtain all the vocal force necessary to the highest oratorical effects. According to Foster, his countenance "was formed as if on purpose for the most declared manifestation of power." The forehead was high and sloping, with well-arched brows, beneath which his dark and brilliant eye, in his more excited moments, burned and glowed with thought and passion. The lower part of his countenance indicated a vehement and headstrong temperament under the control of an iron will—doubtless powerfully reinforced by the strong moral sensibility which gave a peculiar elevation and dignity to features possessing no trait of grace or beauty. Perhaps the "stern, intense, and somewhat formidable expression," which Foster referred to as wanting in the portrait accompanying his works, had its origin partly in his constant suffering.

His gestures in speaking were few and simple, and his manner seemed to be naturally determined by his mental emotions without conscious purpose on his part. He gave the impression of thorough self-forgetfulness and absorption in his subject, and during the latter part of an oration of being wholly possessed and dominated by the thoughts and sentiments which he uttered. It is generally affirmed that in his spoken sermons his style was more easy, graceful, and various than in any of the sermons which he prepared for the press. In the latter the structure of the sentences is often formal and labored, the rhythm artificial and monotonous; and idiomatic vigor is in some degree sacrificed to elegance and pomp. In the higher flights of his eloquence his language was, however, unsurpassed for purity and happy adaptation to the thought. Indeed one of his most remarkable gifts is said to have been his extemporaneous command of a clear and felicitous vocabulary, which seemed to clothe every shade of his meaning with its appropriate expression, and whose musical cadences formed a not unimportant element in the fascination exercised by his oratory. It is true that in many cases his language had before he spoke undergone considerable mental elaboration, but he was nevertheless so little enslaved to his memory that, according to his own statement, he never entered the pulpit without omitting something which he wished to say and saying something which he wished to omit. In preaching his severe taste and deep sense of solemnity restrained every tendency to eccentricity or extravagance, and he never permitted his brilliant wit to emit even the faintest and most momentary sparkle. It may therefore be believed that on a secular platform his oratory would have been more racy and natural, and from the scope afforded for the free exercise of all his powers would have attained to a more varied perfection. In his occasional reviews his style is clear and pointed, but apart from this it is his sarcasm that chiefly conveys the impression of more than average ability. The predominant element of his eloquence was reasoning. His statements and propositions were animated with passion and illuminated by a vivid and rich if not strikingly powerful and original imagination; but in no instance did passion or imagination seem to obtain the chief sway. It was generally not till towards the close of his sermon that the spell of his eloquence asserted its highest influence over his audience. Then the various trains of thought through which he had been guiding them seemed to meet in an intense focus where reason, imagination, and passion were blended together, and in whose light the theme he had been expounding stood revealed in such vivid truth and beauty as to captivate for the moment every heart. But though stating truth chiefly in the form of reasoning, he constantly exhibited it rather in its moral than in its theological aspects. His eloquence was indeed morally more than intellectually powerful; and its moral purpose was besides achieved not so much by the direct inculcation of moral duties, or the detection and exposure of moral deformities, as by his unconscious exhibition of his own moral elevation and of the ardor and purity of his hopes and aims. Indeed in many of his sermons both the form and matter of his thought seemed to be determined rather by his own individual interest in his subject than by the consideration of the capacities and wants of his hearers. Though exhibiting a catholicity of spirit much in advance of

his time, the range of his thought is completely included within the limits of traditional opinion. In treating of what he regarded as the cardinal truths of religion he is of course oratorically effective, but the dexterous and brilliant manner in which he wields the old controversial weapons does not compensate for their inherent inadequacy. He indulges too frequently in innuendoes against the moral character and motives of his opponents, and fails to sound the full depth of the speculative problems upon which he attempts to dogmatize. His sermons will always be esteemed by the student of English literature for their many passages of splendid and finished eloquence, but his theological writings as a whole are of course without that quaint interest attaching to representations of truth which though now old and effete originally exhibited it with the freshness and vividness of a discovery; while on the other hand they have no sufficient coloring from modern tendencies to give to them a more than superficial value in relation to those phases of religious thought which are predominant at the present time.

See *Works of Robert Hall, A. M., with a Brief Memoir of his Life, by Olinthus Gregory, LL.D., and Observations on his Character as Preacher by John Foster*, originally published in 6 vols., London, 1832; *Reminiscences of the Rev. Robert Hall, A.M.*, by John Greene, London, 1832; *Biographical Recollections of the Rev. Robert Hall*, by J. W. Morris, 1848; *Fifty Sermons of Robert Hall from Notes taken at the time of their Delivery*, by the Rev. Thomas Grinfield, M.A., 1843; *Reminiscences of College Life in Bristol during the Ministry of the Rev. Robert Hall, A. M.*, by Frederick Trestrail, 1879. (T. F. H.)

HALLA. See Hala.

HALLAM, Henry, the celebrated English historian, was born at Windsor in the year 1777,—some authorities make the date one year later,—and he died at Pickhurst, Kent, on the 21st of January, 1859. Notwithstanding his great fame and recent death very little seems to be known of the personal history of Hallam. He was the son of a dean of Bristol, and was educated at Eton, and afterwards went to Christ Church, Oxford, where he took his degree in 1799. He was called to the bar by the Inner Temple, and afterwards became a bencher of that society, but he does not appear to have at any time attempted to obtain practice. Early in life he devoted himself to literary work, and became connected with the brilliant band of authors and politicians who then led the Whig party. A commissionership of audits, obtained through that connection, together with some private means, made him independent in point of worldly fortune, and enabled him to devote himself entirely to the studies of his life. He took no active part in practical politics, and was in fact unsuited by nature for the rough work of party polemics. But he was an active supporter of many popular movements—particularly of that which ended in the abolition of the slave trade; and he was throughout his entire life sincerely and profoundly attached to the political principles of the Whigs, both in their popular and in their aristocratic aspect. Hallam's earliest literary work was undertaken in connection with the great organ of the Whig party, the *Edinburgh Review*, where his review of Scott's *Dryden* attracted much notice. His first great work, *The View of the State of Europe during the Middle Ages*, was produced in 1818, and was followed nine years later by the *Constitutional History of England*. In 1837 appeared the *Introduction to the Literature of Europe in the 15th, 16th, and 17th Centuries*. These are the three works on which the fame of Hallam rests. They at once took a place in English literature which has never been seriously challenged. A volume of supplemental notes to his *Middle Ages* was published in 1848. These facts and dates represent nearly all the events of Hallam's career. The strongest personal interest in his life was the affliction which befell him in the loss of all his family, one after another. His eldest son, Arthur Henry Hallam,—the "A. H. H." of Tennyson's *In Memoriam*, and by the testimony of his contemporaries a man of the most brilliant promise,—died in 1833 at the age of twenty-two. Seventeen years later, his second son, Henry Fitzmaurice Hallam, was cut off like his brother at the very threshold of what might have been a great career. The premature death and high talents of these young men, and the association of one of them with the most popular poem of the age, have made Hallam's family afflictions better known than any other incidents of his life. He survived wife, daughter, and sons by many years. In 1834 Hallam published *The Remains in Prose and Verse of Arthur Henry Hallam, with a Sketch of his Life*. In 1852 a selection of *Literary Essays and Characters* from the *Literature of Europe* was published. Hallam was a fellow of the Royal Society, and a trustee of the British Museum, and enjoyed many other appropriate distinctions. In 1830 he received the gold medal for history, founded by George III.

The *Middle Ages* is described by Hallam himself as a series of historical dissertations, a comprehensive survey of the chief circumstances that can interest a philosophical inquirer during the period from the 5th to the 15th century. The work consists of nine long chapters, each of which is a complete treatise in itself. The history of France, of Italy, of Spain, of Germany, and of the Greek and Saracenic empires, sketched in rapid and general terms, is the subject of five separate chapters. Others deal with the great institutional features of mediæval society—the development of the feudal system, of the ecclesiastical system, and of the free political system of England. The last chapter sketches the general state of society, the growth of commerce, manners, and literature in the Middle Ages. The book may be regarded as a general view of early modern history, preparatory to the more detailed treatment of special lines of inquiry carried out in his subsequent works, although Hallam's original intention was to continue the work on the scale on which it had been begun.

The *Constitutional History of England* takes up the subject at the point at which it had been dropped in the *View of the Middle Ages*, viz., the accession of Henry VII.,[1] and carries it down to the accession of George III. Hallam stopped here for a characteristic reason, which it is impossible not to respect and to regret. He was unwilling to excite the prejudices of modern politics which seemed to him to run back through the whole period of the reign of George III. As a matter of fact they ran back much further, as Hallam soon found. The sensitive impartiality which withheld him from touching perhaps the most interesting period in the history of the constitution did not save him from the charge of partisanship. The *Quarterly Review* for 1828 contains an article on the *Constitutional History*, written by Southey, full of railing and reproach. The work, he says, is the "production of a decided partisan," who "rakes in the ashes of long-forgotten and a thousand times buried slanders, for the means of heaping obloquy on all who supported the established institutions of the country." No accusation made by a critic ever fell so wide of the mark. Absolute justice is the standard which Hallam set himself and maintained. His view of constitutional history was that it should contain only so much of the political and general history of the time as bears directly on specific changes in the organization of the state, including therein judicial as well as ecclesiastical institutions. But while abstaining from irrelevant historical discussions, Hallam dealt with statesmen and policies with the calm and fearless impartiality of a judge. It was his cool treatment of such sanctified names as Charles, Cranmer, and Laud that provoked the indignation of Southey and the *Quarterly*, who forgot that the same impartial measure was extended to statesmen on the other side. If Hallam can ever be said to have deviated from perfect fairness, it was in the tacit assumption that the 19th century theory of the constitution was the right theory in previous centuries, and that those who departed from it on one side or the other were in the wrong. He did unconsciously antedate the constitution, and it is clear from incidental allusions in his last work that he did not regard with favor the democratic changes which he thought to be impending. Hallam, like Macaulay, ultimately referred all political questions to the standard of Whig constitutionalism. This prepossession may be connected with the legal tone that runs through all his political writings. The spirit of the English lawyer is as strong in Hallam as in Bentham, who, like him, was never a practising lawyer. It is no doubt owing to this quality that the *Constitutional History* has become one of the text-books of English politics. Hallam, like Blackstone, has become an authority to whom men of all parties appeal. The origin of English institutions has since been explored with greater elaborateness by Professor Stubbs, but our leading guide to the constitution in its maturity is still Hallam.

Like the *Constitutional History*, the *Introduction to the*

[1] Lord Brougham, overlooking the constitutional chapter in the *Middle Ages*, censured Hallam for making an arbitrary beginning at this point, and proposed to write a more complete history himself.

Literature of Europe continues one of the branches of inquiry which had been opened in the *View of the Middle Ages*. In the first chapter of the *Literature*, which is to a great extent supplementary to the last chapter of the *Middle Ages*, Hallam sketches the state of literature in Europe down to the end of the 14th century:—the extinction of ancient learning which followed the fall of the Roman empire and the rise of Christianity; the preservation of the Latin language in the services of the church; and the slow revival of letters, which began to show itself soon after the 7th century—"the *nadir* of the human mind"—had been passed. For the first century and a half of his special period he is mainly occupied with a review of classical learning, and he adopts the plan of taking short decennial periods and noticing the most remarkable works which they produced. The rapid growth of literature in the 16th century compels him to resort to a classification of subjects. Thus in the period 1520–1550 we have separate chapters on ancient literature, theology, speculative philosophy and jurisprudence, the literature of taste, and scientific and miscellaneous literature; and the subdivision of subjects is carried further of course in the later periods. Thus poetry, the drama, and polite literature form the subjects of separate chapters. One inconvenient result of this arrangement is that the same author is scattered over many chapters, according as his works fall within this category or that period of time. Names like Shakespeare, Grotius, Bacon, Hobbes, appear in half a dozen different places. The individuality of great authors is thus dissipated except when it has been preserved by an occasional sacrifice of the arrangement—and this defect, if it is to be esteemed a defect, is increased by the very sparing references to personal history and character with which Hallam was obliged to content himself. His plan excluded biographical history, nor is the work, he tells us, to be regarded as one of reference. It is rigidly an account of the books which would make a complete library of the period,[1] arranged according to the date of their publication and the nature of their subjects. The history of institutions like universities and academies, and that of great popular movements like the Reformation, are of course noticed in their immediate connection with literary results; but Hallam had little taste for the spacious generalization which such subjects suggest. The great qualities displayed in this work have been universally acknowledged—conscientiousness, accuracy, judgment, and enormous reading. Not the least striking testimony to Hallam's powers is his mastery over so many diverse forms of intellectual activity. In science and theology, mathematics and poetry, metaphysics and law, he is a competent and always a fair if not a profound critic. The bent of his own mind is manifest in his treatment of pure literature and of political speculation,—which seems to be inspired with stronger personal interest and a higher sense of power than other parts of his work display. Not less worthy of notice in a literary history is the good sense by which both his learning and his tastes have been held in control. Probably no writer ever possessed a juster view of the relative importance of men and things. The labor devoted to an investigation is with Hallam no excuse for dwelling on the result, unless that is in itself important. He turns away contemptuously from the mere curiosities of literature, and is never tempted to make a display of trivial erudition. Nor do we find that his interest in special studies leads him to assign them a disproportionate place in his general view of the literature of a period.

Hallam is generally described as a "philosophical historian." The description is justified not so much by any philosophical quality in his method as by the nature of his subject and his own temper. Hallam is a philosopher to this extent that both in political and in literary history he fixed his attention on results rather than on persons. His conception of history embraced the whole movement of society. Beside that conception the issue of battles and the fate of kings fall into comparative insignificance. "We can trace the pedigree of princes," he reflects, "fill up the catalogue of towns besieged and provinces desolated, describe even the whole pageantry of coronations and festivals, but we cannot recover the genuine history of mankind." But, on the other hand, there is no trace in Hallam of anything like a philosophy of history or society. Wise and generally melancholy reflections on human nature and political society are not infrequent in his writings, and they arise naturally and incidentally out of the subject he is discussing. His object is the attainment of truth in matters of fact. Sweeping theories of the movement of society, and broad characterizations of particular periods of history, seem to have no attraction for him. The view of mankind on which such generalizations are usually based, taking little account of individual character, was highly distasteful to him. Thus he objects to the use of statistics because they favor that tendency to regard all men as mentally and morally equal which is so unhappily strong in modern times. At the same time Hallam by no means assumes the tone of the mere scholar. He is even solicitous to show that his point of view is that of the cultivated gentleman and not of the specialist of any order. Thus he tells us that Montaigne is the first French author whom an English gentleman is ashamed not to have read. In fact, allusions to the necessary studies of a gentleman meet us constantly, reminding us of the unlikely erudition of the schoolboy in Macaulay. Hallam's prejudices, so far as he had any, belong to the same character. His criticism is apt to assume a tone of moral censure when he has to deal with certain extremes of human thought,—scepticism in philosophy, atheism in religion, and democracy in politics.

Hallam's style is singularly uniform throughout all his writings. It is sincere and straightforward, and obviously innocent of any motive beyond that of clearly expressing the writer's meaning. In the *Literature of Europe* there are many passages of great imaginative beauty. (E. R.)

HALLE (formerly called, to distinguish it from other towns of the same name, Halle in Sachsen, but now generally known as Halle an der Saale), a city of Prussian Saxony, government district of Merseburg, is situated on the right bank of the Saale and at the junction of six railways, 20 miles N. W. of Leipsic. It consists of the old town, or Halle proper, with five suburbs, and the two small towns of Glauchau and Neumarkt, which were added to it in 1817. Halle is under the immediate jurisdiction of the crown, and is the seat of the imperial chief office of mines

Plan of Halle.

1. Penitentiary.
2. Observatory.
3. Moritzburg.
4. Library.
5. University.
6. Theatre.
7. Gymnasium.
8. Post-Office.
9. District Court.
10. Town-Hall.
11. Red Clock Tower.
12. Cathedral.
13. Church of St. Mary.
14. Church of St. Maurice.

[1] Technical subjects like painting or English law have been excluded by Hallam, and history and theology only partially treated.

for the provinces of Saxony, Brandenburg, and Pomerania, of a head tax-office, of a circle court, and of a provincial office. The greater part of the town is irregularly built, and presents a somewhat unattractive appearance to the eye of a stranger; but of late years it has been much improved by the construction of new promenades on the site of the old fortifications, and by the repaving of many of the streets and the addition of new buildings. Its well-known university was founded by King Frederick I. in 1694 in behalf of the jurist Thomasius, whom many students followed to Halle when he was expelled from Leipsic through the enmity of his fellow professors. It was closed by Napoleon in 1806, and again in 1813; and in 1815 it was united with that of Wittenberg. It has faculties of theology, law, medicine, and philosophy. From the beginning it has been recognized as one of the principal schools of Protestant theology, and has numbered among its professors some of the most eminent names of Germany. Its maximum number of students occurred in 1829 when they exceeded 1300. Subsequently the number declined below 600, but at present the average attendance is between 2,000 and 2,100. The present buildings were erected in 1834. In connection with the university there are a botanical garden, a theological and normal seminary, a medical and surgical clinical institute, a maternity hospital, an observatory, and a library of over 100,000 volumes, which also contains collections of coins and engravings. The *Francke'sche Stiftungen*—founded in 1691 by August Hermann Francke, a bronze statue of whom by Rauch was erected in 1829 in the inner court of the building—embrace an orphanage, a laboratory where medicines are prepared and distributed, a Bible press from which Bibles are issued at a cheap rate, and a number of schools of various grades, viz., a Latin school, a higher real-school, a citizen school, a higher female school, and a free school, attended in all by over 3000 pupils. The principal other institutions are the city gymnasium, the provincial trade school, the provincial lunatic asylum, the penitentiary, the town hospital and infirmary, and the deaf and dumb institute. Among the other public buildings may be mentioned the church of St. Mary, containing some fine paintings, an interesting Gothic structure of the 16th century, with four towers, two of which are connected by a bridge; the church of St. Maurice, dating from the 12th century, with interesting wood-carvings and sculptures; the church of St. Ulrich, dating from the 14th century; the cathedral, founded in the 16th century, and containing an altar-piece representing Duke Augustus of Saxony and his family; the red clock tower in the market-place, 276 feet in height; the old town-house; the ruins of the castle of Moritzburg, erected in 1484, formerly the residence of the archbishops of Magdeburg, but destroyed by fire during the Thirty Years' War, with the exception of the left wing, which is now used for military purposes; the lodge of the free-masons; and the theatre. In 1859 a bronze statue was erected in the market-place to Handel, who was born at Halle in 1685; and in the outskirts of the town there is a monument to the Germans who fell at the battle of Leipsic in 1813. The salt-springs of Halle have been known from a very early period. Some rise within the town and others on an island in the Saale; and together their annual yield of salt is about 12,000 tons. The workmen employed in connection with the manufacture are a peculiar and distinct race known by the name of *Halloren*, probably descended from an old Frankish colony. They observe several ancient customs, and enjoy certain special exemptions and privileges. The principal other industries of Halle are the manufacture of starch, beetroot-sugar, chemicals, lignite, candles, pottery-wares, sausages, oil, machines and wagons, sugar-refining, brewing, printing, and bookbinding. Considerable trade, especially in corn, is now carried on by means of the railways, but the shipping trade is unimportant. The population has increased with great rapidity during the last quarter of a century, for while the numbers in 1831 were 25,594, they had risen in 1849 to 33,848 and in 1905 to 169,916.

Halle was first mentioned in 806 as the fortress of Halla erected by Charlemagne. The place was, however, in existence before the Christian era, and owes its origin as well as its name to its salt-springs. Otto the Great presented it in 965 along with the salt-springs to the bishopric of Magdeburg, and in 981 Otto II. raised it to the rank of a town. At the beginning of the 12th century it had attained considerable importance, and in the 13th and 14th centuries as a member of the Hanseatic League it carried on successful wars with the archbishops of Magdeburg; and in 1435 it resisted an army of 30,000 men under the elector of Saxony. On account, however, of internal feuds between the democracy and the patricians it was subdued in 1478 by Archbishop Ernest, who in order to hold it in check built the castle of Moritzburg. Notwithstanding the efforts of the archbishops of Mainz and Magdeburg, the Reformation found an entrance into the city in 1522; and in 1541 a Lutheran superintendent was appointed. After the peace of Westphalia in 1648 the city came into the possession of the house of Brandenburg. In 1806 it was stormed and taken by the French, after which, at the peace of Tilsit, it was united to the new kingdom of Westphalia. After the battle between the Prussians and French, May 2, 1813, it was taken by the Prussians. The rise of Leipsic was for a long time hurtful to the prosperity of Halle, and its present rapid increase in population and trade is principally due to its position as the centre of a network of railways.

See Dreyhaupt, *Ausführliche Beschreibung des Saalkreises*, Halle, 2 vols., 1755 (2d edition, 1771–73; 3d edition, 1842–44); Hoffbauer, *Geschichte der Universität zu Halle*, 1806; *Halle in Vorzeit und Gegenwart*, 1851; Knauth, *Kurze Geschichte und Beschreibung der Stadt Halle*, 3d edition, 1861; Vom Hagen, *Die Stadt Halle*, 1866–67; Hertzberg, *Geschichte der Vereinigung der Universitäten von Wittenberg und Halle*, 1867; Voss, *Zur Geschichte der Autonomie der Stadt Halle*, 1874; A. Kirchkoff, "Ueber die Lagenverhältnisse der Stadt Halle," in *Mittheilungen des Vereins für Erdkunde zu Halle*, Halle, 1877.

HALLECK, Fitzgreene (1790–1867), an American poet, was born at Guilford, Connecticut, July 8, 1790. By his mother he was descended from John Eliot, the "Apostle of the Indians." At an early age he became clerk in a store at Guilford, and at eighteen he entered a banking-house in New York. Having made the acquaintance of Joseph Rodman Drake[1] in 1819, he assisted him under the signature of "Croaker junior" in contributing to the *New York Evening Post* the humorous series of "Croaker Papers." In 1821 he published his longest poem, *Fanny*, a satire on local politics and fashions in the measure of Byron's *Don Juan*. He visited Europe in 1822–23, and after his return published anonymously in 1827 a volume of poems in which were included "Alnwick Castle" and "Burns." From 1824 to 1849 he was confidential agent of John Jacob Astor, who named him one of the trustees of the Astor Library, and left him an annuity of 200 dollars, on which he retired to Guilford, where he lived with an unmarried sister. In 1864 he published in the *New York Ledger* a poem of 300 lines entitled "Young America." He died at Guilford, November 19, 1867. The poems of Halleck are written with great care and finish, and manifest the possession of a fine sense of harmony and of genial and elevated sentiments.

Editions of his poems appeared in 1836, 1842, 1849, 1858, and 1860. He is also the author of an edition of *Byron* with notes and a memoir, and of two volumes of *Selections from the British Poets*. His *Life*, by J. G. Wilson, appeared in 1869.

HALLECK, Henry Wager (1815–1872), an American general, was born at Waterville, Oneida county, New York, January 15, 1815. After studying a short time at Union College, he in 1835 entered the West Point military academy, whence he was in 1839 promoted to the army as second lieutenant in the corps of engineers, being at the same time appointed assistant professor of engineering at the academy. In the following year he was made an assistant to the board of engineers at Washington, and from 1841 to 1844 he was employed in connection with the fortification of New York harbor. In 1845 he was sent by the Government to examine the principal military establishments of Europe, and during his absence he was promoted to the rank of first lieutenant. After his return he in the winter of 1845–46 delivered at the Lowell Institute, Boston, a course of twelve lectures on the science of war, published in 1846 under the title *Elements of Military Art and Science*, and republished with additions in 1861. On the outbreak of the Mexican war in 1846 he as military engineer accompanied the expedition to California and the Pacific coast, where he distinguished himself not only as an engineer, but by his administrative skill as secretary of state, and by his presence of mind and bravery in several skirmishes with the enemy. In 1847 his services were recognized by promotion to the rank of captain. He continued for several years to act on the staff of General Riley in California, holding at the same time the office of secretary of state of the territory; and he took a leading part

[1] A New York poet (1795–1820), studied medicine, wrote *Culprit Fay*, and verses on the American Flag.—Am. Ed.

in framing the State constitution of California, on its being admitted into the Union. In 1852 he was appointed inspector and engineer of lighthouses, and in 1853 he was promoted captain of engineers. He, however, in 1854 resigned his commission in order to devote his chief attention to the practice of law, which he had already for some time carried on; and so great was his success in his profession that the firm of which he was senior partner soon obtained one of the largest legal businesses in the State. He was also from 1850 director of the New Almaden quicksilver mine, and in 1855 he became president of the Pacific and Atlantic Railroad from San Francisco to San José. On the outbreak of the civil war he was in August, 1861, appointed major-general of the United States army, and in the following November was appointed commander of the western department, where he conducted the campaign with great energy and with such uniform success against the Confederates that in 1862 they evacuated Corinth, which they had strongly fortified. In July of the same year he was appointed general-in-chief of the armies of the United States —a position he held till March, 1864, when he was succeeded by Grant and was appointed chief of the staff. In April, 1865, he held the command of the military division of the James and in August of the same year of the military division of the Pacific, which he retained till March, 1869, when he was transferred to that of the south, a position he held till his death at Louisville, January 9, 1872.

Besides his work on the *Science of War*, General Halleck was the author of *Bitumen, its Varieties, Properties, and Uses*, 1841; *The Mining Laws of Spain and Mexico*, 1859; a translation of De Fooz *On the Law of Mines*, with an introduction, 1860; *International Law*, 1861; a translation of Jomini's *Life of Napoleon*, 1864; and a *Treatise on International Law and the Laws of War, prepared for the use of Schools and Colleges*, 1866.

HALLER, Albrecht von (1708–1777), one of the greatest of the anatomists and physiologists of the 18th century, was born of an old Swiss family at Bern, October 16, 1708. Prevented by long-continued ill-health from taking part in boyish sports, he had the more opportunity for the development of his precocious mind. At the age of four, it is said, he used to read and expound the Bible to his father's servants; before he was ten he had sketched a Chaldee grammar, prepared a Greek and a Hebrew vocabulary, compiled a collection of two thousand biographies of famous men and women on the model of the great works of Bayle and Moreri, and written in Latin verse a satire on his tutor, who had warned him against a too great excursiveness. When still hardly fifteen he was already the author of numerous metrical translations from Ovid, Horace, and Virgil, as well as of original lyrics, dramas, and an epic of four thousand lines on the origin of the Swiss confederation, writings which he is said on one occasion to have rescued from a fire at the risk of his life, only, however, to burn them a little later (1729) with his own hand. Haller's attention had been directed to the profession of medicine while he was residing in the house of a physician at Biel after his father's death in 1721; and, following the choice then made, he while still a sickly and excessively shy youth went in his sixteenth year to the university of Tübingen (December, 1723), where he studied under Camerarius and Duvernoy. Dissatisfied with his progress, he in 1725 exchanged Tübingen for Leyden, where Boerhaave was in the zenith of his fame, and where Albinus had already begun to lecture in anatomy. At that university he graduated in May, 1727, undertaking successfully in his thesis to prove that the so-called salivary duct, claimed as a recent discovery by Coschwitz, was nothing more than a blood-vessel. Haller then visited London, making the acquaintance of Sir Hans Sloane, Cheselden, Pringle, Douglas, and other scientific men; next, after a short stay in Oxford, he visited Paris, where he studied under Ledran and Winslow; and in 1728 he proceeded to Basel, where he devoted himself to the study of the higher mathematics under John Bernoulli. It was during his stay there also that his first great interest in botany was awakened; and in the course of a tour through Savoy, Baden, and several of the Swiss cantons, he began a collection of plants which was afterwards the basis of his great work on the flora of Switzerland. In 1729 he returned to Bern and began to practise as a physician; his best energies, however, were devoted to the botanical and anatomical researches which rapidly gave him a European reputation, and procured for him from George II. in 1736 a call to the chair of medicine, anatomy, botany and surgery, in the newly-founded university of Göttingen. The quantity of work achieved by Haller in the seventeen years during which he occupied this post was immense. Apart from the ordinary work of his classes, which entailed upon him the task of newly organizing a botanical garden, an anatomical theatre and museum, an obstetrical school, and similar institutions, he carried on without interruption those original investigations in botany and physiology, the results of which are preserved in the numerous works associated with his name; he continued also to persevere in his youthful habit of poetical composition, while at the same time he conducted a monthly scientific journal to which he is said to have contributed twelve thousand articles relating to almost every branch of human knowledge. He also warmly interested himself in most of the religious questions, both ephemeral and permanent, of his day; and the erection of the Reformed church in Göttingen was mainly due to his unwearied energy. Notwithstanding all this variety of absorbing interests he never felt at home in Göttingen; his untravelled heart kept ever turning towards his native Bern (where he had been elected a member of the great council in 1745), and in 1753 he resolved to resign his chair and return to Switzerland. The twenty-one years of his life which followed were largely occupied in the discharge of his duties as "amman," to which honorable office he had been chosen by his fellow-citizens, and in the preparation of his *Bibliotheca Medica*, the botanical, surgical, and anatomical parts of which he lived to complete; but he also found time to write the three philosophical romances, —*Usong* (1771), *Alfred* (1773), and *Fabius and Cato* (1774), —in which his views as to the respective merits of despotism, of limited monarchy, and of aristocratic republican government are fully set forth. About 1773 the state of his health rendered necessary his entire withdrawal from public business; for some time he supported his failing strength by means of opium, on the use of which he communicated a paper to the *Proceedings* of the Göttingen Royal Society in 1776; the excessive use of the drug is believed, however, to have hastened his death, which occurred on the 17th of December, 1777. Haller, who had been three times married, left eight children, the eldest of whom, Gottlieb Emanuel, attained to some distinction as a botanist and as a writer on Swiss history.

For some account of Haller's contributions to the sciences of which he was especially an ornament, see the articles Anatomy (vol. i. p. 713) and Physiology. Subjoined is a classified but by no means an exhaustive list of his very numerous works in various branches of science and literature:—(1) Anatomical:—*Icones anatomicæ* (1743-54); *Disputationes anatomicæ selectiores* (1746–52); and *Opera acad. minora anatomici argumenti* (1762–68). (2) Physiological:—*De respiratione experimenta anatomica* (1747); *Primæ lineæ physiologiæ* (1747); and *Elementa physiologiæ corporis humani* (1757–60). (3) Pathological and surgical:—*Opuscula pathologica* (1755); *Disputationum chirurg. collectio* (1777); also careful editions of Boerhaave's *Prælectiones academicæ in proprias institutiones rei medicæ* (1739), and of the *Artis medicæ principia* of the same author (1769–74). (4) Botanical:—*Enumeratio stirpium Helveticarum* (1742); *Opuscula botanica* (1749); *Bibliotheca botanica* (1771). (5) Theological:—*Briefe über die wichtigsten Wahrheiten der Offenbarung* (1772); and *Briefe zur Vertheidigung der Offenbarung* (1775–77). (6) Poetical:—*Gedichte* (1732, 12th ed. 1777). His three romances have been already mentioned. Several volumes of lectures and "Tagebücher" or journals were published posthumously.

See J. G. Zimmermann, *Das Leben des Herrn von Haller* (1755), and the articles by Förster and Seiler in Ersch and Gruber's *Encyklopädie*.

HALLEY, Edmund (1656–1742), an eminent astronomer, was born at Haggerston, near London, October 29, 1656. His father, a wealthy soapboiler, desiring to give his only son an education suitable to his promising genius, placed him at St. Paul's School, where he was equally distinguished for classical as for mathematical ability. Before leaving it for Queen's College, Oxford, which he entered as commoner in 1673, he had observed the change in the variation of the compass, and, at the age of nineteen, he supplied a new and improved method of determining the elements of the planetary orbits. His detection of considerable errors in the tables then in use led him to the conclusion that a more accurate ascertainment of the places of the fixed stars was indispensable to the progress of astronomy; and, finding that Flamsteed and Hevelius had already undertaken to catalogue those visible in northern latitudes, he assumed to himself the task of making observations in the southern

hemisphere. A recommendation from Charles II. to the East India Company procured for him an apparently suitable, though, as it proved, ill-chosen station, and in November, 1676, he embarked for St. Helena. On the voyage he noticed the retardation of the pendulum in approaching the equator; and during his stay on the island he observed the transit of Mercury, which suggested to him the important idea of employing similar phenomena for the calculation of the solar distance. He returned to England in November, 1678, having by the registration of 360 stars won the title of the "Southern Tycho," and by the translation to the heavens of the "Royal Oak," earned a degree of master of arts, conferred at Oxford by the king's command December 3, 1678, almost simultaneously with his election as fellow of the Royal Society. Six months later, the indefatigable astronomer started for Dantzic to set at rest a dispute of long standing between Hooke and Hevelius as to the respective merits of plain or telescopic sights; and towards the end of 1680 he proceeded on a Continental tour. In Paris he observed with Cassini the great comet of 1680 after its perihelion passage; and having returned to England, he married in 1682 Mary, daughter of Mr. Tooke, auditor of the exchequer, with whom he lived harmoniously for fifty-five years. He now fixed his residence at Islington, engaged chiefly upon lunar observations, with a view to the great desideratum of a method of finding the longitude at sea. His mind, however, was also busy with the momentous problem of gravity. Having reached so far as to perceive that the central force of the solar system must decrease inversely as the square of the distrace, and applied vainly to Wren and Hooke for further elucidation, he made in August, 1684, that journey to Cambridge for the purpose of consulting Newton, which resulted in the publication of the *Principia*. The labor and expense of passing this great work through the press devolved upon Halley, who also wrote the prefixed hexameters ending with the well-known line—

Nec fas est propius mortali attingere divos.

In 1696 he was, although a zealous Tory, appointed comptroller of the mint at Chester, and (August 19, 1698) he received a commission as captain of the "Paramour Pink" for the purpose of making extensive observations on the conditions of terrestrial magnetism. This task he accomplished in a voyage which lasted two years, and extended to the 52d degree of S. latitude. The results were published in a *General Chart of the Variation of the Compass* in 1701; and immediately afterwards he executed by royal command a careful survey of the tides and coasts of the British Channel, an elaborate map of which he produced in 1702. On his return from a journey to Dalmatia, for the purpose of selecting and fortifying the port of Trieste, he was nominated, November, 1703, Savilian professor of geometry at Oxford, and received an honorary degree of doctor of laws. Between 1713 and 1721 he acted as secretary to the Royal Society, having previously during eight years (1685–93) filled the same office, and early in 1720 he succeeded Flamsteed as astronomer-royal. Although in his sixty-fourth year, he undertook to observe the moon through an entire revolution of her nodes (eighteen years), and actually carried out his purpose. He died in the full possession of his faculties, January 14, 1742, at the age of eighty-five.

Halley's most notable scientific achievements were—his detection of the "long inequality" of Jupiter and Saturn, and of the acceleration of the moon's mean motion; his discovery of the proper motions of the fixed stars; his theory of variation, including the hypothesis of four magnetic poles, revived by Hansteen in 1819, and his suggestion of the magnetic origin of the aurora borealis; his calculation of the orbit of the 1682 comet (the first ever attempted), coupled with a prediction of its return, strikingly verified in 1759 and 1835; and his indication (in 1716, *Phil. Trans.*, No. 348) of a method still used for determining the solar parallax by means of the transits of Venus.

His principal works are *Catalogus Stellarum Australium*, London, 1679, the substance of which was embodied in vol. iii. of Flamsteed's *Historia Cœlestis*, 1725; *Synopsis Astronomiæ Cometicæ*, Oxford, 1705; *Astronomical Tables*, London, 1752; also eighty-one miscellaneous papers of considerable interest, scattered through the *Philosophical Transactions*. To these should be added his version from the Arabic (which language he acquired on the purpose) of the treatise of Apollonius *De sectione rationis*, with a restoration of his two lost books *De sectione spatii*, both published at Oxford in 1706; also his fine edition of the *Conics* of Apollonius, with the treatise by Serenus, *De sectione cylindri et coni*, Oxford, 1710, folio. His edition of the *Spherics* of Menelaus was published by his friend Dr. Costard in 1758.

HALLOWEVEN or Hallowe'en, the vigil of Hallowmas or All Saints' Day. For some account of the singular observances by which it used to be, and to some extent still is, distinguished in Scotland and elsewhere, reference may be made to such works as Brand's *Popular Antiquities*, Chambers's *Book of Days*, or better still to the well-known poem of Burns. Though sometimes neglected in modern practice, the most essential part of Hallowe'en ritual seems to consist in the lighting by each household of a bonfire at nightfall. This points to the very ancient and widely-diffused practice of kindling sacred fires at certain seasons of the year. While the Germanic nations had their Osterfeuer and Johannisfeuer, the Celtic had their Bealtinc or Beiltinc (see Beltane) and Samhtheine, the former on the eve of May 1, and the latter on the eve of November 1. Probably the winter as well as the summer festival was from the beginning regarded as a season at which the fairies were both unusually active and unusually propitious; but there is no evidence to show that the methods of divination at present usually resorted to, although of great antiquity, were originally regarded as limited in their efficacy to any one day. See Grimm's *Deutsche Mythologie*, ch. xx. (Elemente), and ch. xxxiv. (Aberglaube).

HALLUIN, a town of France, in the department of Nord and arrondissement of Lille, and 11 miles N. N. E. of Lille, is situated near the right bank of the Lys. It contains several religious and benevolent institutions, including a hospital. The manufactures comprise linen and cotton goods, bricks, and oil. The family of Halluin or Halowin is mentioned as early as 1266. Baron Walter II. was one of the forty hostages sent to England in 1360 in exchange for the French King John. George of Halluin or Halowin was a general in the service of Henry V., and an ambassador to England. He died in 1537, leaving several treatises in Latin. The family, to which the title of duke had been granted in 1581, became extinct about the middle of the 17th century. Population of the town (1901), 11,994.

HALMSTAD, the chief town of the Swedish län Halland or Halmstad, is situated on the east shore of the Cattegat, about 76 miles S. S. E. of Gothenburg, and at the mouth of the river Nissa. The castle is the residence of the governor of the province. Mention of the church of Halmstad occurs as early as 1462, and the fortifications are mentioned first in 1225. The latter were demolished in 1736. The Dominican and Franciscan monasteries, formerly in the town, are now quite destroyed. The harbor, built in 1837–40, at a cost of about £5250, admits ships of 10 feet draught, by means of which some trade in deals, pitch, and tar is carried on. The salmon-fishery is important. An archæological society holds its meetings in Halmstad, and the popular magazine *Svenska Family Journalen* is published there. There are both mineral and sea-water baths in the neighborhood. The oldest town-privileges of Halmstad date from 1307, while the first recorded event in its military history is the battle of Nissa, between Harold Hardrada and Sven Ulfsson. During the revolt of the miner Engelbrekt, it twice fell into the hands of the rebels —in 1434 and 1436. The town appears to have been frequently chosen as the meeting-place of the rulers and delegates of the three northern kingdoms; and under the union of Calmar it was appointed to be the place for the election of a new Scandinavian monarch whenever necessary. The län of Halland formed part of the territory of Denmark in Sweden, and accordingly, in 1534, during his war with the Danes, Gustavus Vasa assaulted and took its chief town. In 1660, by the treaty of Copenhagen, the whole district was ceded to Sweden. In 1676 Charles XII. defeated near Halmstad a Danish army, which was attempting to retake the district, and since that time Halland has formed part of Sweden. The population of the town in 1900 was 15,362.

HALO (Latin, *halo;* Greek, ἅλως), a luminous circle of light surrounding one of the heavenly bodies. A better definition perhaps would be "a ring of colored light formed

by refraction, on the passage of light from one of the heavenly bodies through the aqueous vapor surrounding the earth." This would include coronæ and rainbows, and similar phenomena.

Halos may be divided into the following classes:—

1. Encircling..... { A. Simple. B. Compound, *i. e.*, halo systems. C. Coronæ.
2. Opposite ..... { *a*. Rainbows. *β*. Fog-bows and mist halos. *γ*. Mountain spectres.

They are usually seen surrounding the sun or the moon, but in the tropics small halos were observed by Humboldt round the planet Venus. The formation of encircling halos of the classes A and B is generally attributed to refraction and reflection of the rays of light by the presence of minute snow crystals in the upper strata of the air, and they occur usually when cirrus or cirro-stratus clouds exist. This theory was originated by Descartes, and was adopted by Marriotte (in 1686), and subsequently followed by Dr. Young and Sir Isaac Newton. It is, however, probable that some halos and certainly all coronæ (class C) are formed by refraction of light from globules of water suspended in the atmosphere. Simple halos are either about 22½ degrees or 47 degrees in diameter. The ice or snow crystals, being hexagonal in form, sometimes produce a double refraction, and then the large and small halos are seen at the same time, and, reflection taking place from the surfaces of the crystals, additional halos or parts of halos are formed as in figs. 1 and 2. At the points of intersection of the halos,

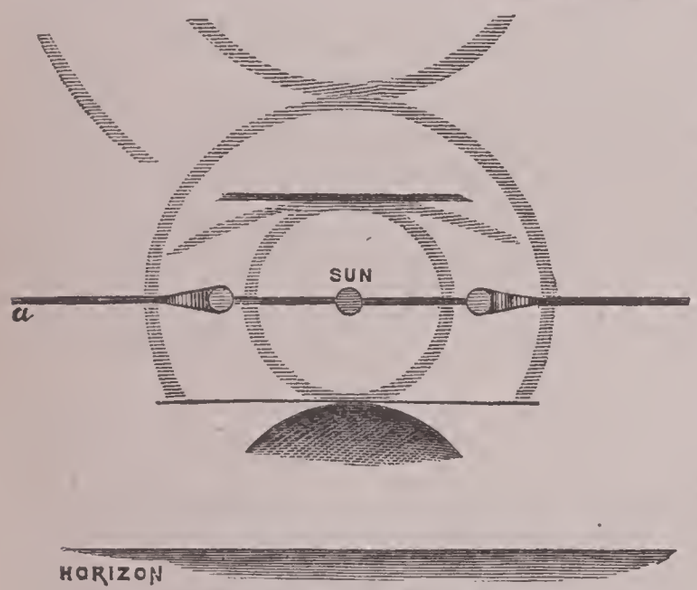


Fig. 1.—Solar halos and parhelia seen at Brighton, June 5, 1875, by F. E. Sawyer, from 4 to 5.45 P. M. The halo *a* was a large one, having the zenith for its centre and going entirely round the heavens. It was a white band, and passed through the sun and the mock suns. The parhelia were of prismatic colors and had flaming tails.

images of the sun or moon sometimes appear; when seen with the former, they are called *parhelia* or *mock-suns*, and when with the latter, *paraselenæ*, or *mock-moons*. They are

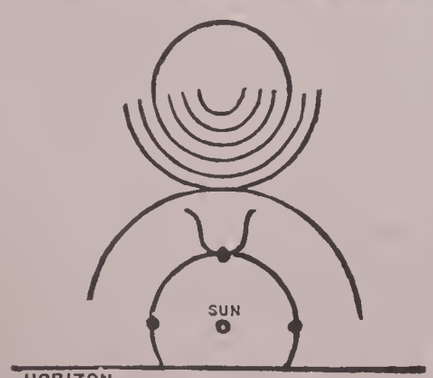


Fig. 2.—Halo system observed at Aberdeen, January 23, 1870, at 2 P. M. (see Symons's *Monthly Meteorological Magazine*, 1870, pp. 1 and 32, and frontispiece).

sometimes accompanied with flaming tails, and are usually of prismatic colors, as also are the halos and coronæ. The latter are seen when fleecy clouds or mist intervene between the spectator and the sun or moon, to which they are in immediate proximity, thereby being distinguished from the halos, which are formed at a distance from those luminaries. The predominating color in coronæ is red or orange.

The second principal division of halos includes those which are seen opposite to the sun and moon. The first

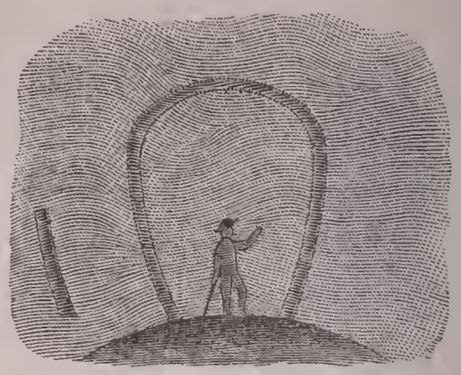


Fig. 3.—A mountain spectre as seen by F. E. Sawyer on the Rigi, shortly after sunrise, August 18, 1877.

class of these comprises rainbows (*a*), which are occasioned by refraction of the light from the sun or moon, produced by falling rain, causing a bow with the prismatic colors in concentric bands and arranged as they appear in the solar spectrum. When the rain is abundant an inner bow is formed, the colors in which are in inverted order. Rainbows when seen from mountain tops and the topmasts of ships are completely circular. Fog-bows and mist halos (*β*) are somewhat similar. The former are frequently white in color, and are seen in the English Channel, and also off the banks of Newfoundland, being called by sailors "fog-eaters," from their indicating a dispersion of the fog and mist. They appear to be formed in a horizontal or very oblique plane. Mist halos are seen in the vapor of fountains or waterfalls, and resemble rainbows. Mountain spectres (*γ*) are caused by reflection, and often appear accompanied by chromatic halos (see fig. 3). They generally occur on mountains when the sky between the observer and the sun is clear and there is a mist or cloud on the side of the mountain opposite to the sun, on which the summit of the mountain and the buildings and persons standing near are reflected. The most notable of mountain spectres is that of the Brocken, in the Harz mountains. Howitt says of this:—

"If the fog is very dry, you see not only yourself but your neighbor; if very damp, only yourself, surrounded by a rainbow-colored glory, which becomes more lustrous and beautiful the damper and thicker the fog is, and the nearer it approaches."

Many of the ancient descriptions of miraculous appearances in the heavens may be attributed to the phenomena before mentioned. Among the chief of these is the appearance of a cross which the emperor Constantine alleged he saw in the heavens about noon when marching against Maxentius (about 313 A. D), and which was the cause of his conversion to Christianity (Eusebius, *Vita Constant.*, i. 27). Some writers have doubted the occurrence; but it is

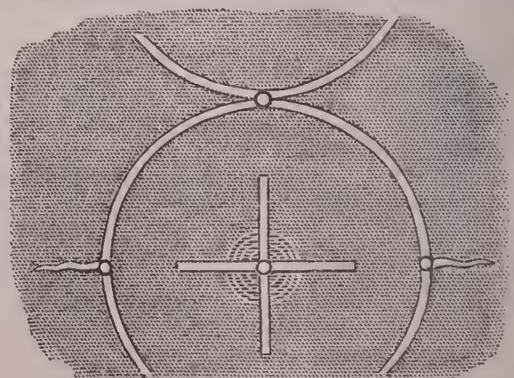


Fig. 4.—A system of lunar halos and paraselenæ figured in Buchan's *Meteorology*, p. 193.

quite possible Constantine saw part of a system of solar halos, and two of these at right angles would form a cross (see fig, 4), The *Brighton Herald* of April 10, 1852,

records a similar phenomenon on April 1st of that year at Brighton:—

"Sun setting, evening very fine with slight haze westward, when a ray of brilliant light shot upwards about 20 degrees above the horizon, directly perpendicular from the sun, and soon after its appearance it was crossed by a horizontal band of light of a paler color, but about the same breadth. It formed a perfect cross, and lasted half an hour."

Halos and rainbows are considered valuable prognostications of future weather. Fragments of rainbows seen on detached clouds are called *wind-dogs*, and are said to be a sign of wind. When the diameter of a corona contracts it shows the water particles are uniting into larger ones which may fall in rain, whereas if the corona extends, the particles are growing smaller, indicating increasing dryness. The open side of a halo is in some places considered to foretell the quarter from which bad weather may be expected.

See M. A. Bravais, "Mémoire sur les Halos et les Phénomènes optiques qui les accompagneut" (*Journal de l'École Royale Polytechnique*, 31 cahier, tome 18, Paris, 1847); Buchan, *Introductory Text-Book of Meteorology*, 1871, *Proc. Met Soc.*, 1875, vol. ii. new ser., pp. 438 to 444. (F. E. S.)

HALS, Frans, was born at Antwerp according to most authorities in 1584, and died at Haarlem in 1666. As a portrait painter, second only to Rembrandt, he displayed extraordinary talent and quickness in the exercise of his art coupled with improvidence in the use of the means which that art secured to him. At a time when the Dutch nation fought for independence and won it, Hals appears in the ranks of its military guilds. He was also a member of the chamber of rhetoric, and (1644) chairman of the painters' corporation at Haarlem. But as a man he had failings unhappily common to persons of his profession in that age. He so ill-treated his first wife that she died prematurely in 1616; and he barely saved the character of his second by marrying her in 1617. Another defect was partiality to drink, which led him into low company. Still he brought up and supported a family of ten children with success till 1654, when the forced sale of his pictures and furniture, at the suit of a baker to whom he was indebted for bread and money, brought him to absolute penury. Subsequently to this he was reduced to still greater straits, and his rent and firing were paid by the municipality, which afterwards gave him (1664) an annuity of 200 florins. We may admire the spirit which enabled him under these circumstances to produce some of his most striking productions. We regret to find his widow seeking outdoor relief from the guardians of the poor and dying obscurely in a hospital.

Hals's pictures illustrate the various strata of society into which his misfortunes led him. His banquets or meetings of officers, of sharpshooters, and guildsmen are the most interesting of his works. But they are not more characteristic than his low-life pictures of itinerant players and singers. His portraits of gentlefolk are true and noble, but hardly so expressive as those of fishwives and tavern heroes. His first master was Van Mander the painter and historian, of whom he possessed some pictures which went to pay the debt of the baker above alluded to. But he soon left behind him the practice of the time illustrated by Schoreel and Moro, and, emancipating himself gradually from tradition, produced pictures remarkable for truth and dexterity of hand. We prize in Rembrandt the golden glow of effects based upon artificial contrasts of low light in immeasurable gloom. Hals was fond of daylight of silvery sheen. Both men were painters of touch, but of touch on different keys. Rembrandt was the bass, Hals the treble. The latter is perhaps more expressive than the former. He seizes with rare intuition a moment in the life of his sitters. What nature displays in that moment, he reproduces thoroughly in a very delicate scale of color, and with a perfect mastery over every form of expression. He becomes so clever at last that exact tone, light and shade, and modelling are all obtained with a few marked and fluid strokes of the brush.

In every form of his art we can distinguish his earlier style from that of later years. Two Boys Playing and Singing in the gallery of Cassel, and a Banquet of Officers (1616) in the museum of Haarlem, exhibit him as a careful draughtsman capable of great finish, yet spirited withal. His flesh, less clear than it afterwards becomes, is pastose and burnished. Further on he becomes more effective, displays more freedom of hand, and a greater command of effect. At this period we note the beautiful full length of a young lady of the Berensteyn family in the house of that name at Haarlem, and a splendid full length of a Patrician leaning on a Sword in the Lichtenstein collection at Vienna. Both these pictures are equalled by the Banquets of Officers of 1627, and a Meeting of the Company of St. George of 1633 in the Haarlem Museum. A picture of the same kind in the town-hall of Amsterdam, with the date of 1637, suggests some study of the masterpieces of Rembrandt, and a similar influence is apparent in a picture of 1641 at Haarlem, representing the "Regents" of the Company of St. Elizabeth. But Rembrandt's example did not create a lasting impression on Hals. He gradually dropped more and more into gray and silvery harmonies of tone; and two of his canvases, executed in 1664, the Regents and Regentesses of the Oudemannenhuis at Haarlem, are masterpieces of color, though in substance all but monochromes.

There are portraits by Hals in many Continental galleries. Comparatively few have found their way to England. Sir Richard Wallace's Cavalier, Lord Chesterfield's Toper, Lord Radnor's Likenesses of an Old Man and Woman, are the best that we can point out. Abroad a better selection may be found. At Amsterdam is the celebrated Flute Player, once in the Dupper collection at Dort, and the pair called Hals and his Wife; at Brussels, the patrician Heythuysen; at the Louvre, Desecartes; at Dresden, the painter Van der Vinne. Hal's sitters were taken in every class of society,—admirals, generals, and burgomasters pairing with merchants, lawyers, clerks. To register all that we find in public galleries would involve much space. There are nine portraits at Berlin, five at Frankfort, six at Cassel, five at St. Petersburg, three at the Louvre, two at Brussels, four at Dresden, two at Gotha. In private collections, chiefly in Paris, Haarlem, and Vienna, we find an equally important number. Amongst his most successful representations of fishwives and termagants we should distinguish the Hille Bobbe of the Berlin Museum, and the Hille Bobbe with her Son in the Dresden Gallery. Itinerant players are best illustrated in the Neville-Goldsmith collection at the Hague, and the Six collection at Amsterdam. Boys and girls singing, playing, or laughing, or men drinking, are to be found in the gallery of Schwerin, in the Arenberg collection, and in the royal palace at Brussels. The latest works of Hals in each of these branches are distinguished by comparatively black shadow.

Of the master's numerous family none has left a name except Frans Hals the younger, born about 1622, who died in 1669. His pictures represent cottages and poultry; and the Vanitas at Berlin, a table laden with gold and silver dishes, cups, glasses, and books, is one of his finest works and deserving of a passing glance.

Quite in another form, and with much of the freedom of the elder Hals, Dirk Hals, his brother (born at Haarlem, died 1656), is a painter of festivals and ball-rooms. But Dirk had too much of the freedom and too little of the skill in drawing which characterized his brother. He remains second on his own ground to Palamedes. A fair specimen of his art is a Lady playing a Harpsichord to a Young Girl and her Lover in the Van der Hoop collection at Amsterdam. More characteristic, but not better, is a large company of gentlefolk rising from dinner, in the academy at Vienna.

HALSTEAD, a market-town of England, county of Essex, is situated on the Colne Valley Railway and on a steep acclivity rising from the river Colne, 48 miles N. E. of London. Though irregularly built it has a neat appearance, and most of the streets are wide and clean. The principal buildings are the parish church, a fine Gothic edifice in the Perpendicular style, containing a monument supposed to be that of Sir Robert Bourchier, lord chancellor to Edward III.; the church of the Holy Trinity, in the Early English style, erected in 1844; the Lady Mary Ramsay's grammar school, the mechanics' institute, and the corn exchange. The principal industries are the manufacture of silk, crape, and velvet. Straw plaiting, at one time the principal occupation of the women, is now nearly extinct. The population of the town in 1901 was 6,072,

HALYBURTON, Thomas (1674–1712), a distinguished Scottish divine, was born at Dupplin, near Perth, on the 25th of December, 1674. His father, one of the ejected ministers, having died in 1682, he was taken by his mother in 1685 to Rotterdam, where he for some time attended with advantage the school founded by Erasmus. On his return to his native country in 1687 he completed his elementary education at Perth and Edinburgh, and in 1692 entered the university of St. Andrews. In 1700 he was ordained minister of the parish of Ceres, and in 1710 he

was recommended by the synod of Fife for the chair of theology in St. Leonard's College, St. Andrews, to which accordingly he was appointed by Queen Anne. After a brief term of active professorial life he died in 1712. The works by which he continues to be known, especially in Scotland, were all of them published after his death. The treatise entitled *Natural Religion Insufficient, and Revealed Necessary, to Man's Happiness in his present State* (1714) is an able reply to some of the arguments of Lord Herbert and of Blount; the *Great Concern of Salvation* (1721), still read, handles questions of practical and experimental religion with great earnestness and in a manner that exhibits favorably one of the best types of piety current in his time; the *Memoirs* written by himself, which have been frequently reprinted, are similarly interesting and valuable.

HAM (חָם), the second son of Noah (Gen. v. 32), and the progenitor of Cush, Mizraim, Phut, and Canaan (Gen. x. 6). On the assumption that these early genealogies are geographical rather than personal or even ethnological, the name Ham, which in Hebrew radically signifies "hot," would seem to indicate the torrid zone; and this inference, though not supported, so far as has been hitherto discovered, by any corresponding explanation of the names of Shem and Japheth, at least harmonizes well with the fact that on the whole Shem seems intended to denote the intermediate and Japheth the northern regions of the world as known to the compiler of the Book of Genesis. The attempt has sometimes been made to identify Ham with Keme or Chemi, an old native name of Egypt, signifying "black," and having reference, it is supposed, to the color of the soil. But this identification has no adequate etymological support (see Lepsius in Herzog and Plitt's *Encykl.*, i. 166); and the allusions in several of the Psalms to Egypt as the land of Ham (Ps. cv. 23, cvi. 22) are not inconsistent with the belief that the latter name was primarily used in a much wider and less local sense. The solitary incident regarding Ham related in Gen. ix. 20–27 seems intended to indicate, from the Israelite point of view, the immodest and sensual tendencies of the Canaanites and other "Hamitic" peoples.

HAM, a small town of France, in a marshy district on the left bank of the Somme, about 40 miles south-east of Amiens, on the railway between Amiens and Rheims. It had in 1901 a population of only 2,866; but historically it is a place of very considerable importance. From the 9th century onwards it appears as the seat of a lordship which, after the extinction of its hereditary line, passed in succession to the houses of Coucy, Enghien, Luxembourg, Rohan, Vendôme, and Navarre, and was finally united to the French crown on the accession of Henry IV. In 1108 an abbey of canons regular of the congregation of France was founded at Ham; and it continued to exist till the great Revolution, the revenue of its abbot about that time amounting to 15,000 livres. The abbey church (Notre Dame) dates from the 12th century, but in April, 1760, all the inflammable portions of the buildings were destroyed by a conflagration caused by lightning, and during the present century a process of restoration has been carried out under the direction of M. Corroyer. Of special note are the bas reliefs of the nave and choir, executed in the 17th and 18th centuries, and the crypt of the 11th century, which contains the sepulchral effigies of Odo of Ham and his wife Isabella of Béthencourt. The castle, founded by Odo in the 12th century, was rebuilt in the 13th and extended in the 14th, and its present appearance is mainly due to Louis of Luxembourg, count of St. Pol, who between 1436 and 1470 not only furnished it with outworks, but gave such a thickness to the towers and curtains, and more especially to the great tower or donjon which still bears his motto *Mon Myeux*, that they would offer a long resistance even to modern artillery (Viollet-le-Duc). It forms a rectangle 395 feet long by 263 feet broad, with a round tower at each angle and two square towers protecting the curtains. The eastern and western sides are each defended by a demi-lune. The Constable's Tower, for so the great tower is usually called in memory of St. Pol, has a height of about 100 feet, and the thickness of the walls is 36 feet; the interior is occupied by three large hexagonal chambers in as many stories. As the castle of Ham has frequently been used as a state prison both in ancient and modern times, the list of those who have tasted its hospitality is an interesting one, including Joan of Arc, Louis of Bourbon, the ministers of Charles X., Louis Napoleon, Cavaignac, and Lamoricière. Louis Napoleon was there for six years, and at last effected his escape in the disguise of a workman. During 1870–71 Ham was several times captured and recaptured by the belligerents.

A view and plan of the town will be found in Caspar Merian's *Topographia Galliæ*, Frankfort, 1656; and the former is copied in the *Gentleman's Magazine*, 1831; see also De Feuillide, *Le Château de Ham*, 1842; and Ch. Gomart, *Ham, son château*, 1864.

HAMADAN, a town of Persia, in the province of Irak-Adjemi, 162 miles W.S.W. of Teheran, in the district of the Djebal at the foot of the Elvend or Arwand Mountain, the Orontes of the ancients. It is a busy place of about 40,000 inhabitants, and has large and well-stocked bazaars. Its principal industry is the manufacture of copper wares. Gold is collected in the streams traversing the town, and the surrounding country is remarkable for its beauty and fertility. Every quarter is shut off from its neighbors by gates which are closed at night. The chief objects of interest are the tombs of Esther and Mordecai, and of the Arabian philosopher Avicenna. The former, constructed of black wood, are adorned with Hebrew inscriptions which may be seen figured in Ker Porter's *Travels*. According to these, the pavilion or temple over the tombs was erected in the year of the creation 4474. The ordinary inhabitants of Hamadan attach more importance to a stone image of a lion which they assert was set up by Belinas a magician, to mitigate the cold from which their city suffers severely. "Hamadan," says Hamadani, echoing a common Persian complaint, "is the most hateful of towns; its children are old men for ugliness, and its old men are children for silliness." At the same time the town has produced many eminent men, among whom are Abu 'l Fadhl Ahmed Hamadani himself, Zafer ed Din the Persian poet, and Zamiri. The origin of the city is carried back by Hischam el Kelbi to Hamadan a grandson of Shem, but other writers are contented with a less antiquity. Its claims to be identified with the Ecbatana of the classical authors have been treated of under ECBATANA. The present town has almost no ancient remains, and especially there are no sculptured works. See Meynard, *Dictionnaire géographique de la Perse*.

HAMAH, the Hamath of the Bible, one of the oldest cities of Syria (Gen. x. 18), situated in the valley of the Orontes, 110 English miles N. (by E.) of Damascus. It finds a place among the northern boundaries of the Holy Land (Num. xxxiv. 8), and is frequently mentioned in Old Testament history (Num. xiii. 21, 2 Sam. viii. 9, 1 Kings viii. 65, 2 Kings xviii. 34, 2 Chron. viii. 3, Isa. x. 9, Amos vi. 2). The city lies in a narrow valley, the pass south of it being probably the "entering in of Hamath" (1 Kings viii. 65). The Orontes flows winding through it, and is spanned by four bridges. On the south-east the houses rise 150 feet above the river, and there are four other hills, that of the *Kalah* or castle being to the north 100 feet high. Twenty-four minarets rise from the various mosques. The houses are principally of mud, and the town stands amid poplar gardens with a fertile plain to the west. The castle is ruined, the streets are narrow and dirty, but the bazaars are good, and the trade with the Bedawin considerable. The numerous water-wheels (*naûrah*), of enormous dimensions, raising water from the Orontes, are the most remarkable features of the view. The population is stated in official returns to consist of about 39,000 Moslems and 4000 non-Moslems. The curious Hamath inscriptions first mentioned by Burckhardt have lately attracted much attention. Four stones exist covered with ideographic designs in a character as yet quite unknown. The latest researches of Mr. George Smith, however, indicate that the inscriptions are probably of Hittite origin, and other relics of that once powerful nation resembling the Hamath stones have been discovered farther east.

In the year 854 B. C. (according to the late George Smith) Hamath was taken by Shalmaneser, king of Assyria, who defeated an army of 1400 chariots and 10,000 footmen under Irhulena, king of the district. Again in 743 B. C. Tiglath Pileser II. reduced the city to tribute, and in 740 B. C. he defeated the Hamathites, who were assisted by Azariah, king of Judah. Another rebellion was crushed by Sargon in 720 B. C. After the Macedonian conquest of Syria Hamath was called Epiphania by the Greeks in honor of Antiochus IV., Epiphanes, and in the early Byzantine period it was known by both its Hebrew and its Greek name. In 639 A. D. the town surrendered

to Abu 'Obeideh, one of Omar's generals, and the church was turned into a mosque. In 1108 A. D. Tancred captured the city and massacred the Ism'aileh defenders. In 1115 it was retaken by the Moslems, and in 1178 was occupied by Saladin. Abulfeda, prince of Hamah in the early part of the 14th century, is well known as an authority on Arab geography.

HAMANN, Johann Georg (1730–1788), a distinguished writer on philosophical and theological subjects, was born at Königsberg in Prussia in 1730. His parents were of humble rank and small means. The education he received was comprehensive but unsystematic, and the want of definiteness in this early training doubtless tended to aggravate the peculiar instability of character which troubled Hamann's after life. In 1746 he began theological studies, but speedily deserted them and turned his attention to law. That too was taken up in a desultory fashion and quickly relinquished. Hamann seems at this time to have thought that any strenuous devotion to "bread-and-butter" studies was lowering, and accordingly gave himself entirely to reading, criticism, and philological inquiries. Such studies, however, were pursued without any definite aim or systematic arrangement, and consequently were productive of nothing. In 1752, constrained to secure some position in the world, he accepted a tutorship in a family resident in Livonia, but only retained it a few months. A similar situation in Courland he also resigned after about a year. In both cases apparently the rupture might be traced to the curious and unsatisfactory character of Hamann himself. After leaving his second post he was received into the house of a merchant at Riga named Berens, who contracted a great friendship for him and selected him as his companion for a tour through Dantzic, Berlin, Hamburg, Amsterdam, and London. Hamann, however, was quite unfitted for business, and, when left in London, gave himself up entirely to his fancies, and was quickly reduced to a state of extreme poverty and want. It was at this period of his life, when his inner troubles of spirit harmonized with the unhappy external conditions of his lot, that he began an earnest and prolonged study of the Bible; and from this time dates the tone of extreme pietism which is characteristic of his writings, and which undoubtedly alienated many of his friends. He returned to Riga, and was well received by the Berens family, in whose house he resided for some time. A quarrel, the precise nature of which is not very clear though the occasion is evident, led to an entire separation from these friends. In 1759 Hamann returned to Königsberg, and lived for several years with his father, filling occasional posts in Königsberg and Mitau. In 1767 he obtained a situation as translator in the excise office, and ten years later a post as storekeeper in a mercantile house. During this period of comparative rest Hamann was able to indulge in the long correspondence with learned friends which seems to have been his greatest pleasure. In 1784 the failure of some commercial speculations greatly reduced his means, and about the same time he was dismissed with a small pension from his situation. The kindness of friends, however, supplied provision for his children, and enabled him to carry out the long-cherished wish of visiting some of his philosophical allies. He spent some time with Jacobi at Pempelfort and with Buchholz at Walbergen. At the latter place he was seized with illness, and died on the 21st June, 1788.

Hamann's works resemble his life and character. They are entirely unsystematic so far as matter is concerned, chaotic and disjointed in style. To a reader not acquainted with the peculiar nature of the man, which led him to regard what commended itself to him as therefore objectively true, they must be moreover entirely unintelligible and, from their peculiar pietistic tone and scriptural jargon, probably offensive. A place in the history of philosophy can be yielded to Hamann only because he expresses in uncouth, barbarous fashion an idea to which other writers have given more effective shape. The fundamental thought is with him the unsatisfactoriness of abstraction or onesidedness. The *Aufklärung*, with its rational theology, was to him the type of abstraction. Even Epicureanism, which might appear concrete, was by him rightly designated abstract. Quite naturally, then, Hamann is led to object strongly to much of the Kantian philosophy. The separation of sense and understanding is for him unjustifiable, and only paralleled by the extraordinary blunder of severing matter and form. Concreteness, therefore, is the one demand which Hamann expresses, and as representing his own thought he used to refer to Giordano Bruno's conception of the identity of contraries. The demand, however, remains but a demand. Nothing that Hamann has given can be regarded as in the slightest degree a response to it. His hatred of system, incapacity for abstract thinking, and intense personality rendered it impossible for him to do more than utter the disjointed, oracular, obscure dicta which gained for him among his friends the name of "Magus of the North." Two results only appear throughout his writings,—first, the accentuation of belief, and, secondly, the transference of many philosophical difficulties to language. Belief is, according to Hamann, the groundwork of knowledge, and he accepts in all sincerity Hume's analysis of experience as being most helpful in constructing a theological view. In language, which he appears to regard as somehow acquired, he finds a solution for the problems of reason which Kant had discussed in the *Critique*. On the application of these thoughts to the Christian theology one need not enter.

None of Hamann's writings are of great bulk; most are mere pamphlets of some thirty or forty pages. A complete collection has been published by Roth (*Schriften*, 8vo, 1821–42), and by Gildemeister (*Leben und Schriften*, 6 vols., 1851–73). See also Petri, *Hamann's Schriften u. Briefe*, 4 vols., 1872–3; Poel, *Hamann, der Magus im Norden, sein Leben u. Mittheilungen aus seinen Schriften*, 2 vols., 1874–76. A very comprehensive essay on Hamann is to be found in Hegel's *Vermischte Schriften*, ii. (*Werke*, bd. xvii.).

HAMASAH (more correctly Hamaseh), the name of a famous Arabian anthology compiled by Habîb ibn Aus et-Tâî, surnamed Abû Temmâm (corruptly Abu-Teman, *q. v.*). The collection is so-called from the title of its first book, containing poems descriptive of constancy and valor in battle, patient endurance of calamity, steadfastness in seeking vengeance, manfulness under reproach and temptation, all which qualities make up the attribute called by the Arabs *hamâseh* (briefly paraphrased by Et-Tebrîzî as *esh-shiddeh fi-l-amr*). It consists of ten books or parts, containing in all 884 poems or fragments of poems, and named respectively—(1) *El-Hamâseh*, 261 pieces; (2) *El-Marâthî*, "Dirges," 169 pieces; (3) *El-Adab*, "Manners," 54 pieces; (4) *En-Nesîb*, "The Beauty and Love of Women," 139 pieces; (5) *El-Hijâ*, "Satires," 80 pieces; (6) *El-Adyâf wa-l-Medîh*, "Hospitality and Panegyric," 143 pieces; (7) *Es-Sifât*, "Miscellaneous Descriptions," 3 pieces; (8) *Es-Seyr wa-n-No'âs*, "Journeying and Drowsiness," 9 pieces; (9) *El-Mulah*, "Pleasantries," 38 pieces; and (10) *Medhemmet-en-nisâ*, "Dispraise of Women," 18 pieces. Of these books the first is by far the longest, both in the number and extent of its poems, and the first two together make up more than half the bulk of the work. The poems are for the most part fragments selected from longer compositions, though a considerable number are probably entire. They are taken from the works of Arab poets of all periods down to that of Abû Temmâm himself (the latest ascertainable date being 832 A. D.), but chiefly of the poets of the Ante-Islamic time (*Jâhiliyyûn*), those of the early days of El-Islâm (*Mukhadrimûn*), and those who flourished during the reigns of the Umawî caliphs, 660–749 A. D. (*Islâmiyyûn*). Perhaps the oldest in the collection are those relating to the war of Basûs, a famous legendary strife which arose out of the murder of Kuleyb, chief of the combined clans of Bekr and Teghlib, and lasted for forty years, ending with the peace of Dhu-l-Mejâz, about 534 A. D. Of the period of the 'Abbâsî caliphs, under whom Abû Temmâm himself lived, there are probably not more than sixteen fragments.

Most of the poems belong to the class of extempore or occasional utterances, as distinguished from *qasîdehs*, or elaborately finished odes. While the latter abound with comparisons and long descriptions, in which the skill of the poet is exhibited with much art and ingenuity, the poems of the *Hamâseh* are short, direct, and for the most part free from comparisons; the transitions are easy, the metaphors simple, and the purpose of the poem clearly indicated. It is due probably to the fact that this style of composition was chiefly sought by Abû Temmâm in compiling his collection that he has chosen hardly anything from the works of the most famous poets of antiquity. Not a single piece from Imra'el-Qeys occurs in the *Hamâseh*, nor are there any from 'Alqameh, Zuheyr, or El-A'shà; En-Nâbighah is represented only by two pieces (pp. 408 and 742 of Freytag's edition) of four and three verses respectively, 'Antarah by two pieces of four verses each (*Id.*, pp. 206, 209), Tarafeh by one piece of five verses (*Id.*, p. 632), Lebîd by one piece of three verses (*Id.*, p. 468), and 'Amr son of Kulthûm by one piece of four verses (*Id.*, p. 236). The compilation is thus essentially an anthology of minor poets, and exhibits (so far at least as the more ancient poems are concerned) the general average of poetic utterance at a

time when to speak in verse was the daily habit of every warrior of the desert.

To this description, however, there is an important exception in the book entitled *En-Nesîb*, containing verses relating to women and love. In the classical age of Arab poetry it was the established rule that all *qasîdehs*, or finished odes, must begin with the mention of women and their charms (*teshbîb*), in order, as the old critics said, that the hearts of the hearers might be softened and inclined to regard kindly the theme which the poet proposed to unfold. The fragments included in this part of the work are therefore generally taken from the opening verses of *qasîdehs;* where this is not the case, they are chiefly compositions of the early Islamic period, when the school of exclusively erotic poetry (of which the greatest representative was 'Omar son of Abû Rabî'ah) arose.

The compiler was himself a distinguished poet in the style of his day, and wandered through many provinces of the Muslim empire earning money and fame by his skill in panegyric. About 220 A. H. he betook himself to Khurâsân, then ruled by 'Abd-allâh son of Tâhir, whom he praised and by whom he was rewarded; on his journey home to El-'Irâq he passed through Hamadân, and was there detained for many months a guest of Abu-l-Wafâ son of Selemeh, the road onward being blocked by heavy falls of snow. During his residence at Hamadân Abû Temmâm is said to have compiled or composed, from the materials which he found in Abu-l-Wafâ's library, five poetical works, of which one was the *Hamâseh*. This collection remained as a precious heirloom in the family of Abu-l-Wafâ until their fortunes decayed, when it fell into the hands of a man of Dînawar named Abu-l-'Awâdhil, who carried it to Isfahân and made it known to the learned of that city.

The worth of the *Hamâseh* as a store-house of ancient legend, of faithful detail regarding the usages of the pagan time and early simplicity of the Arab race, can hardly be exaggerated. The high level of excellence which is found in its selections, both as to form and matter, is remarkable, and caused it to be said that Abû Temmâm displayed higher qualities as a poet in his choice of extracts from the ancients than in his own compositions. What strikes us chiefly in the class of poetry of which the *Hamâseh* is a specimen, is its exceeding truth and reality, its freedom from artificiality and hearsay, the evident first hand experience which the singers possessed of all of which they sang. For historical purposes the value of the collection is not small; but most of all there shines forth from it a complete portraiture of the hardy and manful nature, the strenuous life of passion and battle, the lofty contempt of cowardice, niggardliness, and servility, which marked the valiant stock who bore El-Islâm abroad in a flood of new life over the out-worn civilizations of Persia, Egypt, and Byzantium. It has the true stamp of the heroic time, of its weaknesses and crime as of its strength and beauty.

No less than twenty commentaries on it are enumerated by Hâjî Khalîfeh. Of these the earliest was by Abû Riyâsh (otherwise Er-Riyâshî), who died in 257 A. H.; excerpts from it, chiefly in elucidation of the circumstances in which the poems were composed, are frequently given by Et-Tebrîzî. He was followed by the famous grammarian Abu-l-Fath ibn el Jinnî (died 392 A. H.), and later by Shihâb ed-Din Ahmed el-Marzûqî of Isfahân (died 421 A. H.). Upon El-Marzûqî's commentary is chiefly founded that of Abû Zekerîyâ Yahyâ et-Tehrîzî (born 421 A. H., died 502), which has been published by the late Professor G. W. Freytag of Bonn, together with a Latin translation and notes (1828–1851). This monumental work, the labor of a life, is a treasure of information regarding the classical age of Arab literature which has not perhaps its equal for extent, accuracy, and minuteness of detail, in Europe. No other complete edition of the *Hamâseh* has been printed in the West; but in 1856 one appeared at Calcutta under the names of Maulavî Ghulâm Rahhânî and Kabîru-d-dîn Ahmad. Though no acknowledgment of the fact is contained in this edition, it is a simple reprint of Professor Freytag's text (without Et-Tehrîzî's commentary), and follows its original even in the misprints (corrected by Freytag at the end of the second volume, which being in Latin the Calcutta editors do not seem to have consulted). It is thus worthless as a fresh critical authority, and, owing to the absence of a commentary, of little use to the student; its only merit is that it contains in an appendix of 12 pages a collection of verses (and some entire fragments) not found in Et-Tebrîzî's recension, but stated to exist in some copies consulted by the editors; these are, however, very carelessly edited and printed, and in many places unintelligible.

The *Hamâseh* has been rendered with the utmost skill and spirit into German verse by the illustrious Friedrich Rückert (Stuttgart, 1846), who has not only given translations of almost all the poems proper to the work, but has added numerous fragments drawn from other sources, especially those occurring in the *Scholia* of Et-Tebrîzî, as well as the *Mo'allaqahs* of Zuheyr and 'Antarah, the *Lâmiyyeh* of Esh-Shenferâ, and the *Banet So'ad* of Ka'b son of Zuheyr. No such faithful interpretation of the ways and thoughts of the ancient Arabs exists to our knowledge in any modern European language; it is comparable, for fidelity, spirit, and fluency, only to Lane's translation of the *Thousand and One Nights*.

When the *Hamâseh* is spoken of, that of Abû Temmâm, as the first and most famous of the name is meant; but several collections of a similar kind, also called *Hamâseh*, exist. The best known and earliest of these is the *Hamâseh* of El-Bohturî (died 284 A. H.), of which some fragments were published by Theo. Nöldeke in his *Beiträge zur Kenntniss der Poesie der alten Araber* (Hanover, 1864). Four other works of the same name formed on the model of Abû Temmâm's compilation, are mentioned by Hâjî Khalîfeh. Besides these, a work entitled *Hamâset er-Râh* (the Hamâseh of wine), was composed by Abu-l-'Alâ el-Ma'arrî (died 449 A. H.). (C. J. L.)

HAMBATO, a form of the name AMBATO (*q. v.*).

HAMBURG, a state of the German empire, which consists of the city of Hamburg with its incorporated suburbs of St. George's and St. Paul's, the surrounding district with the sixteen suburban hamlets (*Vororte*), several islands in the Elbe, the five enclaves of Volksdorf, Hansdorf, etc., in Holstein, the communes of Moorburg, in Lüneburg and Cuxhaven-Ritzebüttel in the north-west of the duchy of Bremen at the mouth of the Elbe, the island of Neuwerk about five miles from the coast, and the bailiwick (*amt*) of Bergedorf, which up to 1867 was held in common by Lübeck and Hamburg. The whole territory has an area of 160 square miles, exclusive of 99 square miles occupied by the Elbe. Of this area 124 square miles are within the limits of the German customs, but the rest continues to be practically "abroad" in relation to the commerce of the empire. In 1871 the total population was 338,974; by 1875 it had increased to 388,618 (191,339 males and 197,279 females); by 1877 to 406,014; and by 1905 to 874,878. Administratively the state is divided into the city or metropolitan district, which had 239,107 inhabitants in 1871, the domain of the Geestland[1] with 57,216 inhabitants, the domain of the Marschland with 22,982, the bailiwick of Burgedorf with 13,112, and the bailiwick of Ritzebüttel with 6557. Cuxhaven-Ritzebüttel and Bergedorf are the only towns besides the capital, and they had respectively 4102 and 3899 inhabitants in 1875. The Geestland comprises the suburban districts of Rotherbaum, Harvestehude, Eimsbüttel, Eppendorf, Hohenfelde, Uhlenhorst, Eilbeck, Barmbeck, Winterhude, Borgfelde, Harum, and Horn, which encircle the city on the north and east; and the Marschland includes various "werders,"[2] such as the Billwerder Ausschlag to the east of the city, the Steinwerder and the Little Grasbrook to the south of the Elbe, the Billwerder, the Ochsenwerder, and the so-called Vierlande or Four Districts (Corslake, Altegamme, Nauegamme, and Kirchwerder) as far east as Geesthacht. While the Geestland has in many places an almost unproductive soil, the Marschland is of extraordinary fertility, and its pastures, corn-fields, and market-gardens furnish Hamburg with large quantities of country produce.

As a state of the empire Hamburg is represented in the federal council by one plenipotentiary and in the diet by three deputies. According to the present constitution, which has been in force since September 28, 1860, the legislative power is in the hands of the senate and the general body of citizens, and the executive is committed to the senate alone. Of the 18 members of the senate no less than 9 must have studied law and finance, and of the remaining 9, 7 must be representatives of commerce. The members are chosen by the senate and the burgesses after a complicated process, and the burgess upon whom their choice falls is obliged to accept office for at least six years, on pain of losing his civic rights. The senate by itself has the election of the first and the second burgomaster, each of whom holds office

[1] Geest is a Platt-Deutsch word signifying "dry," and the Geestland is consequently the higher and drier district, in contrast to the marsh-land. The surface of the Geestland is composed of sand and gravel, and part of it is occupied by heath.

[2] Werder, Wärder, or Wörth is either equivalent to the old English "holm," a river-island, or signifies a stretch of flat land between a river and a piece of standing water, or a portion of a swamp drained and devoted to tillage.

for only a year. There are 196 burgesses, of whom 88 are chosen by ballot by the general community, 48 by and from the owners of ground within the town, and 60 by the courts and administrative bodies. They are elected for a period of six years, but as half of each class go out at the end of every three years the elections occur twice as often. Both the senate and the burgesses have the right of introducing new bills. The basis of the civil law is the Jus Hamburgicum, revised in 1603 and supplemented by the Roman law, but in some of the rural districts local customs prevail, and in Bergedorf the Lübeck rights are still partly in force. Hamburg has appeal to the common high court of the Free Cities in Lübeck. There is a special court for commercial disputes. Juries are summoned in the more important trials; and since 1869 there has been public and responsible prosecution of criminal cases. The ecclesiastical arrangements of Hamburg have undergone great modifications since the general constitution of 1860. From the Reformation to the French occupation in the beginning of this century, Hamburg was a purely Lutheran state; according to the "Recess" of 1529, re-enacted in 1603, non-Lutherans were subject to legal punishment and expulsion from the country. Exceptions were gradually made in favor of foreign residents; but it was not till 1785 that regular inhabitants were allowed to exercise the religious rites of other denominations, and it was not till after the war of freedom that they were allowed to have buildings in the style of churches. In 1860 full religious liberty was guaranteed, and the identification of church and state abolished. By the new constitution of the Lutheran Church, published at first in 1870 for the city only, but in 1876 extended to the rest of the Hamburg territory, the parishes or communes are divided into three church-districts, and the general affairs of the whole community are entrusted to a synod of 53 members and to an ecclesiastical council of 9 members which acts as an executive. A central fund for the church was formed in 1870 out of the surplus property of the convent of St. John; and in some of the communes there is a church rate. According to the returns of 1871 there were 300,968 Lutherans, 5585 members of other Evangelical Churches, 7771 Roman Catholics, 194 Mennonites, 2696 Christians of other sects, and 13,796 Jews, while 628 described themselves as without religion or heathens, and 7071 gave no information as to creed. Since 1871 the ratio of Lutherans to non-Lutherans must have somewhat diminished. The German Reformed Church, the French Reformed, the English Episcopal, the English "Reformed," the Roman Catholic, and the Baptist are all recognized by the state. Civil marriages have been permissible in Hamburg since 1866, and since the introduction of the imperial law in January, 1876, the number of such marriages has greatly increased.

The finances of the state of Hamburg are in a generally satisfactory state; for, although the public debt has been increasing, this is due mainly to such undertakings as railways, harbor improvements, and schools. In 1876 the revenue was estimated at £1,206,161 sterling, in 1877 at £1,264,585, in 1878 at £1,330,550, and in 1879 at £1,384,630; and the corresponding expenses were stated at £1,288,503, £1,358,915, £1,422,175, and £1,507,860. The public debt, which was £6,385,042 in the end of 1874, was reduced by 1878 to £5,325,853. Of the former sum £1,457,775 was the remains of the great conflagration loan of 1842, which originally amounted to £2,550,000.

In 1868 the old civic militia, which then consisted of 7354 men, was dissolved; all citizens and inhabitants between the ages of 20 and 45 had been obliged to serve except certain state officials, and school teachers, etc. By convention with Prussia, Hamburg furnishes two battalions to the 2d Hanseatic infantry regiment.

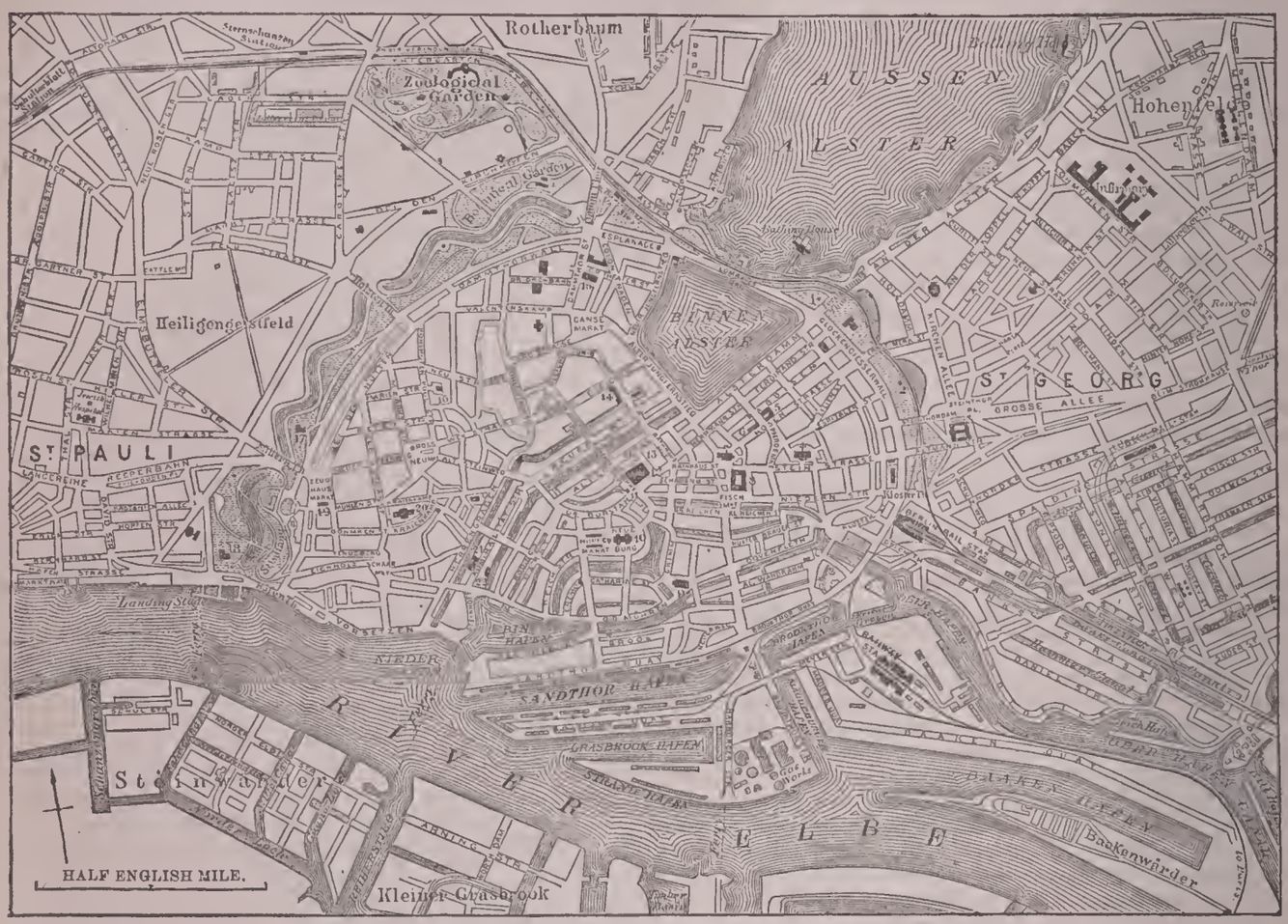
See *Statistik des Hamburgischen Staats*, 1878; J. Nessmann, *Statist. Handbuch für den Hamb. Staat*, 1874 and 1876; Gustav Ritter, *Zehn Jahre Civilstandsamt im Hamburg*, 1876.

HAMBURG, one of the most remarkable cities of Germany and indeed of Europe, ranking as it does as the first of all the seats of commerce on the Continent, is situated on the right bank of the northern arm of the Elbe, about 93 miles from the mouth of that river, just where it is joined by the Alster and the Bille. The latitude of the observatory in the western part of the city is 53° 33′ 55″ N. and the longitude 9° 58′ 23·6″ E., the latitude of the tower of St. Michael's 53° 32′ 55·7″ N. and the longitude 9° 58′ 41·7″ E. Were it not for political and municipal boundaries Hamburg might be considered as forming one town with Altona and Ottensen, the three presenting to the river a continuous frontage of nearly 4 miles; and long lines of suburbs radiate inland in various directions. The city proper lies on both sides of the Alster, which having been dammed up a short distance from its mouth now forms a considerable lake, of which the southern portion within the line of the fortification bears the name of the Inner Alster (*Binnen Alster*), and the other and larger portion (2300 metres long and 1200 metres wide at the widest) that of the Outer Alster (*Aussen Alster*). The fortifications as such were removed in 1815, but they have left their trace in a fine girdle of green round the city, though too many inroads on its completeness have been made by railways and roadways. The oldest portion of the city is that which lies to the east of the Alster; but, though it still retains the name of Altstadt, nearly all trace of its antiquity has disappeared, as it was rebuilt after the great fire of 1842. To the west lies the new town, incorporated in 1678, beyond this and contiguous to Altona is the quondam suburb of St. Paul's, incorporated in 1876, and towards the north-east is the quondam suburb of St. George, which arose in the 13th century, but was not incorporated till 1868. The old town lies low, and it is traversed by a great number of narrow canals or "fleets" (for the same word which has left its trace in London nomenclature is used in the Low-German city), which add considerably to the picturesqueness of the meaner quarters, and serve as convenient channels for the transport of goods. They generally form what may be called the back streets, and they are bordered by warehouses, cellars, and the lower class of dwelling-houses. As they are subject to the ebb and flow of the Elbe, at certain times they run quite dry, and afford a field of operations for the *fleetenkieker*, who wanders along the oozy channel to pick up any articles of value, and at other times they are filled 15 to 20 feet above their ordinary level.[1] As soon as the telegram at Cuxhaven announces high tide three shots are fired from the Stintfang at the harbor to warn the inhabitants of the "fleets;" and if the progress of the tide up the river gives indication of danger, other three shots add emphasis to the warning. Then the dwellers on the lower levels make a rapid escape with their property. At the time of the equinoxes the inundation may be repeated for several days in succession; but when all is over the people (the Lüd von de Waterkant) return like rats to their oozy and dripping abodes. In fine contrast to the dull and dismal fleets is the bright and handsome appearance of the Inner Alster, which is enclosed on three sides by handsome rows of buildings, the Alsterdamm in the south-east, the Old Jungfernstieg in the south-west, and the New Jungfernstieg on the north-west, while it is separated from the Outer Alster by part of the rampart gardens traversed by the railway which unites Hamburg with Altona. These streets and especially the Old Jungfernstieg are fashionable promenades. The largest of the public squares of Hamburg is the Hopfenmarkt, which contains the church of St. Nicholas, and is the principal market for fish, meat, vegetables, and fruit; others of importance are the Gänsemarkt or Goose Market, the Zeughausmarkt, and the Great New Market. The churchyards, of which several are pleasantly laid out, are all to be removed to Ohlsdorf, about 4 miles from the town.

Of the churches actually existing in Hamburg (the old cathedral had to be taken down in 1805), St. Peter's, St. Nicholas, St. Catharine's, St. James's, and St. Michael's are those that give name to the five old city perishes. The church of St. Nicholas is remarkable more especially for its tower, which until the spire of the Cologne cathedral reaches its projected elevation of 511 feet, will probably continue to be the second highest building in the world, rising as it does to a height of 473 feet, about 19 feet lower than St. Ouen's at Rouen. The actual church dates from 1845–1874, the former St. Nicholas having perished in the great fire It was opened for public worship in 1863. The architect the late Sir G. Gilbert Scott, selected the rich Gothic style of the 13th century; and both the exterior and interior are elaborately adorned with sculptures. Sandstone from Osterwald near Hildesheim was used for the outside, and for the inner work a softer variety from Postelwitz near Dresden. The roof is wholly constructed of wood. A large part of the cost, which altogether amounted to £204,220, was defrayed by weekly shilling subscriptions. St. Michael's has a tower which almost rivals that of St. Nicholas, as with its

[1] In 1843 *pegels* or water-gauges were established at Hamburg and Cuxhaven. In 1872 their zeros were lowered respectively 9·80 and 4·31 ft., so that they both stand 9·6 ft. above the zero of Harburg and 10·7 above that of Kiel.

height of 428 feet it ranks ninth in the list of loftiest buildings in the world. It was erected by Ernst G. Sonnin between 1750 and 1762, on the site of the older building of the 17th century destroyed by lightning; and it not only surpasses all the other churches of Hamburg in size, being 229 feet long and 179 feet broad, but produces a fine effect by the colossal proportions of its four principal pillars. St. Peter's church, originally consecrated in 1352, fell a prey to the great conflagration, but it was rebuilt by Chateauneuf in 1844–1849. The ring on the door of the tower (which dates from 1342) is considered the oldest artistic relic in Hamburg; and the granite columns of the old cathedral, the stained glass windows by Kellner of Nuremberg, and Schubert's Entombment of Christ are worthy of notice. St. Catharine's and St. James's are the only churches of Hamburg that have been preserved from the Middle Ages but otherwise neither is of special interest. Of the other churches it is sufficient to mention St. George's, built in 1743, St. Paul's in the suburb of that name, the lesser St Michael's occupied by the Roman Catholics since 1824, and the English Episcopal church dating from 1838. The new synagogue was built by Rosengarten between 1857 and 1859, and to the same architect is due the sepulchral chapel of John Henry Schröder in the churchyard of St. Peter's.



Plan of Hamburg.

1. Schiller's Monument.
2. Adolph von Schaumberg's Monument.
3. New School Buildings.
4. St. James's Church.
5. Markt Halle.
6. Thalia Theatre.
7. St. Peter's Church.
8. Johanneum and Town Library.
9. St. Catharine's Ch.
10. St. Nicholas Ch.
11. Bank.
12. Exchange.
13. Site of Old Town-Hall.
14. Post-Office.
15. Town Theatre.
16. Synagogue.
17. Observatory.
18. Sailors' Home.
19. English Episcopal Church.
20. St. Michael's Ch.
21. Town-House or Rathhaus.
22. Sailors' Poor-house.

The beautiful Gertrude's chapel was unfortunately destroyed in 1842.

Though Hamburg has comparatively few secular buildings that are of high architectural interest, its list of public institutions is one of which any city might be proud, and several of these are accommodated in spacious structures not unworthy of their destination. The exchange is one of the most important. It was erected on the site of the Mary Magdalen convent in 1836–41, and escaped the catastrophe of 1842. At the business hours between 1 and 3 o'clock as many as from 3000 to 5000 merchants and brokers congregate within its walls. The commercial library in the new wing added in 1873 has upwards of 40,000 vols. In the same neighborhood are the Hamburg bank and the site of the old rathhaus, which had to be blown up in the great fire. The town-house, built by Görtz, minister of finance to Charles XII. of Sweden, was purchased by the town in 1722. The academic gymnasium, founded on 16th August, 1610, as a preparatory school for the universities, has since 1873 surrendered its teaching functions, though it still maintains public lectures to which all have access, and is in more or less close connection with the botanic gardens, the natural history museum, the observatory, the chemical laboratory, and the museum of *Culturgeschichte*. The present botanical gardens, which had been preceded by Veit Scharp's (1547–1782) and Flugge's (1810–1813), were laid out by Dr. Lehmann on the glacis of the fortifications, and contain about 11 acres. The natural history museum was founded in 1843, and in 1875 the sum of 1,200,000 marks from the Hamburg share of the French indemnity was assigned for the purpose of supplying better accommodation for its valuable collections, amongst which may be mentioned that from Heligoland and that of Griesbach from South Africa. The observatory, dating from about 1826–28, is a noteworthy institution. It possesses a great equatorial telescope made by Repsold & Sons in 1860, the object-glass of which has an aperture of 9·6 Paris inches, with a focal distance of only 9·6 feet; and among its contributions to science are Helmert's observations on the constellation of Sobieski's Shield (1874), and the determination of all the stars down to 9·5 magnitude in the zone between 80° and 81° of N. declination. In connection with the observatory a time-ball on the tower of the Kaiserquai is caused to fall at 12 o'clock of Greenwich time; there is a similar ball at Cuxhaven, and another at Bremerhaven. The chemical laboratory was built in 1841. It was not till 1866 that the ethnographical collections were put under special curators; and the name *Culturgeschichtliche Museum* only dates from 1872. The principal medical institution in the city is the college of surgeons, founded in 1771 as a general school for doctors and midwives; it received its present constitution in 1833, and was furnished with new buildings in 1861. It was not till 1867, however, that the guild of barbers, with its right of surgical practice, was abolished. The medical union established by H. de Chaufepié about 1815–16 has published several periodical works, and possesses a li-

brary of 12,000 vols. A mathematical society was founded by Heinrich Meissner as early as 1690, the Hamburg-Altona Society for natural science dates from 1837, the Hamburg-Altona branch of the German Anthropological Society from 1870, and the Hamburg branch of the German and Austrian Alpine Club from 1875. A geographical society, which publishes a journal, was founded in 1873; and the firm of Godeffroy, which trades so extensively in the Pacific, has instituted a museum, and sent out scientific explorers and collectors,—Dr. E. Gräffe, Amalie Dietrich, Johann Kubary, Andrew Garrett, Franz Hübner, etc.,—the results of whose labors are registered in the *Journal des Museum Godeffroy* (1871, etc.). Zoological gardens were founded in 1860–1 by a joint-stock company, and an aquarium has since been added under the superintendence of Alfred Lloyd of the Sydenham Crystal Palace. Two of the old monasteries of the town—the St. Johanniskloster and the St. Maria Magdalenenkloster are still maintained as foundations for the daughters and widows of Hamburg citizens, and the former has funds beyond its requirements. The general infirmary (*allgemeine Krankenhaus*) dates originally from 1606, but the present building was erected in 1825–27, and has since received several additions. The annual number of patients increased between 1825 and 1875 from 2398 to 8206. The subvention from the state rose in the same period from £8400 to £23,182, and the average daily cost of each patient from 9d. to 1s. 9d. A lunatic asylum (Friedrichsberg) was founded in 1841 at Barmbeck at a cost of £2540 for the site and £66,086 for the building. Its patients numbered 212 in 1865 and 492 in 1875. Among minor establishments of a similar class are the sailors' infirmary (1863), the St. Mary's hospital founded by the Roman Catholic community on the occasion of the Danish war in 1864, but open to patients of every creed, the infirmary of the German Jews built by Solomon Heine in 1840, the infirmary of the freemasons, the children's hospital dating from 1846–47, the polyclinicum of the patriotic association for the assistance of women (1872), the deaf and dumb institution (1827), and the blind asylum (1830). The orphanage originated in 1600 by Gillis de Greve and Simon von Petkum, admits about 64 children every year. In the beginning of July the orphans, in their bright blue out-door dress, make a procession through the city and the suburb of St. George, and the day, known as the Waisengrün, is considered a popular holiday. In the suburban village of Horn is the famous Rauhe Haus, and at Alsterdorf there is a home founded in 1860 for idiots and children suffering from incurable diseases. It had 273 inmates in 1875. The workhouse, which dates from the beginning of the 17th century, has been situated since 1853 in the village of Barmbeck, and since 1869 has had a branch establishment at Fuhlsbüttel. In 1875 it had 1342 inmates, and its revenues were £17,332, besides a state subvention of £20,417. The annual cost per head is £14, 15s. About 200 free dwellings and a number of pensions are provided by the Schröder foundation for respectable families and individuals in reduced circumstances.

Hamburg is well supplied with places of amusements, especially of the more popular kind. Its town theatre, rebuilt in 1874, has room for 1750 spectators; the Thalia theatre dates from 1841, and contains 1700 to 1800; and there are some 7 or 8 minor establishments. Theatrical performances were introduced into the city in the 17th century, and 1678 is the date of the first opera, which was played in a house in the Gänsemarkt. Under Schröder and Lessing the Hamburg stage rose into importance.[1] Though contributing few names of the highest rank to German literature, the city has been intimately associated with the literary movement. Lappenberg and Hagedorn were born in Hamburg; and not only Lessing, but Heine and Klopstock lived there for some time. In Schröder and Klotze's *Lexicon der Hamburg. Schriftsteller* there are no fewer than 3536 names up to Schroff; and the library of the society for the encouragement of art and science contains 5000 volumes dealing with Hamburg affairs.

The inhabitants of Hamburg used formerly to have no small variety of distinctive costumes; but it is only the public officials in their robes of state or the peasantry from the villages that preserve the more grotesque peculiarities.[2]

The oldest water-works of Hamburg were those of the Oberdamm, constructed in 1531; the first of the modern system with steam power was the Bieber'sche Elbwasserkunst, opened in 1822. In 1849 the city water-works belonging to the state were set in operation, and they have since incorporated and systematized the older water-works. In 1875 they had 5 steam-engines with 850 horse-power, and raised 876 millions cubic feet of water at a cost of about 8d. per 1000 cubic feet. It was not till after the fire of 1842 that Hamburg began to be properly drained; but it now possesses an extensive and elaborate system of sewers. In 1853 the upper Old Town, the New Town, and St. George's were supplied, and in 1859 the lower Old Town; and between 1871 and 1875 the system was extended to the aristocratic suburban districts of Uhlenhorst and Eimsbüttel. In 1875 the total length of sewers was 512,226 feet, which had cost £662,850. The largest sewers, of which there were 10,499 feet, have a diameter of nearly 10 feet, and can be traversed by boats; the second class (8330 feet) have a diameter of 7 feet, and the third class (19,853 feet) of 5⅔ feet. The mouths of the sewers are protected by automatic doors which prevent the flooding of the lower districts by the back-water from the river.

The harbor of Hamburg as it now exists is a very modern creation. At first the city was at some distance from the main branch of the Elbe, and the mouth of the Alster served as its port, but partly owing to natural changes in the bed of the great river, and more to the vast engineering enterprises of the inhabitants,—such as the cutting of the channels through the Grandeswerder (1550), the Spadenland marshes (1570), and the Brook,—the principal current was diverted into its present course. To trace the history of the successive labors devoted to the rectification of the stream and the increase of shipping accommodation would be a long and intricate task. Suffice it to say that up to the middle of the present century the vessels in the harbor of Hamburg used to anchor in the open space and fasten themselves to piles called "dukes of Alba," and the goods were taken ashore in lighters; but since the introduction of the railway it has been found necessary to build quays with hydraulic cranes and other modern appliances. For this purpose the greater Grasbrook was first of all selected. A portion of the Sandthor (Sandgate) quay was opened in 1872, and by 1876 the Kaiser or Imperial quay and the Dallman quay (so named after the engineer) were available. The total length of the three quays was 10,646 feet, and the area of ground covered in by the auxiliary buildings was upwards of 30 acres. Since that date the quays have been largely increased, so that they now extend a distance of about 3 miles from Altona eastwards. The number of ships which took advantage of the quays in 1866–67 was 665, with a burthen of 313,269 tons; by 1875 they had increased to 1425 ships with 837,568 tons, and by 1878 to 1850, with 1,151,903 tons.

Hamburg is emphatically a commercial city, and though within recent years greatly developed, its manufacturing industries are in comparison unimportant; but only in comparison, for, according to the official return of 1875, no fewer than 4931 persons were engaged in metallurgy, 5926 in the manufacture of machinery, instruments, and tools, 940 in chemical works, 1399 in the preparation of heating and lighting materials, 1464 in textile industries, 2687 in the paper and leather manufactures, and 9388 in the wood industries. Ship-building is carried on pretty extensively, the greatest establishment in the department, the Reiherstieg or Godeffroy's yards, which was commenced about 1849, employing on an average 700 workmen. There are several enormous distilleries, and two establishments for the manufacture of artificial manures from the phosphates of guano, each of which employs from 200 to 300 workmen; as well as breweries, sugar-refineries, rice-mills, and factories for the preparation of saltpetre, sulphuric acid, and other chemical products. The curing of beef and pork forms a large trade. Pianofortes and cigars, railway carriages and artificial flowers, sewing-machines and chocolate are all manufactured in the town, and tile-works and glass-works exist in the neighborhood.

In the extent of its commerce Hamburg ranks among European ports immediately after London, Liverpool, and Glasgow. Its imports and exports are more than those of the whole of Holland, of Belgium, or of Spain. From the year 1836, in which it possessed 146 ships, with a total burthen of 25,722, its marine had increased 770 per cent. by 1877.[3] In 1875 it had 443 sea-vessels with 219,567 tons burthen; in 1876 it had 450 with 219,698 tons, and in 1877 468 with 223,010. Of the last number 264 were copper-plated, 6 were zinc-plated, and 147 were built of iron. The steam vessels were 102. The principal line of steamers is that of the Hamburg-American Company, which on 1st January, 1876, had 21 first-class British-built vessels, with a total burthen of 60,300 tons. Its voyages are mainly made to New York and the West Indies. On an average of the three years 1874, 1875, and 1876 it carried 31,930 passengers and 165,465 cubic yards of goods. The Hamburg and South American Company at the same time had six vessels, with a burthen of 8000 tons, trading with Brazil and the river Plate. The German Steamship Company had 8 vessels with a burthen of 6850 tons trading with China and the Far East, and the Kosmos Company had 7 ships with a burthen of 10,897 tons trading with Chili and Peru. The Sloman or Mediterranean line of six vessels with a burthen of 5276 tons keeps up monthly communication with ports of Spain and Italy.

From the following table a general view of the movement of

[1] See Uhde, *Das Stadttheater in Hamburg*, Stuttgart, 1879.

[2] Details and colored designs will be found in Suhr and Hubbe's *Hamburger Ausruf* (which gives 1807 styles) and in Buek's *Album Hamburgischen Costüme* (Hamb., 1843–47). Of the local dialect a knowledge may be obtained from Michael Richey's *Idiotikon Hamburgense, oder Wörterbuch zur Erklärung der eigenen in und um Hamburg gebräuchlichen Nieder-Sächsischen Mund-Art* (1743 and 1755), and Gefficken, *Die Hamburgischen Niedersächsischen Gesangbücher des 16ten Jahrh.* (Hamb., 1857).

[3] In 1865 it reached the exceptionally high figures, 530 ships of 178,605 tons burthen.

the port will be obtained. It is to be observed that the increase shown is not so much in the number of the ships as in their average capacity.

	Ships Entered.	Register-Tons.	Ships Cleared.	Register-Tons.
1865	5186	1,223,403	5186	1,216,499
1866	5185	1,327,673	5210	1,332,563
1867	5055	1,431,082	5071	1,434,563
1868	5297	1,532,665	5287	1,528,844
1869	5192	1,603,812	5201	1,595,946
1870	4144	1,389,789	4101	1,376,179
1871	5439	1,887,505	5457	1,886,784
1872	5913	2,080,913	5872	2,075,472
1873	5270	1,887,057	5363	1,904,050
1874	5225	2,094,102	5238	2,100,193
1875	5260	2,117,822	5209	2,084,748
1876	5433	2,228,162	5481	2,247,129
1877	5473	2,233,929	5489	2,243,500

The average consequently for the years 1866–1875 was—ships entered, 5198, tonnage, 1,735,242, ships cleared, 5201, tonnage 1,731,934.

The following table shows the imports (in centners of 110 lb) into Hamburg in 1878, first from non-European, and secondly from European countries:—

	Non-European.	European.
Coffee	1,015,200	405,280
Tea	14,030	38,400
Sugar	117,460	137,280
Tobacco	264,490	130,930
Rice	790,790	55,590
Grain	611,820	169,050
Rum	130	16,990
Herrings	5,250	394,390
Dye woods	574,170	40,340
Saltpetre	1,074,510	12,030
Copper and silver	52,760	6,050
Guano	1,697,870	95,550
Petroleum	815,050	36,770
Train oil	13,500	141,643
Palm oil	53,330	41,530
Cocoa-nut oil	5,920	38,420
Palm-nuts	165,260	57,630
Cotton	37,460	332,310
Cotton wool	...	307,980
Raw and bar iron	...	2,415,310
Rails	...	31,400
Sulphur	...	105,900
Coal	...	17,224,530
Miscellaneous	2,609,250	8,895,890
Total	9,918,250	31,131,193

Hamburg is an important outlet of emigration, no fewer than 870,000 persons having left Germany by its vessels between 1836 and 1874, or on an average 30,000 every year. In 1874 the number was 42,952; in 1875, 31,787, in 1876, 28,733; in 1877, 22,143; and in 1878, 24,803.

The monetary transactions of Hamburg have long been maintained on a very extensive scale. As early as 1619 the great Hamburg giro-bank was founded on the model of that of Amsterdam, and, in spite of the blow struck by the French in 1813, it continued to flourish till in 1876 it was replaced by a chief office of the German Imperial Bank, which includes in its domain the province of Schleswig-Holstein-Lauenburg, the three Hanseatic towns, and the two grand-duchies of Mecklenburg. In 1876 there were, besides, the North German Bank (1856) with a capital of £2,250,000; the Union Bank (1856), with £1,500,000 capital; the Commercial Bank (1870), with £1,500,000, the International Bank (1870), with £750,000, the Anglo-German Bank (1870), with £1,050,000; the Hypothec Bank (1871), with £375,000; the Exchange (Wechsler) Bank (1872), with £187,500, the Brokers' Bank (1871), with £150,000; the Industrial Bank (1871), with £150,000; the St. Paul's Credit Bank, with £150,000; and the People's Bank (1860). The Imperial Office in 1876 had a total turnover of £336,693,950; and in 1875 the North German Bank had 438 millions, the Union Bank 270 millions, and the Commercial 170 millions. There are also 7 savings banks, the total deposits in which rose from £846,070 in 1866 to £1,615,626 in 1874. Few departments are of more extensive development than the marine insurance. In the ten years 1834–43 the average value insured was £17,534,487, at an average premium of 1 50 per cent.; in the corresponding period 1844–53 it was £24,028,991 at 1 58 per cent., and in the next period 1854–63, it reached £45,571,543.

The following table shows the figures from 1864 to 1877:—

		Per cent.			Per cent.
1864	£47,112,592	1·35	1871	£84,926,839	0·90
1865	40,829,647	1·28	1872	102,816,762	0·93
1866	50,141,966	1·24	1873	90,128,405	1·01
1867	50,377,151	1·25	1874	86,184,290	1·05
1868	56,136,688	1·26	1875	88,817,942	1·11
1869	59,492,244	1·16	1876	91,724,790	1·11
1870	63,445,570	1·12	1877	112,083,625	1·06

It is only within recent years that Hamburg has obtained a fair amount of railway communication. The proposal made about 1840 to construct a line from Hamburg to Lübeck was frustrated by the opposition of the king of Denmark, who feared it would injure the trade between his two towns of Altona and Kiel, which soon afterwards (in 1844) he united by rail. The people of Hamburg were forced to content themselves with a line to Bergedorf (1842), but this was afterwards extended to Schwerin and Berlin, and a branch line was constructed to Lübeck. The Hamburg-Lübeck direct line was opened in 1865, and in the following year a line was constructed between Altona and Hamburg. Direct communication with Paris by way of Harburg, Bremen, Osnabrück, and Venloo was obtained only in 1872. Though as early as 1862 a scheme was set on foot for such a line, the projectors could not come to terms with the Hanoverian Government, which objected to the duchy of Oldenburg obtaining a share in the advantages of the scheme, and wished to keep to itself the whole authority over the bridges on the Elbe while leaving the cost of their construction wholly to Hamburg. In 1866 the Hanovorian Government was swept away by Prussia, and in 1867 the new rulers formed a treaty for the construction of the line. The two main branches of the Elbe, the north and the south, are crossed by two great bridges on the system named after Lohse, which had never before been employed in Germany. As the soil is unstable, the pillars had to be founded on a bed of concrete 17 or 18 feet thick resting on piles. The Hamburg or north bridge has three spans each 334 feet wide, and the Harburg bridge has four spans. The total weight of iron employed was 84,651 cwts. (36,152 for the one and 48,499 for the other). For internal locomotion the city has a system of tramway lines which run out to Wandsbeck and other neighboring villages, and a still more extensive omnibus system. Small steamers plying on the Outer Alster give easy access to the places along its shores.

In 1811 the population of Hamburg (*Stadt* and *Vorstadt*) was 106,983; in 1834 it was 145,418, and by 1861 it had reached 198,214. The present population of the town is 802,-793.

	1866.	1867.	1871.	1875.	Increase 1866–75.	Per cent.
Inner town and harbor	158,296	160,772	160,989	171,558	13,262	8·4
St. George's	30,371	32,423	37,097	43,911	13,540	44·6
St. Paul's	29,135	31,775	41,021	49,206	20,071	68·8
	217,802	224,970	239,107	264,675	46,873	21·5

If we include in our survey the suburban hamlets or *Vororte*, and Altona, Ottensen, and Wandsbeck, we find that there were clustered together 458,585 persons. In 1871 the proportion of males to females in the whole Hamburg territory was 100 to 105, and in 1875 it was 100 to 103. The number of females in proportion to the males is much greater among the native than among the immigrant part of the population, and the proportion of natives to immigrants is a steadily decreasing one,—76 per cent. in 1867, 68 per cent in 1871, and 65 in 1875. Most of the strangers are from the neighboring parts of Germany: 43,523 in 1871 were from Holstein, 30,945 from Hanover, and 15,686 from Mecklenburg-Schwerin. The following table shows the occupations of the people in 1871:—

	Males.	Females.	Total.
Agriculture	7,483	7,092	14,575
Industries	69,878	65,792	135,670
Trade and Commerce	48,701	51,589	100,290
Giving personal service	19,816	18,756	38,572
Other callings	10,370	11,266	21,636
Without calling	8,739	17,913	26,652
Not returned	319	1,260	1,579

The number of marriages, partly in consequence of the changes in the marriage laws, is rapidly increasing (8·29 to every thousand inhabitants in 1861, and 12·26 to every thousand in 1875), and a similar increase is observable in the births.

The death rate varied from 26 to 30 per thousand per annum from 1872 to 1875. Consumption and acute diseases of the respiratory organs are the most prevalent causes of death. Between 1831 and 1873 there were 14 visitations of cholera, by far the most violent being those of 1832 and 1848, which carried off respectively 1652 and 1765 of the population.

History.—Hamburg, or, as the older documents have it, Hammaburg, appears to have taken its rise as a frontier block-house or castle on the Slavonic borders of Germany, which in the 9th century lay thus far to the west. The block-house, which may have been preceded by some insignificant hamlet, was founded by Charles the Great in 808, and he was just on the point of making the newly erected church the seat of a bishopric when he died in 814. His scheme was ultimately carried out by his son Louis the Pious in 831, and three years later a charter was issued at Aix-la-Chapelle and confirmed by Gregory IV. raising the bishopric to the rank of an archbishopric, which was to include not only the surrounding district of Germany, but Iceland, Greenland, and the whole Scandinavian

territory. Ansgarius, the first occupant of the see, founded a monastery and a school, but in 837 (or 839 according to other accounts) his labors were rudely interrupted by the Norman pirates, who laid the little settlement in ashes. Other disasters followed. a large portion of the original territory of the archbishopric fell away from its allegiance, and in 847 it was decided at a synod at Mainz under the presidency of Hrabanus Maurus that Hamburg should be attached to the bishopric of Bremen, and the seat of the archbishop be in the latter city. The title of archbishop of Hamburg remained in use till 1223, though that of archbishop of Bremen appears as early as the 12th century All through the 10th century Hamburg continued to suffer from the inroads of the Danes and the Slavonians, and the latter indeed were in possession from 983 to 987 In spite of all the settlement advanced Archbishop Alebrand built a cathedral in 1037, Archbishop Adalbert not long after a castle, and the havoc wrought by Jarl Kruko of Denmark in 1072 was promptly repaired. In 1110 the counts of Schauenburg got possession of Holstein and Hamburg, an event which bore in many ways fruit for centuries after. In return for a contribution to a crusade, Adolf III. obtained for the town from the emperor Frederick I. in 1189 the right of a separate court and jurisdiction, freedom from toll to the mouth of the Elbe, and right of fishing in the river. Merchants from Flanders now began to visit the place, and its importance as a commercial centre was increased by the destruction of the flourishing town of Bardewijk in 1189 by Henry the Lion. After passing under the lordship of Waldemar of Schleswig (1201) and Albert of Orlamünde (1216) it was recovered by the Schauenburg counts, who erected a strong castle over against it (1231). The alliance with Lübeck, commenced in 1241, and consummated by the treaty of 1255, practically laid the basis of the great Hanseatic League, of which Hamburg continued to be one of the principal members. While its foreign relations were thus improved, its internal organization was also rendered more stable by the new constitution of 1270, and the recognition of the municipal autonomy of the counts of Schauenburg in 1292. The domain of the city was increased in the 14th century by the purchase of Eppendorf, Ritzebüttel, etc., in the 15th the Frisian pirates who had harassed the merchants at the mouth of the Elbe were completely defeated. The claims of the Danish crown to the homage of the city were rejected, and the imperial diet of 1510 under Maximilian I. declared that it was a city of the empire. Not long after two great changes took place. By the so-called "Long Recess" of 1529 the Reformation was introduced, and disagreements with Lübeck set the city free to follow her own path of progress. Through the troubles of the Thirty Years' War Hamburg escaped almost unscathed; but it suffered from the effects of its own bigoted Lutheranism, which drove many of its dissentient religionists forth to become the founders of the neighboring Altona. In 1603 it received a code of exchange, and in 1615 the first imperial post. Its population was not long after increased and its commerce quickened by a number of the Jews who had been expelled from Spain and Portugal. The course of the 17th century was marked by discord and strife between the senate and the lower classes, which ultimately brought about the interference of the empire and the publication of the "Great Recess" of 1712. Though the courts of the empire had decided in 1618 against the claims of the Danish crown, and had confirmed this decision in 1630 and 1643, Christian V. of Denmark made another attempt to take Hamburg by threat of arms; but he accepted a ransom of 280,000 rixdollars, and at length in 1768 by the treaty of Gottorp the Danish crown renounced all its claims, and in 1770 the delegates of the city took their place in the "Rhenish bench" of the imperial diet. From the Seven Years' War and the war of American independence the commerce of Hamburg drew new life, but it suffered terribly during the years of the French ascendency. The town was not only obliged in 1803 to pay 2,125,000 francs to the Hanoverian estates, but in 1806 it had to admit a French garrison within its walls, and to feel the effects of the British blockade of the Elbe. In 1810 indeed it had the honor of being incorporated in the French empire as the chief town of the department of the "Mouths of the Elbe;" but the retreat of the French commandant Carra Saint-Cyr on the 12th March, 1813, and the subsequent entrance of the Russian Tenterborn on the 18th, were welcomed by the citizens with joy. But their joy was premature, for by the 30th of May the enemy was again in possession. Davoust,[1] the new general, not only demanded a contribution of 48,000,000 francs, but confiscated the 7,506,956 marks banco (of about 1s. 6d.) at that time in the bank, forced the inhabitants to work at the new fortifications, and drove 20,000 or 30,000 of them out of the city amid the cold of winter. In spite of the attacks of the Russians under Benningsen, Davoust maintained his position till the close of the war. The whole loss of the city from 1806 to 1814 is estimated at £10,500,000 sterling. In 1815 Hamburg became an independent state of the German federation, and formed with Lübeck, Bremen, and Frankfort the curia of the free cities. Its trade rapidly revived, and when in 1842 the great fire destroyed 4219 buildings and rendered nearly 20,000 persons homeless, its credit was sufficient to secure a loan of 34 million marks banco. The old oligarchical constitution had been restored after the recovery of independence, and the internal history of the town from 1840 till 1860 is mainly a protracted contest between the conservative and innovative parties. The year 1858 was remarkable for a great commercial crisis, and for the meeting in the town of the commission of the navigation of the Elbe, and of the delegates appointed by the principal German states to consider maritime law. By the new constitution of 1861 industrial freedom was introduced, possession of land permitted to strangers, the conditions of settlement greatly modified, and various improvements made in the taxation and duties. At the outbreak of the contest between Prussia and Austria in 1866, Hamburg sided with the former, and in May, 1867, it voted 136 to 1 for the constitution of the North German Confederation. It was allowed to remain a free port, but has to pay an aversum to the Zollverein.

[1] [Louis Nicolas (1770–1823), duke of Auerstadt, prince of Eckmühl, marshal of France, served under Dumouriez, fought at Aboukir, won the battle of Auerstadt, distinguished at Eylau, Eckmühl, Mohilev, Borodino, where he was wounded, and Hamburg, minister of war during the One Hundred Days, peer of France in 1819.—Am, Ed.]

See *Zeitschrift für Hamburgische Geschichte*, published since 1841 by the local historical society; Lappenberg's *Hamburg. Urkundenbuch* (vol. i., Hamb., 1842), *Hamburg. Chroniken* (1861), and *Adam Tratziger's Hamburg. Chronik.* (1862); *Hamburgisches Münz- und Medaillen-Vergnügen* (Hamburg, 1753), Hess, *Hamburg's topogr. polit., und histor. Beschreibung* (2d ed., 1810–11), Bärmann, *Hamburg. Denkwürdigkeiten* (1817–20), and *Hamburg's Chronik* (1822), Zimmermann, *Neue Chronik von Hamburg* (1820), Gallois, *Geschichte der Stadt Hamburg* (1856–57); Wichmann, *Heimathskunde* (Hamb. 1863), Buek, *Die Hamburgische Oberalten* (1857), and *Hamburgische Alterthümer* (1859); *Hamburgs Neueste Zeit*, 1843–60 (anonym., 1866); Avé Lallemont, *Das Werk- und Armenhaus im Hamburg* (1863), Koppmann, *Kleine Beiträge zur Geschichte Hamburgs* (1867–68); Elers, *Chronologie der Geschichte Hamburgs* (1868); Mayer, *Geschichte des Hamb. Contingents, 1814–67* (Berlin, 1874); *Hamburg, die Stadt, die Vororte*, etc. (1875); *Hamburg in Naturhist. und Medic. Beziehung*, with excellent maps showing profile and relief of site, water and sewer systems, and density of population, for the Gesellschaft der deutschen Naturforscher und Aerzten (Hamb., 1876); Debio, *Geschichte des Erzbisthums Hamburg-Bremen* (1877, 2 vols.).

HAMELN, the chief town of a circle in the province of Hanover, Prussia, is situated at the confluence of the Weser and Hamel, and at the junction of four railways, 25 miles S. W of Hanover. It is surrounded by old walls, and possesses a number of old-fashioned houses with quaint richly-adorned gables. The only public buildings of interest are the minster church, restored in 1872, and the town-house. Hameln is the seat of several courts and public offices, and possesses a gymnasium, a higher city school, a higher female school, a trade school, a poorhouse, two hospitals, and a district prison. The principal industries are the manufacture of woollen and cotton goods and machines, distilling, agriculture, and salmon fishing. By the steamboats on the Weser there is communication with Karlshafen and Minden. In order to avoid the dangerous part of the river near the town a channel was cut in 1734, the repairing and deepening of which, begun in 1868, was completed in 1873. The Weser at Hameln is crossed by an iron suspension bridge 830 feet in length, supported by a pier erected on an island in the middle of the river. The population of Hameln in 1905 was 20,736.

The older name of Hameln was Hameloa or Hamelowe, and the town owes its origin to an abbey of St. Boniface. It existed as a town as early as the 11th century, and in 1259 it was sold by the abbot of Fulda to the bishop of Minden, but this transaction gave offence to the townspeople, and after a battle in which many of them lost their lives, they placed themselves under the protection of the house of Brunswick. During the Thirty Years' War Hameln was conquered by the Swedes (1633). In 1757 it capitulated to the French, who, however, vacated it in the following year. Its fortifications were strengthened in 1766 by the erection of Fort George, but they were wholly dismantled in 1807. Hameln is famed as the scene of the myth of the piper of Hameln. According to the legend, the town in the year 1284 was so infested by rats as almost to compel the inhabitants to leave it, when one day there appeared upon the scene a piper clad in a fantastic suit, who offered for a certain sum of money to charm all the vermin into the Weser by his piping. His conditions were agreed to, but after he had fulfilled his promise the inhabitants, on the ground that he was a sorcerer, declined to fulfil their part of the bargain, whereupon on the 26th of June he reappeared in the streets of the town, and putting his pipe to his lips began a soft and curious strain, which drew all the children to come trooping after him while he led them out of the town to the Koppelberg hill, in whose side a door suddenly opened, by which he entered and the children after him, all but one who was lame and could not follow fast enough to reach the door before it shut again and remained fast. Some trace the origin of the legend to the "Child Crusade," or to an abduction of children. For a considerable time the town dated its public documents from the event. The story is the subject of a poem by Robert Browning, and also of one by Julius Wolff (3d edition, Berlin, 1876).

See S. Baring-Gould, *Curious Myths of the Middle Ages*, 2d ser., 1868; Grimm, *Deutsche Sagen*, Berlin, 1866; and Reitzenstein's edition of Sprenger's *Geschichte der Stadt Hameln*, Hameln, 1861.

HAMI, the Chinese name of a town in Central Asia, otherwise called KAMIL, KOMUL, or KAMUL, situated on the southern slopes of the Tian-Shan mountains, and on the northern verge of the Great Gobi desert, in 42° 48′ N. lat. and 93° 28′ E. long., at a height above sea-level of 3150 feet. The town is first mentioned in Chinese history in the 1st century, under the name I-wu-lu, and said to be situated 1000 lis north of the fortress Yü-men-kuan, and to be the key to the western countries. This evidently referred to its advantageous position, lying as it did in a fertile tract, at the point of convergence of two main routes running north and south of the Tian-Shan and connecting China with the west. It was taken by the Chinese in 73 A. D. from the Hiungnu (the ancient inhabitants of Mongolia), and made a military station. It next fell into the hands of the Uigurs or Eastern Turks, who made it one of their chief towns and held it for several centuries, and whose descendants are said to live there now. From the 7th to the 11th century I-wu-lu is said to have borne the name of Igu or I-chu, under the former of which names it is spoken of by the Chinese pilgrim Hwen-Thsang, who passed through it in the 7th century. The name Hami is first met in the Chinese *Yüan-shi* or "History of the Mongol Dynasty," but the name more generally used there is Homi-li or Komi-li. Marco Polo, describing it apparently from hearsay, calls it Camul, and speaks of it as a fruitful place inhabited by a Buddhist people of idolatrous and wanton habits. It was visited in 1341 by John de Marignolli, who baptized a number of both sexes there, and by the envoys of Shah Rukh (1420), who found a magnificent mosque and a convent of dervishes, in juxtaposition with a fine Buddhist temple. Hadji Mahomet (Ramusio's friend) speaks of Kamul as being in his time (*circa* 1550) the first Mahometan city met with in travelling from China. When Benedict Goes travelled through the country at the beginning of the 17th century, the power of the king Mahomet Khan of Kashgar extended over nearly the whole country at the base of the Tian-Shan to the Chinese frontier, including Kamil. It fell under the sway of the Chinese in 1720, was lost to them in 1865 during the great Mahometan rebellion, and the trade route through it was consequently closed, but was regained in 1873. Owing to its commanding position on the principal route to the west, and its exceptional fertility, it has very frequently changed hands in the wars between China and her western neighbors. As regards the latter quality, it is even now said to yield rice, melons, oranges, and grapes of notable excellence, while, with respect to the former, Baron F. Von Richthofen (probably the highest authority) states that the route from Hsi-ngan-fu past Hami to Kuldja, is by far the best and indeed the only natural line for a railway from China to Europe. The Russian officer Sosnofski, our latest authority respecting Hami, entered it in the autumn of 1875 after eight days' journey across the Gobi steppe lying to the south. He speaks of it as an important mart, whither wool from Turfan and Turkistan goods are brought to be exchanged for the products of Central China. The Mahometan population consists of immigrants from Jitishahr (or Kashgaria), Bokhara, and Samarcand, and of descendants of the Uigurs.

HAMILCAR BARCA, the most illustrious of all the Carthaginian generals and statesmen, next to his son, the great Hannibal. The surname Barca is the same as the Hebrew *Barak*, and signifies "lightning." It was in the eighteenth year of the First Punic War, 247 B.C., that Hamilcar first greatly distinguished himself. He had been known before as a young officer of promise who had made raids on the southern coasts of Italy in the neighborhood of Locri and Cumæ. Suddenly he appeared with a squadron off the north-west of Sicily, and seized a strong position on Mount Ercte, now known as Mount Pellegrino, near Palermo. He had but a small force of mercenaries, which his military genius soon made into a well-disciplined body of troops. For three years he maintained himself on Mount Ercte, during which time the Romans were in possession of the whole of Sicily with the exception of the two strongholds of Drepanum and Lilybæum, and these they were blockading. They tried their utmost to drive Hamilcar from his position, but in vain. At last he quitted his stronghold, and in 244 B. C. landed at Mount Eryx, on the western coast, now Mount S. Giuliano, 2 miles from the shore and about 6 from Drepanum. A famous temple of Venus crowned the summit, and half way up the slope was the city, which itself had the name of Eryx. This Hamilcar seized and occupied. His object was to compel the Romans to give up the blockade of Drepanum and Lilybæum. They could not drive him out of the town, and for two more years he held his position, keeping open his communications by sea with the Carthaginian garrison of Drepanum. Hamilcar's chief difficulty was with his mercenaries, who were little better than savages and without an idea of loyalty or good faith. Yet he continued to hold them well in hand. It was a harassing and monotonous warfare, so much so that Polybius, here our chief authority, compares it to a boxing match between two skilful pugilists, the blows in which are delivered in such rapid succession that a spectator could hardly see, much less describe them. The Romans, feeling it necessary to make a supreme effort, in 242 B. C. equipped a fleet, under the command of the consul Lutatius Catulus, and despatched it to the western shores of Sicily. The battle off the Ægates followed, and the Roman victory decided the First Punic War in 241 B. C. Peace had now to be concluded. The cession of Sicily to the Romans was a matter of course. But though Hamilcar had to surrender the island, he refused to comply with the Roman demand that his army should pass under the yoke. The demand was not persisted in, and Hamilcar and his men were allowed to embark from Lilybæum for Africa.

No sooner had peace been concluded than there broke out the so-called African or Libyan War. It was a most formidable mutiny or insurrection. Hamilcar's mercenaries on their return looked for the pay which he had promised them, but had not been able to furnish while he was cooped in within his lines on Mount Eryx. The stupidity of the home Government soon caused trouble. The peace party at Carthage, headed by Hanno, who hated Hamilcar, was foolish enough to raise a dispute about the pay of the troops. The result was a furious mutiny, which Hanno, who was sent to quiet them, could not appease. The men to the number of 20,000 began to march on Carthage itself, and encamped near Tunis. The mutineers were led by Spendius, a fugitive slave from Campania, and by Matho, an African who had served with distinction under Hamilcar in Sicily. These two men incited all the neighboring tribes to rise against the dominion of Carthage. Carthage itself was soon cut off from all communication with the interior. Hanno was called to take the command, but it was only to meet with defeat and disaster. The rebels surprised and captured his camp. The Government was now thoroughly frightened, and begged Hamilcar to save them from the consequences of their own folly. With a force of only 10,000 men he had to face what must now have grown into a very formidable host. It would seem that his personal influence led many of the rebels to return to his standard, and he was also skilful enough to secure the friendship and aid of the Numidian sheiks. One especially, Naravas, helped him very materially; and with his assistance he was able to achieve a decisive victory over the mutineers. At last he so effectually hemmed in Spendius within his camp near Tunis that the rebel leader was obliged to throw himself on his mercy. With nine of his brother leaders he sought an interview with Hamilcar. Hamilcar's demand was the surrender of ten of the rebels, whom he was to name himself. This being agreed, he seized Spendius and his nine companions, a proceeding which the mutineers furiously resented. But they were soon surrounded and cut off to a man, to the number, it is said, of 40,000. The war, which had lasted three years and four months, was now over in the year 238 B. C.

One would have supposed that Hamilcar would be at once recognized as the right man to direct the future policy of the state. But it was not so. Hanno's party, the peace party, was as shortsighted as ever, and actually dared to say that Hamilcar had been the cause of the late war by having made promises which he was not able to fulfil. But by this folly they injured and weakened themselves. The patriotic party, the "Barcine faction," as it was called by its opponents, prevailed so far as to raise their leader to a position answering as nearly as possible to a dictatorship among the Romans. Hamilcar was made commander-in-chief of the Carthaginian army in Africa, and invested with a power which could be taken from him only by the popular assembly. He was still a young man, under thirty

years of age. For a short time he employed himself in overawing the Numidian tribes bordering on Carthaginian territory, but his main object was to form the nucleus of an efficient army out of his Libyan mercenaries. Meanwhile he was maturing a great plan which soon afterwards on his own responsibility he carried into execution. Spain was a country the coasts of which at least were well known to the Carthaginians. Spaniards too had served among Hamilcar's troops. To Spain he decided to go; there, he felt sure, he could find material for an army and abundant means of providing pay. He had now three sons, the "lion's brood," as he called them, Hannibal, Hasdrubal, Mago. Wishing with all his heart that they should be like minded with himself, he made the eldest, Hannibal, then a little boy of nine, swear on the altar of the supreme Carthaginian deity eternal hatred and enmity to Rome. This was just before he left Carthage, probably in the spring of 236 B. C. Suddenly there came tidings to the home Government that their commander-in-chief was, without their orders, carrying on war in Spain. He had, however, done his work so thoroughly in Africa that the troublesome Numidian tribes were now submissive to Carthage, and for the most part paid tribute. He never returned. The last eight years of his life he devoted to the great work of reducing Spain to a Carthaginian province. He penetrated into the interior of the country, subduing some of the tribes by force of arms and drawing others into friendly relations by negotiation. It was not to mere conquest that he aspired; he did his best to win the good-will of the Spaniards and to attach them to Carthage. Spain was to be a compensation to Carthage for the loss of Sicily and Sardinia. But, above all, its possession was to be subordinate to Hamilcar's great design of some day renewing the war with Rome. For this he would have felt himself prepared when, in addition to his Numidian cavalry, he had organized a force of Spanish infantry. Had his life been prolonged, he would doubtless, as Livy says (xxi. 2), have invaded Italy at the head of a Carthaginian army. What he accomplished in Spain so much impressed the elder Cato, who less than half a century afterwards saw the traces of his work, that he declared that there was no king like Hamilcar Barca. In the prime of his years he fell in battle in 228 B. C., fighting, it would seem, somewhere between the Tagus and the Douro. Spain was now left in the hands of his son-in-law Hasdrubal.

(W. J. B.)

HAMILTON, a municipal and parliamentary borough and market-town of Scotland, county of Lanark, is situated about a mile from the junction of the Avon with the Clyde and 10 miles S. E. of Glasgow. It occupies a rising ground commanding fine views of a rich and highly picturesque country, and consists of several streets of well-built houses somewhat irregularly dispersed, and surrounded by a number of villas belonging chiefly to persons engaged in business in Glasgow. The principal buildings are the town-hall, the county buildings in the Grecian style of architecture, the academy, the St. John's grammar school, and the infantry barracks. Among the subjects of antiquarian interest are Queenzie Neuk, the spot where Queen Mary rested on her journey to Langside; the old steeple and pillory built in the reign of Charles I.; the Moat Hill, the old Runic cross, and the carved gateway in the palace park. In the churchyard there is a monument, with four heads in basso-rilievo, to four Covenanters who suffered at Edinburgh, December 7, 1600, their heads being interred below. Among the industries of the town are weaving and the tambouring of muslin; and there are also large market gardens, the district being famed especially for its apples; but the prosperity of the town depends chiefly upon the coal and iron-stone which are extensively worked in the neighborhood. Hamilton originated in the 15th century under the protecting influence of the lords of Hamilton. It unites with Airdrie, Falkirk, Lanark, and Linlithgow to form the Falkirk district of boroughs, which returns one member to parliament. The population in 1905 was 32,775.

Immediately east of the town is Hamilton palace, the seat of the duke of Hamilton and Brandon, premier peer of Scotland. The present palace was commenced in 1822. Its front is a specimen of the enriched Corinthian architecture, with a projecting pillared portico after the style of the temple of Jupiter Stator at Rome, 264 feet in length and 60 feet in height. The interior is richly decorated and contains one of the most valuable collections of paintings in Scotland. Within the grounds, which comprise nearly 1500 acres, is the mausoleum erected by the tenth duke, a structure resembling in general design that of the emperor Hadrian at Rome, being a circular building springing from a square basement, and enclosing a decorated octagonal chapel. About two miles southeast of Hamilton, on the summit of a precipitous rock 200 feet in height, the foot of which is washed by the Avon, stand the ruins of Cadzow Castle, the original seat of the Hamilton family, conferred on the chief of that family immediately after the battle of Bannockburn, having been previously a royal residence for at least two centuries. The castle has been made the subject of a spirited ballad by Sir Walter Scott. Near it is the noble chase with its ancient oaks, the remains of the Caledonian Forest, where are still preserved some of the old Scotch breed of wild cattle. Opposite Cadzow Castle, on the other side of the Avon, is Chatelherault, consisting of stables and offices, and imitating in outline the palace of that name in France. A magnificent double avenue stretches between it and Hamilton palace.

HAMILTON, a city of Canada, the chief town in the county of Wentworth, province of Ontario, is advantageously situated on the south side of Burlington Bay, a large and beautiful basin of water connected with Lake Ontario by a short canal, which forms one of the safest and most commodious harbors on the lake. It is also connected with the town of Dundas by the Desjardins Canal, about 4 miles in length. Hamilton holds an important position at the head of the navigation on Lake Ontario, and in the centre of one of the finest agricultural districts of the Dominion. It is the headquarters of the Great Western Railroad, and is connected by other lines of railway with Lake Erie, Lake Huron, and the Georgian Bay. The site on which it is built rises gradually from the bay to the foot of a lofty bluff called "The Mountain," the summit of which commands an extensive and beautiful view. The streets are well laid out, and planted with shade trees, and the houses and public buildings are substantially constructed of stone and brick. The court-house and county buildings, recently completed, are the finest in Canada. Among the other public buildings are the provincial lunatic asylum, the Anglican and Roman Catholic cathedrals, and handsome places of worship of other denominations, the collegiate institute, the Wesleyan female college, the mechanics' institute, the banks, the city hospital, and other charitable institutions. The city water-works, by means of which a constant supply of pure water is brought from Lake Ontario, have been completed on a scale amply providing for the future growth of the city, at a cost of about $1,000,000. The industries include iron rolling mills, iron foundries, the manufacture of agricultural implements, sewing machines, musical instruments, carriages, glass, pottery, etc., tobacco manufacture, and brushmaking. The total value of imports at the port of Hamilton for the fiscal year 1878–79 was $3,992,123; and the duty collected amounted to $839,153. The total tonnage entered at the port was 160,666 tons; but this is exclusive of a much larger amount of goods brought by railway, including foreign importations, on which the duty has already been paid at Quebec or Montreal, and of which therefore no entry is made. Daily lines of steamers run in the summer months between Hamilton, Toronto, Kingston, and Montreal; and an extensive trade is carried on with the maritime provinces. Hamilton was founded in 1813, and incorporated in 1833. The population in 1836 was 2846; in 1851, 10,248; in 1861, 19,096; in 1871, 26,716; and in 1901 it is estimated at 52,550. It is the seat of the Anglican bishop of Niagara, and of a Roman Catholic bishop. It returns one member to the provincial parliament of Ontario, and two members to the Dominion parliament, or House of Commons.

HAMILTON, a township and post village of Madison county, New York, U. S., is situated on the Chenango canal, and on the Utica branch of the New York and Oswego Midland Railway, 30 miles S. W. of Utica. The village is the seat of Madison university, chartered in 1846, in connection with which there are a theological seminary of the Baptist denomination opened in 1820, and a preparatory academy opened in 1832 under the name of Colgate Academy, and chartered in 1853 as the grammar school of the university. The university has 10 professors, has both a scientific and a classical course, and is attended by upwards of 100 students. The other educational institutions are a female seminary and a union graded school. The village possesses a foundry, a tannery, and manufactories of sashes and blinds, doors, wagons, cigars, and cheese. The population of the village in 1870 was 1529, and in 1900. 3,744.

HAMILTON, a city of the United States, capital of

Butler county, Ohio, is situated on both sides of the Great Miami river, on the Miami and Eric canal, and at the junction of several railways, 23 miles N. of Cincinnati. The water-power for manufacturing purposes is obtained by an hydraulic canal which secures a fall of 30 feet; and the situation of the city in the heart of the Miami valley, a rich agricultural district, is very favorable to the development of commercial enterprise. It possesses two public parks, twelve churches, two national banks, a complete graded system of public schools, an orphans' home, and a free library. Its industries are of a varied kind, and are represented by paper and woollen factories, flour-mills, foundries, breweries, distilleries, bleaching works, machine shops and manufactories of carriages and wagons, reaping machines, ploughs, and other agricultural implements, sashes and blinds, railroad supplies, and machinery. Hamilton received a municipal charter in 1853, at which time the portion on the west side of the river formerly called Rossville was incorporated with it. The population, which in 1860 was 7223, and in 1870 11,081, of whom 3062 were foreigners, was estimated in 1900 at 23,914.

HAMILTON, the principal town in the western district of Victoria, Australia, is situated on the Grange Burne Creek, in 37° 45′ S. lat. and 142° 1′ E. long. It was proclaimed a borough in 1859, the area of the municipality being 5280 acres. It has several elegant buildings—a hospital and benevolent asylum, a town-hall, a treasury and land office, and a public library. Its educational institutions include the Hamilton and western district college, the academy, and the Alexandra college for ladies, besides a state school with accommodation for 500 pupils. It possesses a fine race-course covering 120 acres, and pastoral and agricultural exhibitions are held annually, the surrounding district being chiefly devoted to sheep-farming. The population of the town and suburbs on the 1st January, 1901, was estimated at 4400. The railway from Melbourne to Portland passes through the town.

ALEXANDER HAMILTON.

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HAMILTON, Alexander, soldier, statesman and public financier, was born on the Island of Nevis, in the British West Indies, on January 11, 1757. There has been much dispute concerning his ancestry, but it seems well established that his father was a Scotch merchant of substance and character and that his mother was a French Huguenot, who was first married to a Danish colonist and second, after securing a divorce, to the elder Hamilton. Soon after Alexander Hamilton's birth, his father failed in business and spent the rest of his life in poverty and obscurity; and by the death of his mother the child was left practically an orphan at a tender age. He was cared for by relatives of his mother, at Santa Cruz, and was well cared for. Educational advantages there were meagre, but such as they were were eagerly and richly improved by this precocious child, who almost in infancy showed unmistakable marks of genius. He spoke and read both English and French, and thus had access to the literature of both those languages wherever he could find it. Dr. Knox, a Scotch Presbyterian minister, early recognized his extraordinary ability, and did much for his advancement. At the age of twelve years he was set to earning his living as a clerk in the counting house of Nicholas Cruger, a Santa Cruz merchant. This was not at all to his liking. In a letter to a former schoolfellow he wrote of it as "a grovelling condition," and wished there might be a war in which he could play a glorious part. Nevertheless he performed the duties of his distasteful place with fidelity and zeal, and with marked ability. We may add that he did so with no little profit to himself, for he was there, all unwittingly, laying the foundations of that financial and economical knowledge which before middle age made him the founder of the American fiscal system and one of the greatest constructive statesmen the world has ever known. He began, too, to write, and thus schooled himself for the career of the most formidable political pamphleteer of his age. Indeed, it was to his writing that his advancement further was most directly due. A description of a hurricane which visited St. Kitt's in August, 1772, written by him and published in a local sheet, attracted wide attention, and inspired some of his friends to unite in providing him with the means of acquiring a better education. He was accordingly sent north, and was placed in an academy at Elizabethtown (now Elizabeth), New Jersey, where he became intimate with the eminent families of Livingston and Boudinot. His teacher was Thomas Barber, already an ardent patriot, who promptly entered the army at the outbreak of the Revolution. A few months at this school sufficed to prepare Hamilton to enter King's (now Columbia) College, in New York, where he pursued the ordinary classical course and also a course in anatomy and medicine, with a view of becoming a physician and surgeon.

It was while Hamilton was thus engaged that the controversy between the Colonies and England came to a crisis. There was a call for the election of a Continental Congress. To that end a public meeting was held in New York on July 6, 1774. Hamilton attended the meeting as a spectator, a mere "college boy" unknown to fame. Some utterance of a speaker caught his ear. He pressed his way to the front of the platform and made reply, in a speech which set every listener to wondering and asking who the "marvellous boy" might be. A little later he began writing for *Holt's Journal*, the organ of the New York patriots, and soon showed himself a pungent and convincing political essayist. When Seabury, afterward Bishop of the Protestant Episcopal Church, published a pamphlet criticising the doings of the Continental Congress, Hamilton replied to him in a pamphlet of so great ability that its authorship was ascribed to John Jay and other older men. Seabury responded with a second pamphlet, and Hamilton did not hesitate to retort upon him with another. A third pamphlet by Hamilton, on the Quebec Bill, in June, 1775, and the disclosure of his authorship of them all, made this lad of eighteen one of the leaders of the patriot party in New York. In addition, he joined a body of militia, and became expert in military tactics. Thus he was ready for the first clash of arms, and he was on the spot when it came. This was a land attack, from the Battery, upon the British ship *Asia*, in New York harbor, on August 22, 1775. In the following March he was commissioned a captain in an artillery company, in New York, and spent all his ready money (sent to him by his friends in Santa Cruz) in equipping the company. He was attached to Scott's Brigade, and took an active part in the campaign in Brooklyn and New York. He covered the retreat of the army from Brooklyn to New York, and lost all his baggage and one of his guns. At Harlem Heights he planned and constructed an earthwork with so much skill as to attract the attention of Washington, who invited him into his tent and manifested in him an interest which endured to the end of his life. Hamilton's artillery played a prominent part in the battle of Chatterton Hill, at White Plains, and he was with Washington all through the disheartening retreat across New Jersey. It was he who guarded the rear of the little army, and who held Cornwallis back at the Raritan until the rest of the army had safely crossed that river. He shared, also, in the brilliant victories of Trenton and Princeton, though by all

this hard campaigning his company had been reduced to only 25 men.

Such service, performed by so young a man, was sure to attract attention; the more as Hamilton, in addition to his brilliant qualities as a soldier, showed himself also an economist, the notebook of his company containing many memoranda upon the subjects of the currency, taxation, commerce, and the like. Already two major generals had invited him to accept places upon their staffs, but he had declined, preferring to remain with Washington, though in a subordinate place After Trenton and Princeton, however, Washington offered him a place as aide-de-camp, with the rank of lieutenant colonel, and this Hamilton accepted. His appointment was announced on March 1, 1777, when Hamilton was only a little more than twenty years old. Washington seems to have selected Hamilton for this place on account of his ability as a writer, in order that he might conduct for him his voluminous correspondence with Congress, the various States, and others. This service Hamilton performed with rare ability and discretion. He not only wrote for Washington, but thought for him, the framing as well as the penning of important letters often being left entirely to him. Thus Hamilton gained an intimate knowledge of affairs, and was able to exercise considerable influence over them. After the battles of Brandywine and Germantown he was sent on a confidential errand to Putnam and Gates, to get them to hasten forward re-enforcements. This Gates was reluctant to do, and it required all of Hamilton's diplomacy and force to prevail upon him. Hamilton spent the winter at Valley Forge, and the next summer was at Monmouth, where, in addition to sharing brilliantly in the battle, he served as Laurens's second in his duel with the traitor Lee. He was Washington's envoy to meet Admiral D'Estaing, was at West Point at the time of Arnold's treason, and urged that André be shot rather than hanged. At the close of 1780 he married a daughter of General Schuyler, thus allying himself with one of the wealthiest and most influential New York families. A little later, in a fit of pique at being reproved by Washington, he resigned from the latter's staff and persisted in retiring even after Washington had sent him an apology. The two men continued, however, on terms of the closest personal and political friendship. Hamilton then obtained a commission in the army as commander of a New York battalion, and distinguished himself by leading a storming party at Yorktown.

After the war Hamilton studied law, was admitted to the New York bar in 1782, and in the fall of that year was sent as a New York delegate to the Continental Congress. There he urged provision for paying the public debt, and also the strengthening of Congress as the governing body of the nation. Upon the evacuation of New York by the British he resigned his place in Congress and entered upon law practice in New York, where he soon won prominence and wealth. He was one of the founders of the bank of New York, the first institution of its kind in the State and the second in the Union. He was also one of the founders of the Manumission Society, the object of which was the abolition of slavery. He was a New York delegate to the Annapolis Convention of 1786, and drafted the address to the States which led to the convention, the next year, by which the Federal Constitution was made. As a member of the New York Legislature he urged, though vainly, the concession to Congress of power to levy custom duties, and was successful in settling the dispute between New York and Vermont. In May, 1787, he was a delegate to the Constitutional Convention at Philadelphia, where he held views exactly opposite to those of his two colleagues from New York. There were before the Convention two plans. One, the Virginia plan, provided for a Constitution much like that which now exists. The other, the New Jersey plan, provided for the continuance of the old Confederation, with a few changes. Hamilton advocated the former in an elaborate and powerful speech, though also suggesting that its principles be carried still further in the direction of a strong, centralized national Government. In the end the Virginia plan was adopted, and Hamilton's two colleagues went home in disgust, to oppose its acceptance by the State. Hamilton remained, applied himself to the perfecting of the details of the Constitution, and then began writing *The Federalist* to vindicate the work of the Convention and to prevail upon the people of New York and other States to accept it. That series of essays, of which Hamilton wrote the most, Madison some, and Jay a few, remains to this day an unsurpassed classic of American political literature, and it is not too much to say that to Hamilton more than to any other man, perhaps than to all other men, we owe the adoption of the American Constitution and the formation of the American Union.

Upon the organization of the Government under the Constitution, Washington wisely chose Hamilton to be Secretary of the Treasury. In that office the young statesman brought order out of chaos. At the next session of Congress he presented an elaborate report, concerning the public debt and public credit. The foreign debt he urged must be paid according to the exact terms of the contract. The domestic debt had changed hands at depreciated rates, and there was a strong demand that its securities be paid at the rates at which they had been last purchased. This Hamilton vigorously opposed, and insisted that the bonds should be paid at their original value. He carried his policy in the face of furious opposition, and thus performed a work of incalculable good for the national credit. He also carried, against similar opposition, the policy of assuming on behalf of the nation the war debts of the States. Next he secured the establishment of an excise duty on spirits, and the foundation of a national bank. To the second Congress he presented an elaborate report in favor of a protective tariff, which also in time prevailed. In all these policies, Hamilton's chief opponent was Jefferson, his colleague in the cabinet as Secretary of State, and for years a bitter war was waged between them, in which Hamilton generally had the advantage, and which ended in Jefferson's retirement from the cabinet. In 1795 Hamilton resigned from the cabinet and resumed the practice of law, but continued to use tongue and pen with great effect in the support of Washington's administration against the virulent attacks of Jefferson's extreme partisans. He did much for the ratification of Jay's treaty, and assisted Washington — to what extent is not known — in the preparation of his Farewell Address. At the beginning of John Adams's administration a savage attack upon Hamilton, impugning his public and personal integrity, was made by a number of Jefferson's partisans, including James Monroe. Against this Hamilton fully vindicated himself in a vigorous pamphlet. In the summer of 1798 war with France seemed imminent, and Washington was recalled from his well-earned retirement to assume again the chief command of the army of the United States. He accepted the call, but only on condition that Hamilton should be made the first major general of the army and should have in charge the real work of organization and command. That place Hamilton filled with distinguished ability, meantime also writing strongly in support of Adams's policy, and upon the death of Washington he became the head of the army in name as well as in fact. In September, 1799, however, Adams appointed an embassy to France, to seek a pacific settlement of the differences between the two countries. This was done against the advice of his cabinet, and against Hamilton's judgment, and led to a hopeless breach in the Federalist party. Hamilton and his friends decided secretly to compass the defeat of Adams in the next election, by securing a greater number of votes for the other candidate on the Federalist ticket — for the Constitution then provided that two candidates should be voted for on each ticket without specifying whether for President or Vice-President, the one having the more votes being President. Whether the Federalists would have a majority at all or not depended upon the vote of New York. Hamilton sought to win it for the Federalists, and Aaron Burr worked to get it for the Republicans, or Democrats. Burr won, and the Federalists were defeated. When the election came up in Congress, the Federalists were in a minority, and the two Republican-Democratic candidates, Jefferson and Burr, had each the same number of votes. Which of them would be President and which Vice-President depended upon which could get the more votes from the Federalists. Some of the latter, in their hatred of Jefferson, favored voting for Burr. Hamilton had, of all men, most reason on personal grounds so to do. But he rose quite superior to personal considerations, regarded only the public welfare, and made Jefferson, his rival and enemy, President. That was the climax of Hamilton's career, and not the least of his public services, which he presently sealed with his life-blood, for Burr was infuriated at him and began to plan his destruction. Four years later, being unable to secure re-election to the Vice-Presidency, Burr tried to be elected Governor of New York. Again he was defeated, largely through Hamilton's influence. Thereupon he picked a personal quarrel with Hamilton, and challenged him to fight a duel. Duelling was abhorrent to Hamilton, who had long condemned it and who had especially opposed it since he had lost his eldest son, a youth of twenty, in such a meeting two years before. But he knew that if he declined to meet Burr his influence as a public man would decline. Therefore he accepted the challenge, though with premonitions, which he put into writing, that he would fall. The meeting took place at Weehawken, New Jersey, on the bank of the Hudson River, on July 11, 1804, and at the first fire Hamilton received a wound from which he died the next day. Burr unquestionably sought the meeting with the intention of killing Hamilton, and he and his partisans in New York had the monstrous indecency to celebrate the deed with boisterous revelry, until the rising indignation of the public warned them to desist and to seek safety in obscurity. The death of Hamilton was regarded as a national bereavement, as indeed it was.

In addition to the public services already recounted, it is to be recalled that Hamilton was one of the first American statesmen to encourage Miranda and other South American patriots to take up arms against Spain and win their independence. He was the first to broach the policy of extending the United States beyond the Mississippi and to the Pacific Ocean, and thus of making it the dominant power upon the North American continent. In the early controversy over the Mississippi River, it was he who most strenuously urged that the free use and control of that river was essential to the security and very existence of this Union, and that such use and control were to be obtained only by obtaining sovereignty over the whole territory on both banks of the river. Thus he was the real author of the policy which his great rival, Jefferson, afterward adopted in the purchase of the Louisiana Territory. Indeed, at almost every important point, in both domestic and foreign policy, the genius of Hamilton

directed the young Republic in its first twenty years of life. No other one man had a greater or so great influence in shaping our national destinies. He was the real founder of what we may call the national policy as distinguished from the confederate policy of Jefferson, and we shall not err if we esteem him as the greatest constructive statesman America has yet produced.

Hamilton was personally a man of singular charm. He was under middle height and slight in figure, hut of erect and martial bearing and of dignified and courtly yet most engaging address His features were not classically regular, but his complexion was as fresh and delicate as that of a girl, his eyes sparkling, his smile winning. His voice was flexihle and musical in a high degree, and his speech eloquent and persuasive. His widow, who was inconsolable at his death, survived him and remained constant to his memory for fifty years. He left seven children. whose issue in turn have perpetuated the family name and have often displayed an intellectual ability not unworthy of their illustrious progenitor. Hamilton's writings in *The Federalist* are familiar to all who are familiar with the constitutional history and system of the United States. His other miscellaneous works were edited and puhlished in seven volumes by his son, John C. Hamilton, who also published an elaborate "History of the Republic of the Uuited States as Traced in the Writings of Alexander Hamilton and His Contemporaries," and a "Life of Alexander Hamilton." Henry Cabot Lodge has edited an edition of Hamilton's works, in nine volumes, and has written a life of him in the "American Statesman" series. Various other lives and sketches of Hamilton have been published, and he has been the subject of innumerable articles in magazines and countless addresses. Statues and monuments have been erected in his honor, and his name is borne by banks and avenues, towns, cities and counties, and in many another way has been enshrined in the memory and the records of the nation. W. Fletcher Johnson.

June, 1904.

HAMILTON, Anthony or Antoine (1646–1720), a French classical author, who is especially noteworthy from the fact that, though by birth he was a foreigner, his literary characteristics are more decidedly French than those of many of the most indubitable Frenchmen. His father was George Hamilton, younger brother of James, second earl of Abercorn and head of the family of Hamilton in the peerage of Scotland, and sixth duke of Châtellerault in the peerage of France; and his mother was Mary Butler, sister of the duke of Ormonde. He was born in 1646, but the place of his birth has not been ascertained. According to some authorities it was Drogheda, but according to the London edition of his works in 1811 it was Roscrea in Tipperary county. From the age of four till he was fourteen the boy was brought up in France, whither his family had removed after the execution of Charles I. The fact that, like his father, he was a Roman Catholic, prevented his receiving the political promotion he might otherwise have expected on the Restoration, but he became a distinguished member of that brilliant band of courtiers whose most fitting portraiture was destined to be the product of his pen. His connection with France was always maintained, and the marriage of his sister to the Comte du Grammont rendered it more intimate if possible than before. On the accession of James he found his religious disabilities transformed into advantages. He obtained an infantry regiment in Ireland, and was appointed governor of Limerick. But the battle of the Boyne, at which he was present, brought disaster on all who were attached to the cause of the Stewarts, and before long he was again in France—an exile, but at home. The rest of his life was spent for the most part in the châteaux of his friends. With the duchess Ludovise of Maine he became an especial favorite, and it was at her seat at Sceaux that he wrote the *Mémoires* that made him famous. The ill-advised expedition of 1708 was the last political enterprise in which he shared, and he died at St. Germain-en-Laye, August 6, 1720.

It is mainly, as has already been indicated, hy the *Mémoires du Comte de Grammont* that Hamilton takes rank with the most classical writers of France. The work was first puhlished anonymously in 1713 under the rubric of Cologne, hut it was really printed in Holland, at that time the great patroness of all questionable authors. An English translation hy Boyer appeared in 1714. Upwards of thirty editions have since appeared, the hest of the French heing Renouard's (1812) and Gustave Brunet's (1859), and the best of the English Edward's (1793), with 78 engravings, and Malleville's (1811), with 64 portraits by Scriven and others. The original edition was reprinted hy Pifteau in 1876. In imitation and satiric parody of the romantic tales which Galland's translation of *The Thousand and One Nights* had hrought into favor in France, Hamilton wrote *Le Bélin, Fleur d'Epine, Zénéyde*, and *Les Quatre Facardins*, which are characterized by the graceful ease of their style and the successful extravagance of their incidents. The first three tales appeared at Paris in 1730, ten years after tho death of the author, and a collection of his *Œuvres Diverses* in 1731 contained the unfinished "Zénéyde." A collected edition of Hamilton's works was published in six volumes in 1749, and was reprinted in 1762, 1770, 1776, and 1777. A translation of Popo's *Essay on Criticism*, which procured the author a complimentary acknowledgment from the poet, is still in MSS., with the exception of a fragment printed in the 1812 edition of the works. In the name of his niece, the countess of Stafford, Hamilton maintained a witty correspondence with Lady Mary Wortley Montagu. See Notices of Hamilton in the 1862 edition of his works, and in Lescure's edition of the *Contes*, Sainte-Beuve's *Causeries du Lundi* (tom. i.), and Sayou's *Histoire de la littérature française à l'étranger*, 1853.

HAMILTON, Elizabeth (1758–1816), novelist and miscellaneous writer, was born at Belfast, of Scotch extraction, 25th July, 1758. Her father's death in 1759 left his wife so embarrassed that Elizabeth was adopted in 1762 by her paternal aunt, Mrs. Marshall, who lived in Scotland, near Stirling. There Elizabeth spent her youth and received a good education,—at first at school, afterwards in private, and latterly for some months under masters at Edinburgh and Glasgow. In her 15th year she made a tour in the Highlands with some friends, and wrote a journal of it for her aunt's perusal, which was inserted, unknown to the authoress, in a provincial magazine. In 1780 Mrs. Marshall died, and Miss Hamilton was prevented by household cares from using her pen; but in 1785 she made her first voluntary contribution to the press in the shape of a letter to the *Lounger*, of which paper it forms the 46th number. On the death of Mr. Marshall in 1788, Miss Hamilton lived for a time with her brother, Captain Charles Hamilton, who was engaged on his translation of the *Hedaya*. Prompted by her brother's associations, she produced her *Letters of a Hindoo Rajah* in 1796, and soon after, with her sister Mrs. Blake, settled at Bath, where she published in 1800 the *Memoirs of Modern Philosophers*, a kind of satire on the admirers of the French Revolution. In 1801–2 the *Letters on Education* appeared, her most valuable though not her most popular work. After travelling through Wales and Scotland for nearly two years, the sisters took up their abode in 1803 at Edinburgh. In 1804 Mrs. Hamilton, as she then preferred to be called, published her *Life of Agrippina, wife of. Germanicus;* and in the same year she received a pension from Government. About this time she consented to take charge for six months of a widowed Scotch nobleman's family; and to his eldest daughter were addressed *Letters on the Moral and Religious Principle*, published in 1806. Her next publication of importance, *The Cottagers of Glenburnie*, appeared in 1808. This work, to which the authoress owes most of her fame, is an admirable description of the failings of the Scotch peasantry in their home life, and, while graphic and telling, is "saved from caricature and absurdity." Sir Walter Scott describes it as "a picture of the rural habits of Scotland, of striking and impressive fidelity;" and Lord Jeffrey reviewed it very favorably in the *Edinburgh Review* (vol. xii.). Her subsequent works were a supplement to her *Letters on Education*, under the name of *Popular Essays on the Elementary Principles of the Human Mind* (1812), and *Hints addressed to the Patrons and Directors of Public Schools* (1815). She died at Harrowgate, July 23, 1816.

Memoirs of Mrs. Elizabeth Hamilton, by Miss Benger, were published in 1818. A notice of her literary life and lahors, attrihuted to Miss Edgeworth, appeared in the *Monthly Magazine* for September, 1816.

HAMILTON, James (1769–1831), the author of the Hamiltonian system of teaching languages, was born in 1769 and died October 31, 1831. The first part of his life was spent in mercantile pursuits. Having settled in Hamburg and become free of the city, he was anxious to become acquainted with German and accepted the tuition of a French emigré, General D'Angelis. In twelve lessons he found himself able to read an easy German book, his master having discarded the use of a grammar and translated to him short stories word for word into French. As a citizen of Hamburg Hamilton started a business in Paris, and during the peace of Amiens maintained a lucrative trade with England; but at the rupture of the treaty he was made a prisoner of war, and though the protection of

Hamburg was enough to get the words *effacé de la liste des prisonniers de guerre* inscribed upon his passport, he was detained in custody till the close of hostilities. His business being thus ruined, he went in 1814 to America, intending to become a farmer and manufacturer of potash; but, changing his plan before he reached his "location," he started as a teacher in New York. Adopting his old tutor's method, he attained remarkable success in New York, Baltimore, Washington, Boston, Montreal, and Quebec. Returning to England in July, 1823, he was equally fortunate in Manchester and elsewhere. His system attracted general attention, and was vigorously attacked and defended. In 1826 Sydney Smith devoted an article to its elucidation in the *Edinburgh Review*:—"We are strongly persuaded," he said, "that, the time being given, this system will make better scholars, and, the degree of scholarship being given, a much shorter time will be needed" than in the ordinary system. As text-books for his pupils Hamilton printed interlinear translations of the Gospel of John, of an *Epitome historiæ sacræ*, of Æsop's *Fables*, Eutropius, Aurelius Victor, Phædrus, etc., and many books were issued as Hamiltonian with which he had nothing personally to do. The two master principles of his method, which has left the traces on our modern linguistic discipline, are that the language is to be presented to the scholar as a living organism, and that its laws are to be learned from observation and not by rules.

See Hamilton's own account—*The Principles, Practice, and Results of the Hamiltonian System for the last Twelve Years*, Manchester, 1829; Alberte, *Ueber die Hamilton'sche Methode*; C. F. Wurm, *Hamilton und Jacotot*, 1831.

HAMILTON, Patrick (1504–1528), son of Sir Patrick Hamilton, well known in Scottish chivalry, and of Catherine Stewart, daughter of Alexander duke of Albany, second son of James II. of Scotland, was born in the diocese of Glasgow, probably at his father's estate of Stonehouse in Lanarkshire. Of his early boyhood and education nothing is known. In 1517 he was appointed titular abbot of Ferne, Ross-shire; and it was probably about the same year that he went to study at Paris, for his name is found in an ancient list of those who graduated there in 1520. It was doubtless during this period that he received the germs of the doctrines he was afterwards so nobly to uphold. From Ales we learn that Hamilton subsequently went to Louvain, attracted probably by the fame of Erasmus, who in 1521 had his headquarters there. Returning to Scotland, the young scholar naturally selected St. Andrews, the capital of the church and of learning, as his residence. On the 9th June, 1523, he became a member of the university of St. Andrews, and on the 3d October, 1524, he was admitted to its faculty of arts. There Hamilton attained such influence that he was permitted to conduct in the cathedral a musical mass of his own composition. But the Reformed doctrines had now obtained a firm hold on the young abbot, and he was eager to communicate them to his fellow-countrymen. Early in 1527 the archbishop Beatoun's attention was directed to the heretical preaching of the young priest, whereupon he ordered that Hamilton should be formally summoned and accused. Hamilton fled to Germany, first visiting Luther at Wittenberg, and afterwards enrolling himself as a student, under Francis Lambert of Avignon, in the new university of Marburg, opened May 30, 1527, by Philip, landgrave of Hesse. Frith and Tyndale were among those whom he met there. Late in the autumn of 1527 Hamilton returned to Scotland, bold in the truth of his principles. He went first to his brother's house at Kincavel, near Linlithgow, in which town he preached frequently, and soon afterwards he married a young lady of noble rank, whose name has not come down to us. Beatoun, avoiding open violence through fear of Hamilton's high connections, invited him to a conference at St. Andrews. The reformer resolutely accepted the invitation, and for nearly a month was permitted to preach freely. At length, however, he was summoned before a council of bishops and clergy presided over by the archbishop; and though he clearly and calmly answered all the written charges brought against him, his replies gave ground for new accusations of heresy. The council eagerly convicted him, and handed him over to the secular power. The sentence was carried out on the same day (February 29, 1528), lest he should be rescued by his friends, and he was burned at the stake as a heretic. His courageous bearing attracted more attention than ever to the doctrines for which he suffered, and greatly helped to spread the Reformation in Scotland.

Hamilton left a short treatise showing the antithesis between the law and the gospel. Frith's translation of it, under the name of "Patrick's Places," is to be found in Foxe's *Acts and Monuments*. *Patrick Hamilton, the first Preacher and Martyr of the Scottish Reformation*, by the Rev. Peter Lorimer, was published at Edinburgh in 1857.

HAMILTON, Robert (1743–1829), an able writer on political economy and finance, was born at Pilrig, Edinburgh, on the 11th June, 1743. He was of good family, his grandfather, William Hamilton, professor of divinity and afterwards principal of Edinburgh University, having been a cadet of the family of Preston. He received an excellent education, and especially distinguished himself in the classes of mathematics at the university of Edinburgh, then under Professor Matthew Stewart. Although desirous of following a literary life, he was induced to enter the banking-house of Messrs. Hogg in order to acquire a practical knowledge of business. In 1766 he was disappointed in his effort to obtain the mathematical chair at Aberdeen university, but three years later he gave up business pursuits and accepted the rectorship of Perth academy. In 1779 he was presented to the chair of natural philosophy at Aberdeen university. For many years, however, by private arrangement with his colleague Professor Copland, Hamilton taught the class of mathematics. In 1817 he was presented to the latter chair. For some years before his death in July, 1829, he had retired from the active business of his chair, and quitted his privacy only at rare intervals to take part in important affairs concerning the college.

Hamilton's most important work is the *Essay on the National Debt*, which appeared in 1813, and was undoubtedly the first to expose the economic fallacies involved in Pitt's policy of a sinking fund. It is still of value. A posthumous volume published in 1830, *The Progress of Society*, is also of great ability, and is a very effective treatment of economical principles by tracing their natural origin and position in the development of social life. Some minor works of a practical character (*Introduction to Merchandise*, 1778; *Essay on War and Peace*, 1790) are now forgotten.

HAMILTON, Thomas (1789–1842), the author of *Cyril Thornton*, was the younger brother of Professor Sir William Hamilton, Bart., and was born in 1789. In his early years he acquired a thorough mastery of the classics, and notwithstanding that he entered the artillery and was engaged in active service throughout the Peninsular and American campaigns, he continued to cultivate his literary tastes. On the conclusion of peace he withdrew, with the rank of captain, from active professional duties, and amused his leisure hours with the congenial pastime of literature. He was a frequent contributor to *Blackwood's Magazine* from its commencement, his papers manifesting great variety and versatility of talent, and embracing both prose and poetry. The most important and popular of his contributions to that periodical was the military novel *Cyril Thornton*, whose deficiency of plot is sufficiently compensated for by the interest of its details, its vivacity of movement, its truthful and clever delineation of character, and its easy, fresh, and graceful style. His *Annals of the Peninsular Campaign* published originally in 1829, and republished in 1849 with additions by Frederick Hardman, though too condensed to leave room for graphic description, is written with great clearness and impartiality. His only other work, *Men and Manners in America*, published originally in 1832, is the result of much careful observation, and its criticisms, though frank and outspoken, and somewhat colored by British prejudice, are always expressed with courtesy and good taste. He died at Pisa, December 7, 1842.

HAMILTON, Sir William, Bart. (1788–1856), one of the most eminent of Scottish metaphysicians, was born in Glasgow, on the 8th March, 1788. His father, Dr. William Hamilton, had in 1781, on the strong recommendation of the celebrated William Hunter, been appointed to succeed *his* father, Dr. Thomas Hamilton, as professor of anatomy in the university of Glasgow; and when he died in 1790, in his thirty-second year, he had already gained a reputation that caused his early death to be widely and deeply regretted. William Hamilton and a younger brother (afterwards Captain Thomas Hamilton, noticed above) were thus brought up under the sole care of their mother,—a woman, fortunately, of considerable ability and force of character.

William received his early education in Scotland, except during two years which he spent in a private school near London, and went in 1807, as a Snell exhibitioner, to Balliol College, Oxford. There he pursued his studies zealously, though for the most part independently,—devoting himself chiefly to Aristotle, but in other directions also laying the foundations of that wide and profound scholarship with which his name is associated. In November, 1810, he took the degree of B. A. with first-class honors, after an examination so much above the usual standard in the number and difficulty of the works which it embraced that the memory of it was long preserved at Oxford. He had been intended for the medical profession, but, soon after leaving Oxford, gave up this idea, and in 1813 became a member of the Scottish bar. Henceforward Edinburgh was his place of residence, and, except on occasion of two short visits to Germany in 1817 and 1821, he never again quitted Scotland. Neither his ambition nor his success was such as to absorb his time in professional pursuits. His life was mainly that of a student; and the following years, marked by little of outward incident, were filled by researches of all kinds, through which he daily added to his stores of learning, while at the same time he was gradually forming his philosophic system. The outward and visible traces of these researches remain in his common-place books, especially in one which, having been in constant use, is a valuable record of his studies from this time onwards to the close of his life. He did not withdraw himself from society, but his favorite companions were the books of his own and of every library within his reach. Among these he lived in a sort of seclusion, from which only now and then, when stirred by some event of the world around, did he come forth, in vigorous pamphlets, to denounce, or protest, or remonstrate, as the case might be.

His own investigations enabled him to make good his claim to represent the ancient family of Hamilton of Preston, and in 1816 he took up the baronetcy, which had lain dormant since the death (in 1701) of Sir Robert Hamilton, well known in his day as a Covenanting leader.

In 1820 he was an unsuccessful candidate for the chair of moral philosophy in the university of Edinburgh. Soon afterwards he was appointed professor of civil history, and as such delivered several courses of lectures on the history of modern Europe and the history of literature. In 1829 his career of authorship began with the appearance of the well-known essay on the *Philosophy of the Unconditioned*,—the first of a series of articles contributed by him to the *Edinburgh Review*. He was elected in 1836 to the Edinburgh chair of logic and metaphysics, and from this time dates the influence which, during the next twenty years, he exerted over the thought of the younger generation in Scotland. Much about the same time he began the preparation of an annotated edition of Reid's works, intending to annex to it a number of dissertations. Before, however, this design had been carried out, he was struck with paralysis of the right side, which seriously crippled his bodily powers, though it left his mind wholly unimpaired. The edition of Reid appeared in 1846, but with only seven of the intended dissertations,—the last, too, unfinished. It was Sir William's distinct purpose to complete the work, but this purpose remained at his death unfulfilled, and all that could be done afterwards was to print such materials for the remainder, or such notes on the subjects to be discussed, as were found among his MSS. Considerably before this time he had formed his theory of logic, the leading principles of which were indicated in the prospectus of "an essay on a new analytic of logical forms" prefixed to his edition of Reid. But the elaboration of the scheme in its details and applications continued during the next few years to occupy much of his leisure. Out of this arose in 1847 a sharp controversy with the late Professor De Morgan of University College, London. The essay did not appear, but the results of the labor gone through are contained in the valuable appendices to his *Lectures on Logic*. Another occupation of these years was the preparation of extensive materials for a publication which he designed on the personal history, influence, and opinions of Luther. Here he advanced so far as to have planned and partly carried out the arrangement of the work; but it did not go farther, and still remains in MS. In 1852–53 appeared the first and second editions of his *Discussions in Philosophy, Literature, and Education*, a reprint, with large additions, of his contributions to the *Edinburgh Review*. Soon after, his general health began to fail. Still, however, aided now as ever by his courageous and devoted wife—(he had married in 1829)—he persevered in literary labor, and during 1854–55 he brought out nine volumes of a new edition of Stewart's works. The only remaining volume was to have contained a memoir of Mr. Stewart from his pen; but this he did not live to write. He taught his class for the last time in the winter of 1855–56. Shortly after the close of the session he was taken ill, and on the 6th May, 1856, he died at his house in Edinburgh.

Sir W. Hamilton's philosophy is presented in writings either more or less fragmentary in form and occasional in purpose, or else, in whole or in part, prepared for publication by others, not by himself. Hence, not only do some points receive what seems almost a superfluity of attention, while others of equal importance are treated with barely enough of detail, but there is no complete statement of the latest results of his thinking in their mutual relations. It may be that this imperfection of the outward form has tended to obscure the real harmony of his system, and in part led to its being pronounced—as it has too often been—an assemblage of contradictory doctrines. How far this is from being the case, and how closely the various parts are connected, becomes apparent when it is seen how they are all developed from the central conception of consciousness. In the following sketch that conception will be used as a point from which briefly to view the system as a whole, and to trace the bearing on one another of its leading doctrines.

Consciousness is regarded by Hamilton under three chief aspects:—(1) as it is in itself: (2) as realized under actual conditions; (3) as a source of truth.

1. Consciousness in itself is to Hamilton but another name for immediate or intuitive knowledge. For such knowledge is a relation between a subject (knowing) and an object (known), which, as it is viewed from the side of the one or the other term, is properly called consciousness or knowledge: there are two aspects, but the thing itself is one. Immediate knowledge or consciousness involves the existence of both subject and object,—it is the affirmation by the subject implicitly of its own existence, explicitly of that of the object. In this relation as realized in the primary judgment, that which knows is conceived as the ego or self,—that which is known, either as a mode of the ego or self, or as a mode of the non-ego or not-self. Thus we have, in the *terms* of the relation, a division of *existence* into the noumenon self and the contrasted phenomena of mind and of matter; while the *relation* itself yields a division of *knowledge* into philosophy, corresponding to its subjective, and science, corresponding to its objective, phase,—the latter being further subdivided into the sciences of mental and those of material phenomena.[1]

2. Hamilton adopted the division of mental phenomena (not as states but as elements) into the three groups or classes of *cognition, feeling*, and *conation*. Cognitions he classified according to the different relations between subject and object, calling these relations,—as subjective, powers or faculties,—as objective, forms or stages, of knowledge. Under these, cognition is either immediate or mediate, *i. e.*, either consciousness itself or the datum of consciousness. The first of the faculties, therefore, is of immediate knowledge,—the acquisitive or presentative power, which yields perception (external and internal). The second is of that form of mediate knowledge which is representative of an individual object. Here Hamilton distinguished three moments or phases, which he termed the retentive, the reproductive, and the representative powers,—distinguished them perhaps too widely, but at the same time indicated their essential unity. The third is of that form of mediate knowledge in which a number of objects receive a factitious unity from being thought under a common relation. This he named the elaborative or discursive faculty.[2] Here, where he had to deal with consciousness in the form of experience, realized under actual conditions and comprehending every variety of mental life, Hamilton showed, in the first place, how the mutual action and reaction of the several elements produces the complexity which the phenomena present. Reminiscence, imagination, and judgment are all, as acts of which we are conscious, and which imply a prior immediate knowledge, contained in self-perception. But, on the other hand, our knowledge or perception even of self could not be what it is, did processes of reminiscence, imagination, and judgment not enter into its composition. Consciousness includes all the particular forms of knowledge; yet its development into a whole is the effect of the agencies which make up its content.[3] In the next place, he showed the laws of mental action in the conditions under which consciousness is exercised. From the variety and the limitation of consciousness, under the relation of time, arises the successive variation of its units,—in other words, the train of thought. By the limitation of consciousness is meant

[1] *Reid's Works*, pp. 804–810, 878, 929 *sq.*; *Lectures*, i. 193, 202–204, ii 279; *Discussions*, 3d ed., 47, 603.
[2] *Lectures*, i. 183–189, ii. 1–17.
[3] *Reid's Works*, 932; *Lects.*, i. 205, ii. 523

the limited number of objects to which it can at one time be directed, but this issues in a farther limitation, consisting in the disproportion between consciousness and the whole sum of mental modifications. Sir W. Hamilton held that consciousness is the mental modes or "movements, rising above a certain degree of intensity," and that "the movements beyond the conscious range are still properties—and effective properties—of the mental ego." This doctrine he used to explain not only the phenomena of ordinarily latent knowledge and of forgetfulness but also those of the abnormal recovery of apparently lost knowledge and of the formation of habits and dexterities.[1] The units (or rather groups of units) of the train—partly former thoughts again present, partly thoughts for the first time present to the mind—follow one another according to what Hamilton called the law of integration, *i. e.*, "only as they stand together as relative parts of the same common whole." Of this supreme law subordinate phases determine more special consecutions of thought. The reappearance of former thoughts (reminiscence voluntary or involuntary) is governed by the laws of (1) redintegration and (2) repetition. "Thoughts tend to suggest one another which are coidentical (1) in time or (2) in mode." New wholes of thought are framed by successive analyses and syntheses. Under the law of integration these analyses are effected by means of attention and abstraction, *i. e.*, by consciousness being continuously and repeatedly concentrated on certain parts or aspects of objects and withdrawn from others. The syntheses of thought are infinitely diverse in character, yet possess in common an invariable form. This process of forming new wholes, by discrimination and comparison, out of the materials supplied by perception and recollection, is the one kind of mental activity recognized by Hamilton in the various products of thought, from the simplest to the most complex. In other words, he regards judgment as the fundamental act of mind, the proposition, or expressed judgment, as its primary product.[2]

3. Hamilton's theory of consciousness in its third aspect, *i. e.*, as a source of principles, is embodied in his doctrines of *the conditioned* and of *common sense*. The former is so called because it professes to be a demonstration that "the conditionally limited (what we may briefly call the conditioned) is the only possible object of knowledge and of positive thought." The name of the latter was adopted by Hamilton, not as in itself a good one, but as sanctioned by the usage of philosophers in general and of Scottish philosophers in particular. The doctrine itself is that the primary data of consciousness are, as such, *i. e.*, as facts, and solely on the authority of consciousness, to be accepted as true. The two doctrines are complements of each other, as severally explications of the principle of the relativity of human knowledge, which, common to both, is manifested in the one through that which we cannot know,—in the other through the inexplicable character of our fundamental cognitions.

The primary data of consciousness Hamilton held to be of two orders, otherwise diverse, but in this the same, that they are known merely as facts. These are—(1) truths of perception—the conviction of the reality as modes of self of our own thoughts and feelings, and the allied conviction that in sense-perception we come into contact with a reality external to the mind; and (2) truths of reason—the fundamental laws of logic, the necessary forms of thought or relations of existence (*i. e.*, quality, and quantity in its threefold aspect as time, space, degree), the causal judgment, the principle of substance and phenomenon, etc.[3]

Now here it was Hamilton's peculiar contribution to philosophy that he placed the data of perception along with the data of thought, and affirmed that both classes alike are inexplicable, yet as facts clear; that both rest on the same authority; and that, if the one be accepted as true, so also should be the other. He was a realist, because he held realism to be the dictate of consciousness. Evidently here the ground of the view is of even more importance than the view itself, and so to Hamilton the question of realism *versus* idealism was momentous chiefly from its connection with that of the authority of consciousness. He was fully aware that, since he claimed so high an authority for the primary data of consciousness, it was necessary to supply the means of deciding whether any given cognition is or is not entitled to be placed among such; and to this end he laid down certain criteria of alleged primary facts of consciousness. These criteria are (1) simplicity, (2) universality and (subjective) necessity, (3) comparative evidence and certainty, (4) incomprehensibility. In other words, no cognition is an original datum of consciousness which is not simple (*i. e.*, incapable of being resolved into another), not held by all men as a self-evident and necessary truth, and not in itself inexplicable. Now the doctrine of the immediate knowledge of the non-ego will, Hamilton affirmed, stand all those tests. It is the simple residuum of truth in the crude and erroneous beliefs of men as to what they perceive through their senses; it is the spontaneous conviction of all (as to this he cited as witnesses philosophers who regarded the belief as a mistake and a delusion); and it does not admit of being made comprehensible.[4] That this is so can hardly be denied. Practically, indeed, all acknowledge that consciousness does intuitively affirm what he alleges it to affirm; and, the question being one of fact, a practical acknowledgment is quite as good as a theoretical one.

Here let it be remarked in passing that Hamilton's doctrine of common sense is wholly misrepresented when held up as an appeal to the belief of the unthinking multitude *versus* the judgment of philosophers. Rather it carries the appeal into a sphere where the philosophic and the vulgar have ceased to be distinguished; it shows that not the mind of the philosopher, and not the mind of the vulgar, but the mind of man, is what philosophy has to deal with, and that its office is to resolve current beliefs into their elements, not satisfied till it has reached the final and absolutely pure deliverance of consciousness.

But it may be said, as it often has been said, that consciousness is not competent to affirm immediate knowledge of the non-ego, because to discriminate the non-ego from the ego is beyond its power. Hamilton's answer is that, if knowledge be, as he holds, essentially relative, self cannot be known except with and through not-self, and that natural realism is but a corollary of the general principle of the relativity of knowledge. On that principle he held that "we think one thing only as we think two things mutually and together," and that, self being inherently a relative notion, we should never interpret by it facts of our experience, if experience did not come before us under a relation that needs both terms (self and not-self) for its expression. Hamilton certainly implies, if he does not expressly say, that, had we no knowledge of a not-self, we could never objectify self so as to know it as such at all. To him a knowledge of the ego alone would be absolute, not relative—such a knowledge, that is, as he held to be impossible. But, viewing knowledge as a relation between an existing subject and an existing object, he saw no reason why the object should not *be* what it is *known as*—sometimes a mode of self, sometimes a mode of not-self—and why consciousness of the ego should not include also that which stands in relation with it.[5]

But that there has been so amazing an amount of misconception on the point, it might seem hardly needful to say that Hamilton did *not* hold that in perception we know the thing-in-itself. His doctrine of relativity included phenomenalism, though it was more than phenomenalism; and not only his oft-repeated assertions that there can be no such object of knowledge, but the whole tenor of his philosophy, are directly against this interpretation. In passages where he speaks of "the thing" as directly known, the word is obviously used, not for noumenon or the thing in itself, but for the real as opposed to the ideal in phenomena. There can be no doubt that he held the object in senso-perception to be a phenomenon of the non-ego; and arguments that proceed upon a different supposition are of no effect against his theory.

The relativity of perception on that theory is, indeed, not open to doubt. According to him, we perceive phenomena alone—such alone as we have faculties to apprehend—such alone as stand in relation to our organs of sense; and we perceive only under the contrast of self and not-self. There is thus in every act of perception a twofold relation—(1) between the thing and the organ, manifested in sensation being a condition of perception, and (2) between self and not-self, manifested in consciousness and perception being different names for the same thing. This of itself should show that he cannot be expected to state definitely what is the object in perception—as it has often been said that he does not do, or does differently in different places. The object of intuition or perception does not admit of being definitely stated. For individual objects cannot as such be conceived, still less named, till knowledge has risen above the intuitive or perceptive stage. On this, as on all points relating to perception, Hamilton's mature and carefully expressed view is to be found in his dissertations appended to Reid's works. There he divides the qualities of body into three classes—primary, secondary, and secundo-primary. He shows that sensation and perception proper, though up to a certain point inseparable, are not only distinct, but above that point actually in the inverse ratio of one another; that sensations proper (identical with the secondary qualities) are merely subjective affections of the animated organism, and afford no knowledge of external reality; that in perception proper the material organism, which is to be regarded as an external reality, is presented under those relations which constitute its extension, *i. e.*, we know its primary qualities; and that in sensation and perception together we know the secundo-primary qualities, *i. e.*, objects external to the body become known, as directly related, through various modes of resistance, to the organism in motion. The object in

[1] *Reid's Works*, 910, 932, 938; *Lects.*, i. 338–371, ii. 209–218.
[2] *Reid's Works*, 911–913; *Lects.*, i. 225–263, ii. 227–295, iii. 117–140, 275.
[3] *Reid's Works*, pp. xviii. 743.
[4] *Reid's Works*, 742 *sq.*; *Lects.*, ii. 347–349; *Disc.*, 54, 85–86, 95.
[5] *Lects.*, ii. 537; *Disc.* 61, 599.

perception is, then, according to him, a primary quality of the organism, or the quasi-primary phase of a secundo-primary quality. It is a fundamental point of Hamilton's doctrine that the organism is differently related to the ego in perception propor and in sensation proper. In his own words—"the organism is the field of apprehension to both, but with this difference, that the former views it as of the ego, the latter as of the non-ego—that the one draws it within, the other shuts it out from, the sphere of self." On this distinction is partly founded his doctrine of the twofold character of space, as at once an *a priori* conception and an *a posteriori* perception. He held with Kant that space is a necessary condition of thought, and as such not derived from experience, but he at the same time held that through sense we have a perception of something extended, *i. e.*, of extension. Now the cognition of extension is a cognition of *relations*—properly therefore realized by a simple energy of *thought*; but the facts that *sensation* is an essential condition of this cognition, and that what is known as extended is the *organism*, which is as much external to the ego as any other part of the material world, seemed to him to justify these relations being regarded not as subjective but as objective.[1]

Hamilton's doctrine of the conditioned relates to the second group of primary truths or original data of consciousness. Relativity, as a general condition of the thinkable, he asserts, is brought to bear under three principal and necessary relations:—the first (subjective) *the contrast of self and not-self*, the second (objective) *quality*, and the third (objective) *quantity*. Quality is realized under the twofold aspect of substance and phenomenon. Quantity has three phases:—time (protensive), space (extensive), degree (intensive). Now the doctrine of the conditioned is (1) that under these relations—specially those of quality and time—we must think everything; (2) that the unconditioned as such is either the unconditionally limited—the absolute, or the unconditionally unlimited—the infinite; (3) that, under the necessary relations of thought, we are unable positively to conceive either unconditional limitation or unconditional illimitation; *e. g.*, an absolute whole or part of existence in time or in space or in degree is inconceivable, so is infinite increase or division; absolute quality is inconceivable, quality infinitely undetermined is so equally.[2] Thus this doctrine claims to demonstrate the limited range of positive thought by showing that the mind is tossed from the one to the other of two contradictory extremes, unable to conceive either, yet compelled to believe that one or other is actual. The kind of inconceivability of the two extremes is indeed different, and it may be regretted that, in his expositions of this part of his philosophy, Hamilton did not more explicitly recognize that fact. It seems true that to combine the absolute with existence regarded quantitatively, *i. e.*, in time or in space or in degree, or the infinite with existence regarded qualitatively, is impossible, not only as beyond but as against thought, *i. e.*, as involving a contradiction; and therefore that, in respect of one of the two extremes, the mind is not simply impotent, seeing it rejects it as that to which there can be nothing answering in actual existence. But then it does so only to find itself face to face with an alternative which, while it must be inferred to be actual, can by no effort be realized in thought. So that, even if this objection be allowed, the doctrine still remains intact as a demonstration how limited is the sphere of human thought as compared with that of existence, and how little human powers of conception are to be made the measure of truth.

Its significance becomes still more apparent in the original and ingenious application made of it by Hamilton to the solution of such philosophic problems as the origin of the principles of cause and effect, substance and phenomenon, etc. That the sum of existence of one set of modes has passed into another mode is, according to him, what we mean by saying that an event had causes. Consciousness is a knowledge of existence only as conditioned in time, and we are impotent—(it matters not *how*)—to conceive the forms of existence within our experience as having had an absolute commencement; therefore we conceive them as having existed in other forms, in other words, as caused. Thus it is in order to escape from the necessity of thinking an absolute beginning for existence in time that we view all things as a series of causes and effects. In like manner, it is because we can think neither that which exists in and for itself nor that which exists merely in and through something else that we recognize all objects under the double aspect of substance and phenomenon—knowing nothing but the latter, yet always supposing the former.[3]

Having showed that the original data of consciousness, however different in other respects, are alike in this, that they are as facts—but only as facts—clear and certain, and as cognitions relative, more properly indeed, beliefs than cognitions—Hamilton claims for all that, on the sole authority of consciousness, they be accepted as truths. This is the point to which the whole of his philosophy leads up; hence he offers no arguments in its support. He only asks—If the authority of consciousness be disallowed, what other warrant or truth remains? Where else will a source of certainty be found? He saw no alternative between absolute scepticism and implicit reliance on consciousness. But his reliance was no absolute and blind belief. He claimed implicit credence for consciousness only after having investigated and laid down the conditions of its credibility. The inexplicability that is to him a mark of truth must be proved to be that which springs from the fundamental character of the cognition. While the establishment of principles on which belief may be sure, rational, and consistent is the ultimate aim of his philosophy, groundless or inconsistent belief he sweeps away wherever he meets with it. Thus he will not allow the validity of belief in an external reality which, *ex hypothesi*, is not known.[4] Be it noted too, that it is consciousness, *i. e.*, reason, for which he claims supreme authority.[5] His position is best understood through the mutual relation (already referred to) of his doctrines of the conditioned and of common sense. The former extends the bounds of existence as much as it narrows those of thought, and so makes room for belief; while the latter shows belief to be the condition on which alone even primary and fundamental truths can be apprehended. Thus, for example, on the ground of both, he held that freedom of will and necessity are alike inconceivable, but that we are not entitled to reject the testimony of consciousness to the fact that as moral agents we are free, on account of the speculative difficulties with which it is surrounded.[6] These two doctrines Sir W. Hamilton did not himself apply to theology, and in themselves they have no direct theological bearing, since the one is concerned with the infinite and the absolute merely as notions, and the other with simple forms of thought long prior to those of theology. But his references to this subject indicate clearly what he considered to be the true relation of theology to philosophy, and show that, in the one as in the other, he held wisdom to lie in such a conviction of human ignorance as disposes the mind to accept harmony with the facts of consciousness as evidence of truth.[7]

Of the three classes into which, as we have seen, Hamilton divided mental phenomena, the third—the phenomena of conation—is not treated of in his *Lectures*, and his other works contain only fragmentary discussions of particular ethical points. Several lectures, however, are devoted to the consideration of the phenomena of feeling and a development of a theory of pleasure, founded chiefly on that of Aristotle, which is in substance that pleasure is the reflex in consciousness of the spontaneous and unimpeded exercise of power or energy,—pain being, on the other hand, the consciousness of overstrained or repressed exertion.[8]

The logic with which Sir W. Hamilton's name is associated is a purely formal science. Nothing else indeed did he consider properly to be called logic. For it seemed to him an unscientific mixing together of heterogeneous elements to treat as parts of the same science the formal and the material conditions of knowledge. He was quite ready to allow that on this view logic cannot be used as a means of discovering or guaranteeing facts, even the most general, and expressly asserted that it has to do, not with the objective validity, but only with the mutual relations, of judgments. He further held that induction and deduction are correlative processes of formal logic, each resting on the necessities of thought, and deriving thence its several laws. In establishing the distinction between logical and scientific induction, he showed that deduction no more than induction is self-sufficient, since it also must have a prior process to start from before it can be applied to nature. He also held that no other than formal logic can be distinguished from the body of the sciences. Perhaps he may have too much overlooked the fact that the search for causes (a problem common to all the sciences) and the presumable uniformity of nature (a principle capable of guaranteeing general inferences) yield the conditions of a logic entitled to the name of a science of science, and possessing all the importance of the knowledge whose organon it is. Yet it is well to be reminded by a difference of name that a science such as this, consisting of inferences from the actual order of things, is quite distinct from the body of truths developed from the conditions of thought as such.

The only logical laws recognized by Hamilton were the three axioms of identity, non-contradiction, and excluded middle, which he regarded as severally phases of one general condition of the possibility of existence and, therefore, of thought. The law of reason and consequent he considered not as different, but merely as expressing metaphysically what these express

[1] *Reid's Works*, 104*n*, 247*n*, 809, 816–888; *Lects.*, i. 136–155, ii. 129–132, 522; *Disc.*, 54, 639.
[2] *Reid's Works*, 743, 934; *Lects.*, ii. 366–374, 523–538; iii. 98–105; *Disc.*, 12–15, 28–30, 596–604.
[3] *Reid's Works*, 935–937; *Lects.*, ii. 376–413, 538–541; *Disc.*, 604–617.
[4] *Lects.*, ii. 138–141; *Disc.*, 91 *sq.*
[5] *Reid's Works*, 755–770; *Disc.*, 63.
[6] *Reid's Works*, 599*n*, 602*n*, 975–981; *Lects.*, ii. 541–543; *Disc.*, 98, 618–620.
[7] *Disc.*, 620 *sq.*; *Lects.*, ii. 530–535.
[8] *Lects.*, ii. 414–520.

logically. He added as a postulate—which in his theory was of importance—"that logic be allowed to state explicitly what is thought implicitly."

The changes by which he to a great extent remodelled formal logic were the result (1) of applying to propositions and syllogisms the two aspects of notions as wholes,—*extension*, answering to the objects denoted, and *intention*, answering to the attributes connoted,—and (2) of assigning quantity to the predicate as well as to the subject in judgments of extension. These judgments receive the form of an equation. Only simple conversion is allowed, but, all propositions being shown to be capable of simple conversion, the class of immediate inferences is greatly increased. Categorical syllogisms (inductive and deductive) may be either unfigured or figured, according as the distinction of subject and predicate and the distinctions included in that are or are not recognized. Unfigured syllogism has but one form; figured syllogisms are of three forms, according to the position of the middle term in the premises. Of these the first corresponds to the first and fourth figures of ordinary logic,—the moods of the latter being shown to be merely indirect intensive moods of the first. The laws of categorical syllogism are reduced to one. On the other hand, one of the results of the quantification of the predicate being to increase the number of propositional forms, a number of new moods are added, and each figure contains twelve. Hypothetical and disjunctive inferences, whether regarded as mediate or as immediate,—(as to this Hamilton varied in opinion, *cf.*, *Lects.*, iv. 369, 371, 373, 374),—form a separate class of syllogisms,—the conditional, properly subdivided into conjunctive and disjunctive; for, according to Hamilton, as all inference is hypothetical, this term ought not to be used as the name of one particular group. The quantities allowed by him in logic were but two—the definite, including the universal and singular, and the indefinite. The latter also he considered to be twofold,—partiality as such, from which the universal, both affirmative and negative, is excluded, and partiality which excludes only one universal extreme, while possibly admitting the other. All these improvements were embodied in a notation that clearly and compendiously presents to the eye the whole logical scheme.[1]

Even from this imperfect outline of Hamilton's system of psychology, metaphysics, and logic it appears how extensive and original were his labors in the various departments of philosophy, how powerful an impetus he gave to speculation, and how much he himself contributed to the elucidation of the ultimate problems of thought. By his thorough-going analysis of consciousness and of the relation of consciousness to mind he did much to promote the scientific study of psychology in his own country and in America,—in particular to give it at once a sound method and a well-defined sphere. He did not himself trace the growth of consciousness; but, by showing that it is both simple and complex, both involving and evolved, he implied that it had grown, and suggested the problem of the conditions of its development. On the other hand, to him there was a wide gulf between mental and material phenomena, and the acceptance of innate ideas was attended with no difficulty; thus his point of view is so far removed from that of most of the psychologists of the present day that probably his influence now is much less either than it was in his own lifetime or than it may be hereafter.

In metaphysics his place is plainly marked. Taking his stand at once on the exclusive authority and on the limited sphere of human consciousness, he comes into direct antagonism with all schools of philosophy that find in the *Unconditioned* a field for speculation. At the same time he is divided from scepticism by his assertion that, as the realm of existence transcends that of thought, so belief is wider than knowledge, and from empiricism by his admission of *a priori* and inexplicable cognitions. He ranked himself among the Scottish school of philosophers; yet there he stands by himself, since even those doctrines which he held in common with his predecessors he held after a fashion widely different as to both grounds and results. The doctrine of common sense, in particular, he set in a new light, rescued from misapprehension, and showed, on the testimony of every school of thought, to be one of the most widely recognized of philosophic tenets. In Reid he found a philosopher to whom by many ties of intellectual affinity he was bound, and who seemed to him to have so unskilfully used the right clue to a solution of the problems with which he dealt as to justify the doubt whether he really had it. Hence he made Reid's writings, as it were, his own, corrected his errors, and gave a solid basis to the theory which he had himself failed even to make plain.

The philosopher to whom above all others he professed allegiance was Aristotle. His works were the object of his profound and constant study, and supplied in fact the mould in which his whole philosophy was cast. With the commentators on the Aristotelian writings, ancient, mediæval, and modern, he was also familiar; and the scholastic philosophy he studied with care and appreciation at a time when it had hardly yet begun to attract attention in his country. His wide reading enabled him to trace many a doctrine to the writings of forgotten thinkers; and nothing gave him greater pleasure than to draw forth such from their obscurity, and to give due acknowledgment, even if it chanced to be of the prior possession of a view or argument that he had thought out for himself. Of modern German philosophy he was a diligent, if not always a sympathetic, student. How profoundly his thinking was modified by that of Kant is evident from the tenor of his speculations; nor was this less the case because, on fundamental points, he came to widely different conclusions. There is a closer likeness as to results between his system and that of Jacobi,—from which however, his is distinguished by its more scientific character, especially by intuition being more clearly identified with the voice of reason, and more rigidly required to prove its authority as such.

His labors in logic coincided in time with a general movement by which formal logic was effectually advanced and improved. But as to the originality of his contributions, especially in regard to the quantification of the predicate, there is no room for doubt. No evidence has ever been adduced that in the smallest degree weakens the force of the abundant evidence brought forward in its support.

Any account of Hamilton would be incomplete which regarded him only as a philosopher, for his knowledge and his interests embraced all subjects related to that of the human mind. Physical and mathematical science had, indeed, no attraction for him; but his study of anatomy and physiology was minute and experimental. In literature alike ancient and modern he was widely and deeply read; and, from his unusual powers of memory, the stores which he had acquired were always at command, every topic suggesting to him apt quotations or pertinent examples. If there was one period with the literature of which he was more particularly familiar, it was the 16th and 17th centuries. Here in every department he was at home. He had gathered a vast amount of its theological lore, had a critical knowledge especially of its Latin poetry, and was minutely acquainted with the history of the actors in its varied scenes, not only as narrated in professed records, but as revealed in the letters, table-talk, and casual effusions of themselves or their contemporaries. His article on the *Epistolæ Obscurorum Virorum*, and his pamphlet on the Disruption of the Church of Scotland in 1843, may be cited in confirmation and illustration of what has now been said. Among his literary projects were editions of the works of George Buchanan and Julius Cæsar Scaliger. His general scholarship found expression in his library, which, though mainly, was far from being exclusively, a philosophical collection. It now forms a distinct portion of the library of the university of Glasgow.

His chief practical interest was in education,—an interest which he manifested alike as a teacher and as a writer, and which had led him long before he was either to a study of the subject both theoretical and historical. He thence adopted views as to the ends and methods of education that, when afterwards carried out or advocated by him, met with general recognition; but he also expressed in one of his articles an unfavorable view of the study of mathematics as a mental gymnastic which excited much opposition, but which he never saw reason to alter. As himself a teacher, he was zealous and successful. He did not indeed deem it necessary to give to his lectures the elaboration and precision that he bestowed on his published writings. But he made them sufficient for the end which they had to accomplish, he supplemented them at times by other instruction, and he strove, not only by all academic means, but also by his personal influence, to develop the speculative energy and interest of his pupils. His writings on university organization and reform had, at the time of their appearance, a decisive practical effect, and contain much that is of permanent value.

[1] See *Lectures on Logic*, vols. iii. and iv., and Appendices, iv. 229-274; also *Discussions*, 117-173, 646-706.

Many of his moral as well as intellectual characteristics are expressed in his writings,—the intensity and force of his nature, his tendency to be carried away by polemical ardor, his freedom from anything like pettiness, his perfect sincerity and candor. Such a reflex is at best very imperfect, but here could hardly be bettered by description, which, therefore, is not attempted.

His posthumous works are his *Lectures on Metaphysics and Logic*, 4 vols., edited by the Rev. H. L. Mansel, Oxford, and Professor Veitch (*Metaphysics*, 1858; *Logic*, 1860); and *Additional Notes to Reid's Works, from Sir W. Hamilton's MSS.*, under the editorship of the Rev. H. L. Mansel, D. D., 1862. A *Memoir of Sir W. Hamilton*, by Professor Veitch, appeared in 1869. (E. H.)

HAMILTON, Sir William (1730–1803), antiquary and patron of the fine arts, was born in 1730 of a noble but needy Scottish family. Of his early life and education we know nothing beyond the fact that he was equerry to Prince George, afterwards George III., whose foster-brother he is said to have been; but in his twenty-fifth year he married a young and beautiful heiress, whose fortune placed him in affluence. In the first parliament of George III. Hamilton sat as member for Midhurst; and in 1764 he was accredited ambassador to Naples, an office which he retained till 1800. On proceeding to his post his attention and interest were at once awakened by the discoveries at Pompeii and Herculaneum, and he took up the study of antiquities with ardor. The Porcinari collection of Greek and Etruscan vases, purchased in 1765, was the nucleus of a valuable collection of his own, now for the most part in the British Museum. Engravings and descriptions of the most valuable pieces are given in the famous *Antiquités Etrusques, Grecques, et Romaines, tirées du Cabinet de M. Hamilton*, edited by D'Hancarville, and published at Naples in 1766–67. Hamilton also contributed liberally to the museum at Portici, and gave much attention to the MSS. and other valuable articles rescued from the buried cities; but his efforts were almost nullified by the inertness of the Neapolitan court, which was even suspicious of his zeal. Natural history and science also were not neglected by him. Between 1764 and 1767 Hamilton paid numerous visits to Vesuvius, Etna, and the Lipari Islands, accompanied by a young artist, Pietro Fabris, who made drawings of the noteworthy objects and appearances under Hamilton's directions. The result of these excursions, first sent as letters to the Royal Society, of which he became a member in 1766, was afterwards expanded into two works,—*Observations upon Mount Vesuvius, Mount Etna, and other Volcanoes of the Two Sicilies*, published at London in 1772, and *Campi Phlegræi*, a collection of plates illustrating the volcanic phenomena, accompanied by concise descriptions in English and French, published at Naples in 1776–77. A *Supplement* to the latter described the eruption of Mount Vesuvius in 1779. Hamilton's daughter died in 1775, and his first wife in 1782. In 1772 he was made K. C. B., and in 1791 privy councillor. His continued interest in art and antiquity is manifested by his contributions to the *Philosophical Transactions* of the Royal Society from 1767 to 1795, and to the *Archæologia* in 1777, as well as by his generosity to artists and antiquaries, such as Morghen, Winckelmann, and Piaggi. Recalled in 1800, he died April 6, 1803.

Sir William Hamilton's second wife, Emma Lyon or Harte, whose name is so notoriously associated with that of Nelson, was born of very humble parents at Preston in Lancashire, about April 26, 1764. Her youth was spent in domestic service, and it was first as attendant on a lady of fashion that she learned to develop her talent for singing and mimicry. Having lost this situation she became waitress in a tavern frequented by actors, and soon entered upon a gay and dissolute career. Her beauty attracted among others the painter Romney, who depicted her in no fewer than twenty-three of his works. Sir William Hamilton married her in 1791; and, going with him the same year to Naples, she speedily acquired an ascendency over the mind of the queen, which at the instigation of Nelson she used for the advantage of the British fleet. On the death of Sir William she lived in a house at Merton Place, provided for her by Nelson, but on his death in 1805 she soon squandered the modest fortune left her by her husband, and after being imprisoned for debt, retired with Nelson's daughter Horatia to Calais, where she died, January 16, 1815. Her *Memoirs* appeared in the year of her death.

HAMILTON, William (1704–1754), a minor Scottish poet, the author of *The Braes of Yarrow*, was born in 1704, probably at Bangour in Linlithgowshire, the second son of James Hamilton of Bangour, a member of the Scottish bar. It is supposed that he studied at the university of Edinburgh; and it is certain that he received an education which enabled him to enjoy the classical writers of Greece and Rome, and to be a congenial associate in after years with such men as Allan Ramsay and Henry Home. As early as 1724 we find him contributing to Ramsay's *Tea Table Miscellany*. In 1745 Hamilton joined the cause of Prince Charles, and, though it is doubtful whether he actually bore arms, he certainly celebrated the battle of Prestonpans in an ode beginning—"As over Gladsmuir's bloodstained field.' After the disaster of Culloden he lurked for several months in the Highlands, and at length escaped to France; but in 1749 the influence of his friends at home procured him permission to return to Scotland, and in the following year he obtained possession of the family estate of Bangour. In 1751 he married for the second time, but the state of his health was such that he soon afterwards went abroad, and he died at Lyons on 25th March, 1754.

Hamilton has left behind him a considerable number of what are best described as poetical effusions, many of them pleasing and tasteful, but none of them except the *Braes of Yarrow* of striking originality. The first collection of his pieces was published without his permission or even knowledge by Foulis (Glasgow, 1748), and introduced by a preface from the pen of Adam Smith. Another edition with corrections by himself was brought out by his friends in 1760, and to this was prefixed a portrait engraved by Sir Robert Strange. Though the poems have been since reprinted in Anderson's *British Poets* (vol. ix.), in Sharpe's *Collection of the British Poets*, and in Chalmers's *English Poets* (vol. xv.), there was no separate edition between 1760 and 1850, when James Paterson edited *The Poems and Songs of William Hamilton*. This volume contains several poems till then unpublished, and presents a bibliographical introduction and life of the author.

See also James Chalmers's "Notices of Life of William Hamilton" in *Transactions of Society of Scottish Antiquaries*, vol. iii., 1831; and Charles Mackay, *The Poetical Works of Allan Ramsay, with Selections from the Scottish Poets before Burns*.

HAMILTON, Sir William Rowan (1805–1865), one of the really great mathematicians of the present century, was born in Dublin, August 4, 1805. His father, who was a solicitor, and his uncle (curate of Trim), migrated from Scotland in youth. A branch of the Scottish family to which they belonged had settled in the north of Ireland in the time of James I., and this fact seems to have given rise to the common impression that Hamilton was an Irishman.

His genius displayed itself, even in his infancy, at first in the form of a wonderful power of acquiring languages. At the age of seven he had already made very considerable progress in Hebrew, and before he was thirteen he had acquired, under the care of his uncle, who was an extraordinary linguist, almost as many languages as he had years of age. Among these, besides the classical and the modern European languages, were included Persian, Arabic, Hindustani, Sanskrit, and even Malay. But though to the very end of his life he retained much of the singular learning of his childhood and youth, often reading Persian and Arabic in the intervals of sterner pursuits, he had long abandoned them as a study, and employed them merely as a relaxation.

His mathematical studies seem to have been undertaken and carried to their full development without any assistance whatever, and the result is that his writings belong to no particular "school," unless indeed we consider them to form, as they are well entitled to do, a school by themselves. As an arithmetical calculator he was not only wonderfully expert, but he seems to have occasionally found a positive delight in working out to an enormous number of places of decimals the result of some irksome calculation. At the age of twelve he engaged Colburn,[1] the American "calculating boy," who was then being exhibited as a curiosity in Dublin, and he had not always the worst of the encounter. But, two years before, he had accidentally fallen in with a Latin copy of *Euclid*, which he eagerly devoured; and at twelve he attacked Newton's *Arithmetica Universalis*. This was his introduction to modern analysis. He soon commenced to read the *Principia*, and at sixteen he had mastered a great part of that work, besides some more modern works on analytical geometry and the differential calculus.

About this period he was also engaged in preparation for entrance at Trinity College, Dublin, and had therefore to

[1] Zerah C. (1804–40), a Vermont prodigy; exhibited by his father for money; lost his computing gift at 20; became a Methodist preacher.—Am. Ed.

devote a portion of his time to classics. In the summer of 1822, in his seventeenth year, he began a systematic study of Laplace's *Mécanique Céleste*. Nothing could be better fitted to call forth such mathematical powers as those of Hamilton; for Laplace's great work, rich to profusion in analytical processes alike novel and powerful, demands from the most gifted student careful and often laborious study. It was in the successful effort to open this treasure-house that Hamilton's mind received its final temper. "Dès-lors il commença à marcher seul," to use the words of the biographer of another great mathematician. From that time he appears to have devoted himself almost wholly to original investigation (so far at least as regards mathematics), though he ever kept himself well acquainted with the progress of science both in Britain and abroad.

Having detected an important defect in one of Laplace's demonstrations, he was induced by a friend to write out his remarks, that they might be shown to Dr. Brinkley, afterwards bishop of Cloyne, but who was then royal astronomer for Ireland, and an accomplished mathematician. Brinkley seems at once to have perceived the vast talents of young Hamilton, and to have encouraged him in the kindest manner. He is said to have remarked in 1823 of this lad of eighteen,—"This young man, I do not say *will be*, but *is*, the first mathematician of his age."

Hamilton's career at college was perhaps unexampled. Amongst a number of competitors of more than ordinary merit, he was first in every subject, and at every examination. His is said to be the only recent case in which a student obtained the honor of an *optime* in more than one subject. This distinction had then become very rare, not being given unless the candidate displayed a thorough mastery over his subject. Hamilton received it for Greek and for physics. How many more such honors he might have attained it is impossible to say; but he was expected to win both the gold medals at the degree examination, had his career as a student not been cut short by an unprecedented event. This was his appointment to the Andrews professorship of astronomy in the university of Dublin, vacated by Dr. Brinkley in 1827. The chair was not exactly offered to him, as has been sometimes asserted, but the electors, having met and talked over the subject, authorized one of their number, who was Hamilton's personal friend, to urge him to become a candidate, a step which his modesty had prevented him from taking. Thus, when barely twenty-two, he was established at the Dublin Observatory. He was not specially fitted for the post, for although he had a profound acquaintance with theoretical astronomy, he had paid but little attention to the regular work of the practical astronomer. And it must be said that his time was better employed in grand original investigations than it would have been had he spent it in meridian observations made even with the best of instruments,—infinitely better than if he had spent it on those of the observatory, which, however good originally, were then totally unfit for the delicate requirements of modern astronomy. Indeed there can be little doubt that Hamilton was intended by the university authorities who elected him to the professorship of astronomy to spend his time as he best could for the advancement of science, without being tied down to any particular branch. Had he devoted himself to practical astronomy they would assuredly have furnished him with modern instruments and an adequate staff of assistants.

In 1835, being secretary to the meeting of the British Association which was held that year in Dublin, he was knighted by the lord-lieutenant. But far higher honors rapidly succeeded, among which we may merely mention his election in 1837 to the president's chair in the Royal Irish Academy, and the rare and coveted distinction of being made corresponding member of the academy of St. Petersburg. These are the few salient points (other, of course, than the epochs of his more important discoveries and inventions presently to be considered) in the uneventful life of this great man. He retained his wonderful faculties unimpaired to the very last, and steadily continued till within a day or two of his death (September 2, 1865) the task (his *Elements of Quaternions*) which had occupied the last six years of his life.

The germ of his first great discovery was contained in one of those early papers which in 1823 he communicated to Dr. Brinkley, by whom, under the title of *Caustics*, it was presented in 1824 to the Royal Irish Academy. It was referred as usual to a committee. Their report, while acknowledging the novelty and value of its contents, and the great mathematical skill of its author, recommended that, before being published, it should be still further developed and simplified. During the next three years the paper grew to an immense bulk, principally by the additional details which had been inserted at the desire of the committee. But it also assumed a much more intelligible form, and the grand features of the new method were now easily to be seen. Hamilton himself seems not till this period to have fully understood either the nature or the importance of his discovery, for it is only now that we find him announcing his intention of applying his method to dynamics. The paper was finally entitled "Theory of Systems of Rays," and the first part was printed in 1828 in the *Transactions of the Royal Irish Academy*. The second and third parts have not yet been printed; but it is understood that their more important contents have appeared in the three voluminous supplements (to the first part) which have been published in the same *Transactions*, and in the two papers "On a General Method in Dynamics," which appeared in the *Philosophical Transactions* in 1834–35. The principle of "Varying Action" is the great feature of these papers; and it is strange, indeed, that the one particular result of this theory which, perhaps more than anything else that Hamilton has done, has rendered his name known beyond the little world of true philosophers, should have been easily within the reach of Fresnel and others for many years before, and in no way required Hamilton's new conceptions or methods, although it was by them that he was led to its discovery. This singular result is still known by the name "Conical Refraction," which he proposed for it when he first predicted its existence in the third supplement to his *Systems of Rays*, read in 1832.

The step from optics to dynamics in the application of the method of "Varying Action" was made in 1827, and communicated to the Royal Society, in whose *Philosophical Transactions* for 1834 and 1835 there are two papers on the subject. These display, like the "Systems of Rays," a mastery over symbols and a flow of mathematical language almost unequalled. But they contain what is far more valuable still, the greatest addition which dynamical science had received since the grand strides made by Newton and Lagrange. Jacobi and other mathematicians have developed to a great extent, and as a question of pure mathematics only, Hamilton's processes, and have thus made extensive additions to our knowledge of differential equations. But there can be little doubt that we have as yet obtained only a mere glimpse of the vast physical results of which they contain the germ. And though this is of course by far the more valuable aspect in which any such contribution to science can be looked at, the other must not be despised. It is characteristic of most of Hamilton's, as of nearly all great discoveries, that even their indirect consequences are of high value.

The other great contribution made by Hamilton to mathematical science, the invention of QUATERNIONS, is fully treated under that heading. It is not necessary to say here more than this, that quaternions form as great an advance relatively to the Cartesian methods as the latter, when first propounded, formed relatively to Euclidian geometry. The following characteristic extract from a letter shows Hamilton's own opinion of his mathematical work, and also gives a hint of the devices which he employed to render written language as expressive as actual speech. His first great work, *Lectures on Quaternions* (Dublin, 1852), is almost painful to read in consequence of the frequent use of italics and capitals.

"I hope that it may not be considered as unpardonable vanity or presumption on my part, if, as my own taste has always led me to feel a greater interest in *methods* than in *results*, so it is by METHODS, rather than by *any* THEOREMS, which *can* be separately *quoted*, that I desire and hope to be remembered. Nevertheless it is only human nature, to derive *some* pleasure from being cited, now and then, even about a 'Theorem;' especially where . . . the quoter can enrich the subject, by combining it with researches of *his own*."

The discoveries, papers, and treatises we have mentioned might well have formed the whole work of a long and laborious life. But, not to speak of his enormous collection of MS. books, full to overflowing with new and original matter, which have been handed over to Trinity College, Dublin, and of whose contents it is to be hoped a large portion may yet be published, the works we have already called attention to barely form the greater portion of what he has published. His extraordinary investigations connected with the solution of algebraic equations of the fifth degree, and his examination of the results arrived at by Abel, Jerrard, and Badano, in their researches on this subject, form another grand contribution to science. There is next his great paper on *Fluctuating Functions*, a subject which, since the time of Fourier, has been of immense and ever increasing value in physical applications of mathematics. There is also the extremely ingenious invention of the HODOGRAPH (*q. v.*). Of his extensive investigations into the solution (especially by numerical approximation) of certain classes of

differential equations which constantly occur in the treatment of physical questions, only a few items have been published, at intervals, in the *Philosophical Magazine*. Besides all this, Hamilton was a voluminous correspondent. Often a single letter of his occupied from fifty to a hundred or more closely-written pages, all devoted to the minute consideration of every feature of some particular problem: for it was one of the peculiar characteristics of his mind never to be satisfied with a general understanding of a question; he pursued it until he knew it in all its details. He was ever courteous and kind in answering applications for assistance in the study of his works, even when his compliance must have cost him much valuable time. He was excessively precise and hard to please with reference to the final polish of his own works for publication; and it was probably for this reason that he published so little compared with the extent of his investigations.

Like most men of great originality, Hamilton generally matured his ideas before putting pen to paper. "He used to carry on," says his elder son, "long trains of algebraical and arithmetical calculations in his mind, during which he was unconscious of the earthly necessity of eating; we used to bring in a 'snack' and leave it in his study, but a brief nod of recognition of the intrusion of the chop or cutlet was often the only result, and his thoughts went on soaring upwards."

For further details about Hamilton (his poetry and his association with poets, for instance), the reader is referred to the *Dublin University Magazine* (Jan., 1842), the *Gentleman's Magazine* (Jan., 1866), and the *Monthly Notices of the Royal Astronomical Society* (Feb., 1866); and also to an article by the present writer in the *North British Review* (Sept., 1866), from which much of the above sketch has been taken. (P. G. T.)

HAMÍRPUR, or HUMEERPOOR, a British district in the lieutenant-governorship of the North-Western Provinces, India, lying between 25° 5′ and 26° 10′ N. lat., and between 79° 22′ 45″ and 80° 25′ 15″ E. long. It forms the south-western district of the Allahábád division, and is bounded on the N. by the Jumna (Jamuná); on the N. W. by the native state of Baoni and Betwa river; on the W. by the Dhasán river; on the S. by Alípura, Chhatarpur, and Charkhári states; and on the E. by the Bánda district. It encloses the native states of Saríla, Jigní, and Bíhat, besides portions of Charkhári and Garrauli.

Hamírpur forms part of the great plain of Bundelkhand, which stretches between the banks of the Jumna and the central Vindhyán plateau. The district is in shape an irregular parallelogram, with a general slope northward from the low hills on the southern boundary. The scenery is rendered picturesque by the artificial lakes of Mahoba. These magnificent reservoirs were constructed by the Chandel rájás about 800 years ago, for purposes of irrigation and as sheets of ornamental water. Many of them enclose craggy islets or peninsulas, crowned by the ruins of granite temples, exquisitely carved and decorated. From the base of this hill and lake country the general plain of the district spreads northward in an arid and treeless level towards the broken banks of the rivers. Of these the principal are the Betwa and its tributary the Dhasán, both of which are unnavigable. There is little waste land, except in the ravines by the river sides. The deep black soil of Bundelkhand, known as *már*, retains the moisture under a dried and rifted surface, and renders the district fertile.

The census of 1872 gives a population of 529,137—276,196 males and 252,941 females. The Hindus numbered 493,877, and the Mahometans 33,658. The Chandels and Bundelas, the old dominant classes, have now sunk to 548 and 612 respectively; most of these still cling to the neighborhood of Mahoba, the seat of their former supremacy. The district contains 6 towns with a population of more than 5000 souls—namely, Ráth, Hamírpur, Mahoba, Maudha, Sumerpur, and Jáitpur. The staple produce of the district is grain of various sorts, the most important being gram. Cotton is also a valuable crop, whose cultivation is on the increase. Out of a total area of 1,464,641 acres, 762,212 are under cultivation. Irrigation is practised on only 16,000 acres, chiefly in the south, where water can be obtained from the artificial lakes. Agriculturists suffer much from the spread of the *kâns* grass, a noxious weed which overruns the fields and is found to be almost ineradicable, wherever it has once obtained a footing. The district is little subject to blight or flood; but droughts and famine are unhappily common. The scarcity of 1837 and 1868–69 was severely felt in Hamírpur. Commerce is chiefly carried on by means of its great river highway, the Jumna. Cotton and grain, the main exports, are carried downwards; while rice, sugar, tobacco, and Manchester goods constitute the principal imports upwards. The manufactures consist of coarse cotton cloth and soapstone ornaments. There is only one metalled road, that between Hamírpur and Naugáon, 70 miles in length. The gross revenue in 1870–71 was £184,646; expenditure, £116,416. In 1871 the police force numbered 534 men, supplemented by 1953 village watchmen (*chaukidárs*), maintained at a cost of £8058. The district contains only one jail: the average number of prisoners in 1850 was 400; 1860, 72; and 1870, 129. In 1870 the number of schools was 112, with 3066 pupils, the cost, £1354. The district is divided into 8 fiscal divisions (*parganás*). The climate is dry and hot, owing to the absence of shade and the bareness of soil, except in the neighborhood of the Mahoba lakes, which cool and moisten the atmosphere. The rainfall in 1869–70 was 37·1, and in 1870–71 38·1 inches.

History.—From the 9th to the 14th century this district was the centre of the Chandel kingdom, with its capital at Mahoba. The rájás adorned the town with many splendid edifices, remains of which still exist, besides constructing the noble artificial lakes already described. At the end of the 12th century Mahoba fell into the hands of the Mussulmans, who retained possession of it for 500 years. In 1680 the district was conquered by Chhatar Sál, the hero of the Bundelas, who assigned at his death one-third to his ally the peshwa of the Marhattás. Until Bundelkhand was constituted a British district in 1803, there was constant warfare between the Bundela princes and the Marhattá chieftains. The land had been impoverished by the long war carried on under Chhatar Sál, overrun and ravaged during the Marhattá aggression, and devastated by robber chiefs, so that in 1842 it was reported to be utterly valueless. On the outbreak of the mutiny, Hamírpur was the scene of a fierce rebellion. All the principal towns were plundered by the surrounding native chiefs. Since then the condition of the district seems to have improved; but it has not yet recovered from the long anarchy of Marhattá rule.

HAMÍRPUR, the administrative headquarters of the above district, in 25° 58′ N. lat. and 80° 11′ 50″ E. long., is situated on a tongue of land at the confluence of the Betwa and the Jumna, on the right bank of the latter river. It was founded, according to tradition, by Hamír Deo, a Karchuli Rájput expelled from Ulwar (Alwar) by the Mahometans. The town possesses little importance; there are no manufactures, and quite a limited trade in grain. Population in 1872, 7007.

HAMLET, the hero of Shakespeare's drama, is according to some interpreters an historical or quasi-historical personage, but according to others his story is a mere development or "precipitation" of the great Scandinavian system of mythology. The decision of this point is rendered all the more difficult as the only original authority for the facts (historical or mythological) is the Danish historian Saxo Grammaticus (d. 1204). Though Dr. Vigfusson (prolegomena to the *Sturlunga Saga*, Oxford, 1878), concludes that the Hamlet legend was contained in the Skjöldunga Saga now lost, it is of course matter of question whether Saxo based this portion of his narrative on previous writings or collected his material from oral tradition.

According to Saxo, whose account is excerpted in Simrock's *Quellen des Shakspeare* (Bonn, 1870), and summarized in Latham's *Dissertations on Hamlet* (Lond., 1872, reprinted from *Transactions of the Roy. Soc. of Literature*, vol. x., new series), Hamlet's history is briefly as follows. In the days of Rörik, king of Denmark, Gervendill was governor of Jutland, and in this office he was succeeded by his sons Horvendill and Fengo. The former, returning with glory from a viking expedition in which he had defeated Koller, king of Norway, obtained the hand of Gerutha, Rörik's daughter, who in due course bore him a son Amleth. But Fengo, out of jealousy, murdered Horvendill with his own hand, and then persuaded Gerutha to become his wife, on the plea that he had committed the crime for no other reason than to avenge her of a husband by whom she had been hated. Amleth, afraid of sharing his father's fate, pretends to be imbecile, but the suspicion of Fengo puts him to various tests, which are related with all the inconsequent simplicity of the ordinary *Märchen*. Despatched to England in company with two attendants, who bear a letter instructing the king of that country to put him to death, he surmises the purport of their instructions, and secretly modifies the inscription on their "tablets" so that the king is requested to put them to death and to treat him with honor. By his wisdom he makes a deep impression on the king, and obtains the hand of the royal princess; but instead of settling in England he returns at the end of a year to Denmark, where he is supposed to be dead, just as the people are celebrating his obsequies. During the feast that follows he makes the courtiers all drink freely, and then, when they are heavy with wine and sleep, he pulls down over them the hangings of the hall, fixes these with pegs which he had sharpened and prepared in the early stage of his folly, and then setting

fire to the building leaves the revellers to their fate. He next proceeds to the royal chamber to take vengeance on Fengo himself, who falls beneath the stroke of his own sword, for which Amleth had substituted his own scabbard-fastened weapon. Returning to England for his wife, the hero finds that his father-in-law and Fengo had been under pledge to each other that the survivor should avenge the other's death if it resulted from violence; and his father-in-law, unwilling to make a direct attack on his life, sends him to Scotland as proxy-suitor for the hand of a terrible queen Hermuthruda, who has put all previous wooers to death. But Hermuthruda happens to fall in love with Amleth, and he returns to England to upbraid his father-in-law with his treachery. As king of Jutland he has to endure the grievous hostility of Vikletus, Rörik's successor, but at last determines, though well aware that he is doomed to death in the attempt, to engage with him in a decisive battle. He perishes, and his widow marries Vikletus.

According to Latham, who may be taken as the representative of the historical theory, there are really two Hamlets,—the Hamlet of Saxo's third book and the Hamlet of his fourth book, who have been confounded together. The former, who is the Shakespearean hero, he would identify with Olaf Kyrre, the Anlaf Cwiran of the Saxon Chronicle and the Amlaf Cuaran of the Irish Annals, whose name, having passed through England and Ireland, he supposes to have returned to Denmark in a form which is Latinized by Saxo as Amlethus; the latter he considers as the Hygelac of Beowulf, the Chochilaicus of Gregory of Tours, the Huhleike of the Heimskringla, and even the Havelok of English legend. "By a confusion between them as man and man, the bearers," he says, "of names as different as Olaf and Higelac take a form out of which Amlethus is a probable educt." But this theory, which is expounded with more learning than lucidity, is hardly so much in favor as that of the mythological school.

That, in spite of the links by which Saxo has sought to connect its different portions with the authentic history of Denmark, the whole story was destitute of historical basis was maintained by P. E. Müller (*Critisk Undersögelse af Danmarks og Norges Sagahistorie eller om Troværdigheden af Saxos og Snorros Kilder*, Copenhagen, 1823), and his conclusions in regard to the matter have been very generally accepted. Though Hamlet or Amleth himself is not mentioned in the earlier documents of the Scandinavian mythology—the only allusion to his existence being the phrase *Amlotha qvern*, or Hamleth's mill, applied to the sea in the Skaldskaparmal—his father, Horvendill or Orvandil (from *ör*, the spear, and *vandel*, skilful), appears in the great Scandinavian mythus in connection with Thor's contest with Hrungnir, and is further to be identified with the Orendel of German legend, whose memorial coat was afterwards christened the seamless coat of our Saviour at Treves, and whose name, which occurs also as Ernthelle, may possibly be the source of the more famous name of Tell. Hamlet's own name finds its explanation in the Norse *amr* or *aml*, toil (still used colloquially in Icelandic, *amla*, to toil), and *lothi*, devoted to, and probably has reference to his mythic impersonation of the endless toil and travail of the sea. The various details of the story—not only improbable and impossible, but essentially stupid and trivial—lend themselves with remarkable readiness to the theory which explains them as versions of the tale, a thousand times retold, of the contests between summer and winter, sea and land, light and darkness. An elaborate exposition of the whole will be found in Zinzow's *Die Hamletsage an und mit verwandten Sagen erläutert*, Halle, 1877. It has been already stated that Saxo's is the only original authority; but proof of the popularity of the legend is found in the presence in Jutland of such names as Amelhede (*i. e.*, Hamlet's Heath), near Randers, Fegges Sund, that is, Fengo's Sound, and Feggesklint, that is, Fengo's Cliff, and in the fact that in modern Icelandic the word *amlothi* is a regular equivalent for an idiotic or stupid man. Nor are literary rifacimentos of the story wanting. The Icelanders have their Amlotha Saga, which is a free translation of Saxo, and their Ambales Saga, in which the matter is treated in a more romantic style. The story of Brian, given in Jon Arnason's *Islenzkur þjodsögur* (Leipsic, 1864, ii.), has the same main features; and Dr. Vigfusson, by whom it was discovered, is disposed to surmise that the legend may actually be of Celtic origin,—a supposition quite in keeping with other well-known facts in Icelandic history. It was taken down from the lips of Lady Hildur Arngrimsdotter, whose father was born in 1568. As Niels of Sorö in the 15th century made Hamlet more familiar to the Danes by his *Danske Rimkronike*, so the French story-teller Belleforest introduced him to a wider company in his *Cent Histoires tragiques*. That as early as 1587 or 1589 he had been represented on the English stage is shown by the well-known passage from Nash's preface to Green's *Menaphon*, "He will afford you whole *Hamlets*, I should say, handfulls of tragical speeches."

HAMM, a town of Prussia, capital of a circle in the government district of Arnsberg, province of Westphalia, is situated at the junction of several railways, on the Lippe at its confluence with the Ahse, 22 miles N. W. of Arnsberg. It is enclosed by walls, but the ditches which formerly surrounded it have been filled up and converted into promenades. The principal buildings are two Catholic and two Evangelical churches, a gymnasium, a poorhouse, an orphanage, and an infirmary. The town is flourishing and rapidly increasing, and possesses very extensive wire factories (in connection with which there are puddling and rolling works), foundries, machine works, and manufactories of gloves, baskets, wadding, leather, sausages, sago, starch, chemicals, sugar-of-lead, gum, lac, varnish, oil, and beer. The population in 1905 was 38,429.

Hamm, which became a town about the end of the 11th century, was originally the capital of the countship of Mark, and was fortified in 1226. It became a member of the Hanseatic League. In 1614 it was besieged by the Dutch, and in 1622 it was taken by Tilly, after which during the Thirty Years' War it was alternately in the hands of the imperial and the Hessian forces. In 1666 it came into the possession of Brandenburg. In 1761 and 1762 it was bombarded by the French, and in 1763 its fortifications were dismantled.

HAMMARSKÖLD, Lorenzo (1785–1827), Swedish author, was born at Tuna, near Wimmerby, on the 7th of April, 1785. He became a student at Upsala in 1801, but failed to take his degree in 1806. He therefore accepted a humble post at the royal library at Stockholm, with which institution he remained connected for many years. In 1804 he published an article on Tieck and Novalis, which attracted much attention, and was the means of founding the "Phosphoric School," as it was called, of poetry in Sweden. Hammarsköld became the friend of Atterbom and antagonist of Wallmark, and in due time, by the bitterness of his tone, brought down on himself the scathing anger of Tegnér. In 1806 he published *Translations and Imitations of Poets, Old and New*, in the preface of which he denounced the classic Swedish writers with much force and wit, commending Goethe and Tieck to the young poets of the day. In 1808 appeared his trenchant *Critique of Schiller*, and in 1810 a volume of essays of a polemical kind. In 1813 Hammarsköld published a collection of his poems, and in 1815 had to endure the ridicule of Tegnér in his brilliant satire of *Hammarspik*. In 1818 appeared the first part of Hammarsköld's chief contribution to literature, his famous *Svenska Vitterheten*, a history of polite letters in Sweden, a book that was revised and republished after his death by Sondén, in 1833. He is chiefly remembered as a critic; his lyrics and his juvenile tragedy of *Prince Gustaf*, 1812, are of little value.

HAMME, a town of Belgium, in the province of East Flanders and the arrondissement of Termonde or Dendermonde, is situated on the right bank of the Durme, near its junction with the Scheldt, and 18 miles E. N. E. of Ghent. It contains grain and oil-mills, has manufactures of lace, ribbons, linen, starch, ropes, and cordage, and carries on trade in flax. Population (1900), 13,755.

HAMMER. This well-known tool stands quite without rival for producing the numberless effects which are due to the remarkable force of "impact." Of all the array of hand tools in use in the industrial arts it is undoubtedly the one that could least be dispensed with, and so it must have been from the very earliest days of handicraft. A hammer of some rude kind must have been as essential to the shaping of an arrow-head out of a flint, as is its modern representative to the forging of a bayonet out of a bar of steel.

Hammers to be used by hand are made of an endless variety of shapes, and of weights varying from a small fraction of an ounce to 28 or 30 lb. Of the various types now in use the differences are mainly due to the special requirements for the particular trades for which they are in-

tended, but partly also to individual fancy. A few examples are given in fig. 1—*a* being the ordinary carpenter's hammer with a cross pane, *b* a claw hammer, *c* an engineer's, and *d* a shoemaker's hammer, which last has apparently retained its form for many generations. The same may also be said of the two others in the woodcut, which are good examples of the roughness of the instruments with which results of almost incredible delicacy can be produced. Of

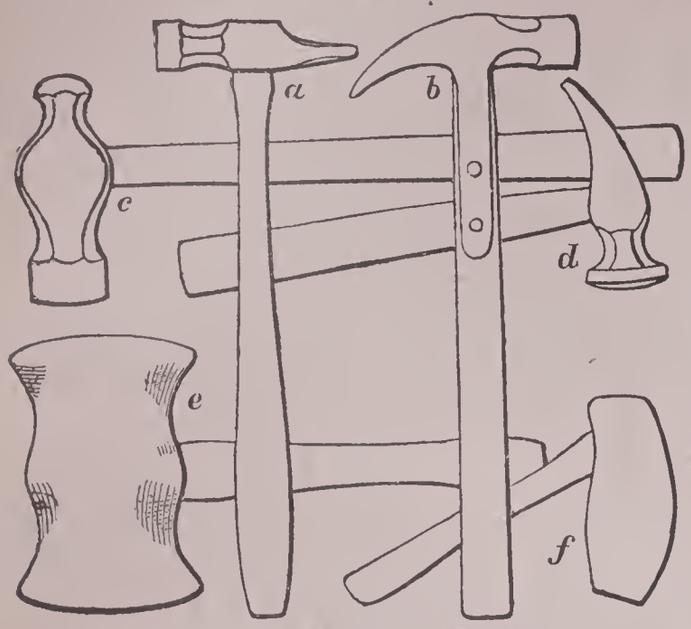


Fig. 1.—Varieties of Hand Hammer.

these *e* is a favorite hammer used in the workshops of a London firm of goldbeaters, with which, together with others not less rude in appearance, gold is hammered out into leaves of such exceeding thinness that 250,000 are required to make up the thickness of an inch. Extraordinarily ill-shaped as *f*, the file-cutter's hammer, looks, yet with this and a simple chisel the teeth of files are cut by hand with a precision with which no machinery has as yet been able to compete, at least in England.

Hand-hammers and sledge hammers being rigidly limited as to weight by the trifling power which one man—or at most two men—can bring to bear upon them, it long ago became obviously desirable to obtain the force of impact from some more powerful source than human muscles, so that the weight of hammer heads might be largely increased and their blows made proportionately more effective. The first step taken in this direction seems to have been the introduction of the "Hercules," a ponderous mass of iron attached to a vertical guide rod, which was lifted originally by a gang of men with ropes, but afterwards by steam power, and allowed to fall by its own weight. This was a fairly efficient tool for forging large anchors and for similar purposes, the strength of the blow and the point at which it was delivered being easily regulated. But as the demand for wrought iron increased, the necessity for more rapid as well as more powerful hammers to aid in its manufacture in-

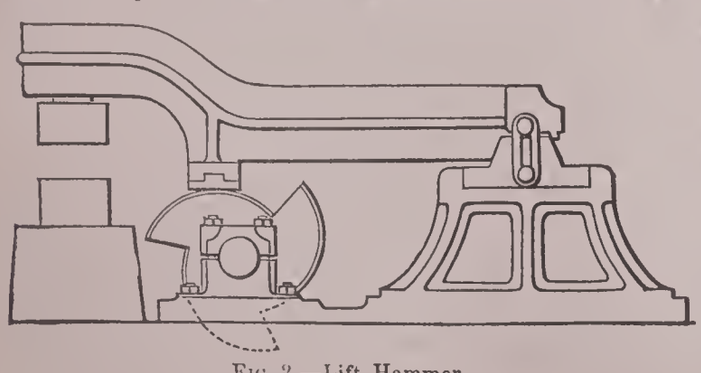


Fig. 2.—Lift Hammer.

creased also. The lift or helve hammer (fig. 2) and the tilt hammer (fig. 3) thus came into use, and under these forms hammers may be said to have ranked for the first time as true machine tools. Each of these consists of a heavy head attached to a beam mounted on gudgeons, which is lifted at regular intervals by suitable cams or pins carried by a revolving shaft driven by steam or other power, their chief points of difference being the relative position of the gudgeons and the portion of the beam at which the power is applied, as shown in the diagrams. Heavy blows are thus obtained with the one, and lighter but much more rapid blows with the other, both, however, invariable in their intensity, the lift being always to one fixed height.

In the steam hammer (fig. 4), which was first patented by Nasmyth in the year 1842, this objection is completely obviated. By the simple device of attaching the hammer head to the lower end of the rod of a piston working in an inverted steam cylinder, he produced a machine capable of being made to deliver its blows with a force to which no limit has yet been found, and yet so perfectly under control as to be able to crack a hazel nut without injuring the kernel. To the introduction of this invaluable tool is due more than to any other single cause the power which we now possess of producing the forgings in iron and steel which are demanded by the arts of modern times; and in one or other of its many forms it is now to be met with in every workshop in which heavy work is carried on. Many modifications of the Nasmyth steam hammer have been introduced. In one of these steam pressure has been applied above the piston to intensify the blow, it being only used in the original form for lifting the "tup" and piston and for regulating their descent. In another the piston and piston-rod have been attached to the framing, and the cylinder made movable, its weight being thus added to that of the hammer.

Duplex hammers differ materially from the ordinary steam hammer, inasmuch as no anvil is necessary,—two hammer heads of equal weight (and for some purposes they weigh only a few pounds, for others as much as 30 tons) being made to deliver horizontal blows of equal force simultaneously on opposite sides of the forging, which thus receive perfectly equal treatment. The importance of this may be gathered from the fact that every increase in the

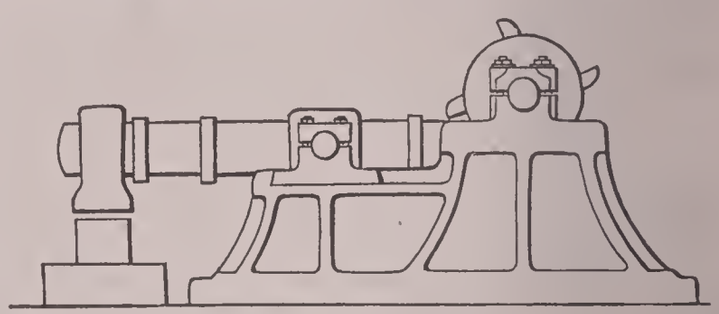


Fig. 3.—Tilt Hammer.

weight of the vertical steam hammer necessitates a very much larger increase in the weight and solidity of the anvil which is necessary to afford the requisite inertia for resisting the blow. For instance, the anvil of a 40-ton hammer now in use at Woolwich Arsenal weighs upwards of 160 tons, and has nearly 500 tons of iron in its foundation, whereas the anvil of an 80-ton hammer of which a full-sized model was amongst the most striking objects at the Paris Exhibition of 1878, is of no less than 20 tons weight.[1]

The recent growth of steam hammers to the enormous size just mentioned is due chiefly to the large dimensions, independently of the mere weight, of the forgings which have now to be made for heavy ordnance and for other purposes. As long as the thickness of a forging is moderate, the reaction of the anvil acting upon its under side has an effect not greatly inferior to that of the hammer on the upper side. But with every increase in thickness some of this reaction is lost and the effect of the blow is more and more confined to the outer portions of the mass, which thus receive more than their share of treatment at the expense of the central portions. On this account the difficulty of obtaining thick forgings thoroughly sound throughout their substance is very great, and it seems as if we had now reached the limit beyond which the hammer cannot be advantageously applied for their production. It has been found indeed in the case of large shafts that dispensing altogether with the central portion, thus making them tubular instead of solid, is accompanied by an increase in their strength, owing to the possibility of thus forging the

[1] [The weight of the anvil should be from five to ten times that of the hammer.—Am. Ed.]

metal uniformly throughout. But a much more widely applicable remedy, and one which will doubtless come into general use for heavy work, is the substitution of hydraulic or other pressure for the force of impact, a system which has lately been employed by Sir Joseph Whitworth with wonderfully good results. The reason of the superiority of its effect seems to be mainly this, that a certain amount of time is essential for completing the "flow" of the metal which it is the object of forging to induce. Under continuous pressure this flow can take place uniformly throughout the mass, whereas the instantaneous blow of the hammer, though it acts violently on the surface particles, and to a decreasing extent on the adjacent ones, is entirely expended before the action has had time to reach those at the centre, so that unequal density and consequent weakness is the result. For massive forgings therefore the old saying can be no longer accepted that "there is no machine like a hammer." (C. P. B. S.)

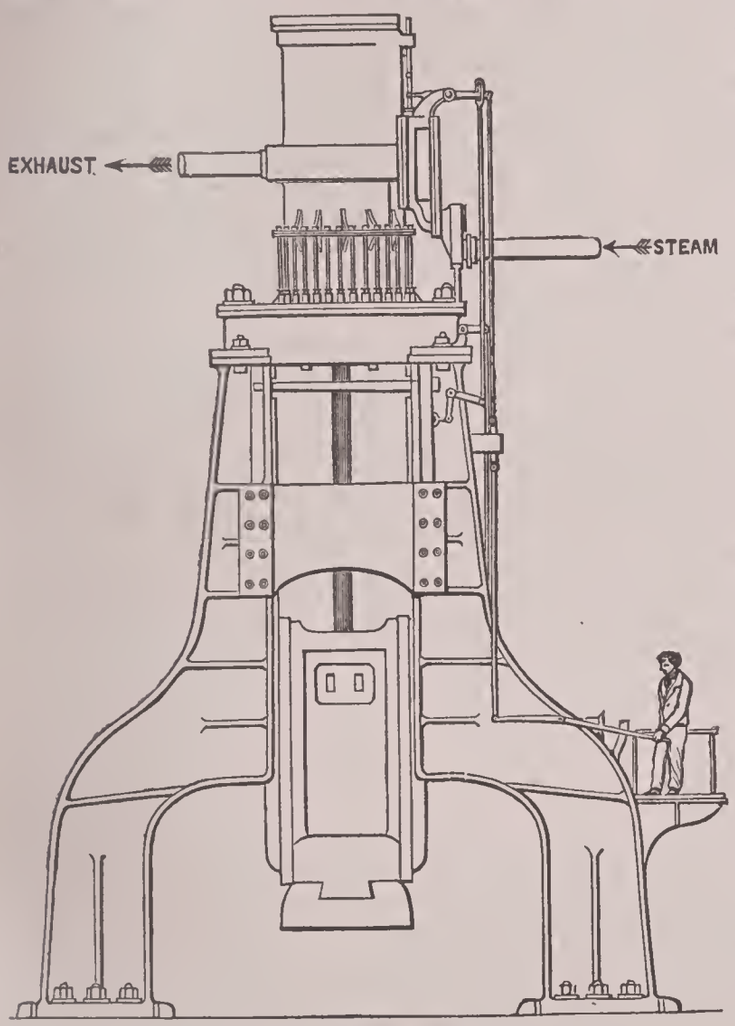


Fig. 4.—Steam Hammer.

HAMMERFEST, the most northern town in Europe, is situated in the department of Hammerfest in the province of Finmark, on the western side of the island of Kvalö (*i. e.*, "Whale Island"), which lies off the north-western coast of Norway. Its latitude is 70° 39′ 15″, and the sun stays for two months above its horizon. Though a small place of 2,298 inhabitants, it is the seat of a considerable trade, in which not only Norwegian and Danish but English, German, and particularly Russian vessels are engaged. About thirty small ships are sent out from Hammerfest every spring to Spitzbergen to take part in the fisheries and walrus hunting. Train oil from the liver of the *Scymnus microcephalus* and cod-liver oil are manufactured in the town. The exports, among which salted fish occupies the principal place, amounted in 1876 to the value of 1,629,500 crowns (£90,528), and the imports, chiefly salt and coal, to 721,700 (£40,094). On the Fuglenaes or Bird's Cape, which protects the harbor on the north, there stands a column with an inscription in Norse and Latin, stating that Hammerfest was one of the stations of the expedition for the measurement of the arc of the meridian. Nor is this its only association with science; for it was one of the spots chosen by Captain Sabine for his series of pendulum experiments. The ascent of the Tyven or Diebsberg in the neighborhood is usually undertaken by travellers.

HAMMER-HEAD. See Shark.

HAMMER-PURGSTALL, Joseph von (1774–1856), was born at Gratz in 1774, and after some training in the Oriental academy of Vienna entered the Austrian diplomatic service. He was the son of Joseph Johann von Hammer, and it was not till 1835, when he had inherited the estates of the countess of Purgstall (in Styria), that he received the title Baron von Hammer-Purgstall, by which he is generally known. His youth and early manhood were passed in the Levant, where he bent all his energies to the task of improving his acquaintance with Oriental literature, in which as early as 1796 he proved his interest by the translation of a Turkish poem. He did not again come forward as an author till 1804, when his *Encyclopædia of Oriental Learning* appeared, a work whose ambitious character was so diffidently felt by its author that he feared to put his name to it. From that time there was little pause in his literary productiveness. For fifty years he wrote incessantly on the most diverse subjects, and his works were composed in most of the languages of Europe. He published numerous texts and translations of Arabic, Persian, and Turkish authors; compiled histories of Persian poetry, Turkish poetry, and Arabic literature; brought the poems of Háfiz, Mutanebbi, Baki, and Ibn-el-Fáridh within the reach of European readers; published travels in Turkey and Austria; wrote the history of the Tatar races, the Krim Khans, the Golden Horde, the Russians, and the Ottoman Turks; formed a biographical gallery of Eastern celebrities; put forth theories about every possible subject in the wide range of Oriental learning, discussing the *Arabian Nights*, Arab music, Mahometan theology, Egyptian papyri, gnostic coffrets, Arabic grammar, Eastern antiquities, the sect of the Assassins, the sieges of Vienna, the Knights Templars, and Spenser's sonnets, which he translated into German. Von Hammer did for Germany the same work that Sir William Jones did for England. He showed that Oriental subjects were not to be studied merely so far as they were connected with biblical theology, but were a worthy object of research for their own sake. For more than fifty years he persisted in introducing Eastern authors and Eastern topics to the general reader, and there was a time when no Orientalist was more widely known and admired. As Jules Mohl said —"C'était le doyen de la littérature orientale, le premier associé que la Société (Asiatique de Paris) ait tenu à l'honneur d'inscrire sur sa liste, et le plus zélé, le plus fertile, et le plus célèbre des hommes qui se sont voués, de notres temps, à la culture des lettres orientales."

It was natural that a scholar who traversed so large a field and wrote so rapidly should lay himself open to the criticism of specialists, and no man was more severely handled by his critics than Von Hammer, to whom Diez, for example (in *Unfug und Betrug*, 1815), devotes nearly 600 pages of heavy abuse. Von Hammer was undoubtedly inaccurate and superficial at times; he attempted more than he could possibly achieve with thoroughness, and was in the habit of giving his own whimsical view of matters about which he knew next to nothing; and he used to offend his critics as much by his Oriental florid style and want of method as by the occasional inaccuracy of his facts and the inconsequence of his deductions. But in spite of his faults he did more for Oriental studies than most of his critics put together.

When he was seventy-six years of age he planned a second edition of his *Encyclopædia of Oriental Learning*, and designed a "preliminary" series of twelve volumes which should clear the ground by expounding the history of Arabic literature, and for the last seven years of his life he regularly put forth his annual volume. Jules Mohl, going to see him, found the old man hard at work, helped by no colleague, and disdaining the aid of an amanuensis. His early travels in the Levant, and then his busy life at Vienna, where he held the post of court-interpreter, saved him from the crushing influence of solitary study; and to the last he maintained his singular buoyancy of mind. "C'était un homme généreux, franc jusqu'à l'imprudence, hardi, bouillonnant d'esprit, aimable jusqu'à la coquetterie,

doué d'une faculté de travail rare, ambitieux dans les grandes et les petites choses, et d'une vivacité inconcevable —vivacité qui fut la source de sa bonne et de sa mauvaise fortune." So Mohl pictured him in his address to the Société Asiatique in 1857, when he recorded the death of Von Hammer on November 23, 1856, at the age of eighty-two, a hard worker to the last, like his younger but greater English contemporary Lane, with whom he came into collision in a friendly way on the subject of the origin of *The Thousand and One Nights*.

Von Hammer's principal works are his *Geschichte des osmanischen Reiches*, 10 vols., 1827 (2d ed., 1834–6), translated into French (1835 and 1840); *Geschichte der osmanischen Dichtkunst*, 4 vols., 1836; *Literatur-Geschichte der Araber* (unfinished), 7 vols., 1850–6; *Les Origines Russes*, 1827; *Geschichte der Goldenen Horde*, 1840; *Geschichte der Ilchane*, 1842; *Geschichte der Chane der Krim*, 1856; *Geschichte der Assassinen*, 1818; *Constantinopolis und der Bosporos*, 1822; *Encyklopädische Uebersicht der Wissenschaften des Orients*, 1804. Texts and translations of—*Eth-Thaálabi*, Arab. and Germ., 1829; *Ibn Wahshiyah, History of the Mongols*, Arab. and Engl., 1806; *El-Wassáf*, Pers. and Germ., 1856; *Esch-Schebistani's Rosenflor des Geheimnisses*, Pers. and Germ., 1838; *Ez-Zamakscheri, Goldene Halzbänder*, Arab. and Germ., 1835; *El-Ghazzáli, Hujjet-el-Islám*, Arab. and Germ., 1838; *El-Hamawi, Das arab. Hohe Lied der Liebe*, Arab. and Germ., 1854. Translations of—*El-Mutanebbi's Poems; Er-Resmi's Account of his Embassy*, 1809; *Contes inédits des 1001 Nuits*, 1828. Besides these and smaller works, Von Hammer contributed numerous essays and criticisms to the *Fundgruben des Orients*, which he edited; to the *Journal Asiatique;* and to many other learned journals; above all to the *Transactions* of the Akademie der Wissenschaften of Vienna, of which he was mainly the founder; and he translated Evliya Effendi's *Travels in Europe*, for the English Oriental Translation Fund. For a fuller list of his works, which amount in all to nearly 100 volumes, see *Comptes Rendus* of the Acad. des Inscr. et des Belles Lettres, 1857. (S. L. P.)

HAMMERSMITH, a town and parish in the county of Middlesex, situated on the north bank of the Thames, 3½ miles S. W. of Hyde Park corner, and now connected with London by continuous lines of streets. The bridge across the Thames at Hammersmith, completed in 1827 at a cost of £80,000, was the earliest suspension bridge erected near London. Formerly Hammersmith was celebrated for its nurseries and market gardens, but these have almost entirely given place to buildings. In the neighborhood there are a number of fine residences. The principal public buildings are the parish church of St. Paul, consecrated in 1631 and restored in 1864, containing a number of interesting monuments; the Latymer schools, founded by Edward Latymer in 1624; the Godolphin school, founded in the 16th century, and rebuilt as a grammar school in 1862, with accommodation for 200 boys; the Roman Catholic theological institute, founded originally as a school for ladies in 1669; the convent of the Good Shepherd, with an asylum for penitent women; the convent of Little Daughters of Nazareth; the Roman Catholic reformatory, the town-hall, the office of the board of works, and the West London hospital. In the district there are distilleries, lead-mills, oil-mills, coach factories, boat-building yards, and the works of the West Middlesex Water Company. The population of the parish in 1861 was 24,519, and in 1901, 111,976. Hammersmith falls within the limits of the metropolitan district, and forms part of the parliamentary borough of Chelsea.

HAMMOND, Henry (1605–1660), a learned royalist divine of the Church of England, was born at Chertsey in Surrey, August 18, 1605. He was educated at Eton, whence in his fourteenth year he passed to Magdalen College, Oxford, becoming demy or scholar in 1619, and fellow in 1625. After graduating in arts he turned his attention to divinity; in 1629 he entered holy orders, and in 1631 became bachelor of divinity. Two years afterwards, in preaching before the court, he won the approval of the earl of Leicester, who in the same year presented him to the living of Penshurst in Kent. Hammond received his doctor's degree in 1639, and in 1643 was promoted to the dignity of archdeacon of Chichester. He was a member of the convocation of 1640, and also, but nominally only, of the Westminster Assembly of divines, which began its sittings in 1643. In the latter year Dr. Hammond was concerned in the unsuccessful rising at Tunbridge in favor of King Charles I., and was obliged to flee in disguise to Oxford, then the royal headquarters. There he spent much of his time in writing, though he accompanied the king's commissioners to London, and afterwards to the ineffectual convention at Uxbridge in 1645, where he disputed with the Presbyterian Vines. In his absence he was appointed canon of Christ Church and public orator of the university. These dignities he relinquished for a time in order to attend the king as chaplain during his captivity in the hands of the parliament. When Charles was deprived of all his loyal attendants at Christmas, 1647, Hammond returned to Oxford and was made subdean of Christ Church, only, however, to be removed from all his offices in 1648 by the parliamentary visitors, who imprisoned him for ten weeks. Afterwards he was permitted, though still under quasi-confinement, to retire to the house of Sir Philip Warwick at Clapham in Bedfordshire. In 1650, having regained his full liberty, Hammond betook himself to the friendly mansion of Sir John Pakington, at Westwood, in Worcestershire, where he died on April 25, 1660, just on the eve of his preferment to the see of Worcester.

Independently of his works, Hammond possessed qualities entitling him to be remembered long after the former are forgotten. He was an excellent preacher. Charles I. pronounced him the most natural orator he had ever heard. His range of reading was extensive. A diligent scholar and a copious writer, he left no time for idleness, which he regarded as the heaviest burden and most dangerous temptation of man.

His writings, published in 4 vols. fol., 1674–84, consist for the most part of controversial sermons and tracts. The best of them are his *Practical Catechism*, first published in 1644; his *Paraphrase and Annotations on the New Testament;* and an incomplete work of a similar nature on the Old Testament. His *Life*, written by Bishop Fell, and prefixed to the collected *Works*, has been reprinted in vol. iv. of Wordsworth's *Ecclesiastical Biography*. See also Lloyd's *Memoires*, 1668, and *Life of Henry Hammond*, by the Rev. G. G. Perry.

HAMON, Jean Louis (1821–1874), one of the best known of French painters under the second empire, was born at Plouha on 5th May, 1821. At an early age he was destined to the priesthood, and placed under the care of the brothers Lamennais, but his strong desire to become a painter finally triumphed over family opposition, and in 1840 he courageously left Plouha for Paris,—his sole resources being a pension of five hundred francs, granted him for one year only by the municipality of his native town. At Paris Hamon received valuable counsels and encouragement from Delaroche and Gleyre, and in 1848 he made his appearance at the Salon with Le tombeau du Christ (Musée de Marseille), and a decorative work, Dessus de Porte. The works which he exhibited in 1849—Une Affiche Romaine, L'Égalité au Sérail, and Perroquet jasant avec deux jeunes Filles—obtained no marked success. Hamon was therefore content to accept a place in the manufactory of Sèvres, but an enamelled casket by his hand having attracted notice at the London International Exhibition of 1851, he received a medal, and, reinspired by success, left his post to try his chances again at the Salon of 1852. La Comédie Humaine, which he then exhibited, turned the tide of his fortune, and Ma sœur n'y est pas (purchased by the emperor) obtained for its author a third class medal in 1853. At the Paris International Exhibition of 1855, when Hamon re-exhibited the casket of 1851, together with several vases and pictures of which L'Amour et son Troupeau, Ce n'est pas moi, and Une Gardeuse d'Enfants were the chief, he received a medal of the second class, and the ribbon of the legion of honor. In the following year he was absent in the East, but in 1857 he reappeared with Boutique à quatre Sous, Papillon enchainé, Cantharide esclave, Dévideuses, etc., in all ten pictures; L'Amour en visite was contributed to the Salon of 1859, and Vierge de Lesbos, Tutelle, La Volière, L'Escamoteur, and La Sœur ainée were all seen in 1861. Hamon now spent some time in Italy, chiefly at Capri, whence in 1864 he sent to Paris L'Aurore and Un Jour de Fiançailles. The influence of Italy was also evident in Les Muses à Pompéi, his sole contribution to the Salon of 1866, a work which enjoyed great popularity and was re-exhibited at the International Exhibition of 1867, together with La Promenade, and six other pictures of previous years. His last work, Le triste Rivage, appeared at the Salon of 1873. It was painted at St. Raphael, where Hamon had finally settled in a little house on the shores of the Mediterranean, close by Alphonse Karr's famous garden. In this house he died on the 29th of May, 1874, and the contents of his studio and portfolios were dispersed at an obscure sale—thinly attended—for an almost nominal sum. Hamon had

made his own a quiet place amongst those workers who since the days of Vien and David have been trying to bring home to us something of the pictorial aspect of classic time. He had neither the power nor the learning which might have enabled him to give to that aspect any very real shape, nor was the side of human life with which he was most concerned weighty or important. He especially loved the gestures of children and their little ways,—now comic, now cunning, but always naive, and always full of charms. Dressed in classic fashion they play on the canvas of Hamon, with endless fanciful alterations, the same nursery comedies of which Ma sœur n'y est pas is one of the best examples. The painter's very mannerisms, his pale color, and the hazy atmosphere which pervades his often rather empty field, enhance the graceful unreality of these little creatures, who are not quite classic loves nor yet altogether human babies.

HAMPDEN, John (1594–1643), the eldest son of William Hampden of Great Hampden in Buckinghamshire, by Elizabeth, second daughter of Sir Henry Cromwell, and aunt of Oliver,. the future Protector, was born in 1594. By his father's death, when he was but a child, he became the owner of a good estate, and a ward of the crown. He was educated at the grammar school at Thame, and in 1609 he became a commoner of Magdalen College at Oxford. In 1613 he was admitted a student of the Inner Temple, and in 1619 he married Elizabeth Symeon. He first sat in parliament for the borough of Grampound in 1621. From that time he was a member of every succeeding parliament till he died.

To the biographer who does not wish to become an historian under the pretence of narrating the incidents of his hero's life, Hampden's career must appear to give little scope for narrative. The letters which he left behind him are few. His speeches are scarcely more numerous and are extremely brief. In the early days of his parliamentary career he was content to be overshadowed by Eliot, as in its later days he was content to be overshadowed by Pym, and to be commanded by Essex. Yet it is Hampden, and not Eliot or Pym, who lives in the popular imagination as the central figure of the English revolution in its earlier stages. It is Hampden whose statue rather than that of Eliot or Pym has been selected to take its place in St. Stephen's Hall as the noblest type of the parliamentary opposition, as Falkland's has been selected as the noblest type of parliamentary royalism.

Something of Hampden's fame no doubt is owing to the position which he took up as the opponent of ship-money. But it is hardly possible that even resistance to ship-money would have so distinguished him but for the mingled massiveness and modesty of his character, his dislike of all pretences in himself or others, his brave contempt of danger, and his charitable readiness to shield others as far as possible from the evil consequences of their actions. Nor was he wanting in that skill which enabled him to influence men towards the ends at which he aimed, and which was spoken of as subtlety by those who disliked his ends.

During the last two parliaments of James and the first three parliaments of Charles, Hampden did not, so far as we know, open his lips in public debate, but he was increasingly employed in committee work, for which he seems to have had a special aptitude. In 1626 he took an active part in the preparation of the charges against Buckingham. In January, 1627, he was bound over to answer at the council board for his refusal to pay the forced loan. Later in the year he was committed to the gate-house, and then sent into confinement in Hampshire, from which he was liberated just before the meeting of the third parliament of the reign, in which he once more rendered useful but unobtrusive assistance to his leaders.

When the breach came in 1629 Hampden is found in epistolary correspondence with the imprisoned Eliot, discussing with him the prospects of the Massachusetts colony, or rendering hospitality and giving counsel to the patriot's sons now that they were deprived of a father's personal care. It was not till 1637, however, that his resistance to the payment of ship-money gained for his name the lustre which it has never since lost. Seven out of the twelve judges sided against him, but the connection between the rights of property and the parliamentary system was firmly established in the popular mind.

In the Short Parliament of 1640 Hampden stood forth amongst the leaders. During the eventful months which followed, when Strafford was striving in vain to force England, in spite of its visible reluctance, to support the king in his Scottish war, rumor has much to tell of Hampden's activity in rousing opposition. It is likely enough that the rumor is in the main true, but we are not possessed of any satisfactory evidence on the subject.

In the Long Parliament, though Hampden was by no means a frequent speaker, it is possible to trace his course with sufficient distinctness. Unwearied in attendance upon committees, he was in all things ready to second Pym, whom he plainly regarded as his leader. In the earlier proceedings of the Commons there was practically unanimity in the House, though a difference afterwards arose as to the form in which the attack upon Strafford should be conducted. All were agreed in desiring that the constitution should rest upon a combination between the king and the two Houses, and that legal questions in which the king was concerned should be decided only by the judges of the ordinary courts.

There was another point on which there was no agreement. A large minority wished to retain Episcopacy, and to keep the Common Prayer Book unaltered, whilst the majority were at least willing to consider the question of abolishing the one and modifying the other. On this subject the parties which ultimately divided the House and the country itself were fully formed as early as February 8, 1641. The details of the contest between Episcopacy and Presbyterianism will be more fitly told in connection with the life of Pym. It is enough to say that Hampden fully shared in the counsels of the opponents of Episcopacy. It is not that he was a theoretical Presbyterian, but the bishops had been in his days so fully engaged in the imposition of obnoxious ceremonies that it was difficult if not impossible to dissociate them from the cause in which they were embarked. Closely connected with Hampden's distrust of the bishops was his distrust of monarchy as it then existed. The dispute about the church therefore soon attained the form of an attack upon monarchy, and, when the majority of the House of Lords arrayed itself on the side of Episcopacy and the Prayer Book, of an attack upon the House of Lords as well.

No serious importance therefore can be attached to the offers of advancement made from time to time to Hampden and his friends. Charles would gladly have given them office if they had been ready to desert their principles. Every day Hampden's conviction grew stronger that Charles would never abandon the position which he had taken up. He was therefore a warm supporter of the Grand Remonstrance, and was chosen out to be one of the five impeached members whose attempted arrest brought at last the opposing parties into open collision. In the angry scene which arose on the proposal to print the Grand Remonstrance it was Hampden's personal intervention which prevented an actual conflict, and it was after the impeachment had been attempted that Hampden laid down the two conditions under which resistance to the king became the duty of a good subject. Those conditions were an attack upon religion, and an attack upon the fundamental laws. There can be no doubt that Hampden fully believed that both those conditions were fulfilled at the opening of 1642.

When the civil war began Hampden levied a regiment of Buckinghamshire men for the parliamentary cause. In the earlier operations of the war, and in the undecided fight of Edgehill, he bore himself gallantly and well. But it is not on his skill as a regimental officer that Hampden's fame rests. In war as in peace his distinction lay in his power of disentangling the essential part from the non-essential. In the previous constitutional struggle he had seen that the one thing necessary was to establish the supremacy of the House of Commons. In the military struggle which followed he saw, as Cromwell saw afterwards, that the one thing necessary was to beat the enemy. He protested at once against Essex's hesitations and compromises. In the formation of the confederacy of the six associated counties, which was to supply a basis for Cromwell's operations, he took an active part. His influence was felt alike in parliament and in the field. But he was not in supreme command, and he had none of that impatience which often leads able men to fail in the execution of orders of which they disapprove. His precious life was a sacrifice to his unselfish devotion to the call of discipline and duty. On June 18, 1643, when he was holding out on Chalgrove Field against the superior numbers of Rupert till reinforce-

ments arrived, he received two carbine balls in the shoulder. Leaving the field he reached Thame, and after nearly six days he died on the 24th praying for his country and his king. (S. R. G.)

HAMPDEN, Renn Dickson (1793–1868), bishop of Hereford, was born at Barbados, where his father was colonel of the local militia, in 1793, and after receiving a private school education under Dr. Rowlandson, vicar of Warminster, Wiltshire, entered as a commoner at Oriel College, Oxford, in 1810. Having taken his B.A. degree with first-class honors in both the classical and mathematical schools in 1813, he in the following year obtained the chancellor's prize for a Latin essay "On the office of the Ephors at Sparta," and shortly afterwards he was elected to a fellowship in his college, Keble, Newman, and Arnold being among the number of his contemporaries. Having left the university in 1816 he held successively the curacies of Newton, Faringdon, and Hackney, and in 1827 he published *An Essay on the Philosophical Evidence of Christianity*, followed by a volume of *Parochial Sermons illustrative of the importance of the Revelation of God in Jesus Christ* (1828). In 1828 he returned to Oxford as tutor of Oriel, and after having twice acted as public examiner in classics, he was selected to preach the Bampton lectures in 1832, when he chose for his subject *The Scholastic Philosophy considered in its Relation to Christian Theology* (1833; 3d ed. 1848). Notwithstanding a charge of Arianism now brought against him by the Tractarian party, he in 1833 obtained the principalship of St. Mary's Hall, and in 1834 the chair of political economy; nor did a university statute of censure against him on the ground of the supposed heterodoxy of the Bampton lectures avail to check his promotion to the regius professorship of divinity in 1836. There resulted a widespread and violent though ephemeral controversy, after the subsidence of which he published a *Lecture on Tradition*, which has passed through several editions, and a volume on *The Thirty-nine Articles of the Church of England*. His nomination by Lord John Russell to the vacant see of Hereford in December, 1847, was again the signal for a violent and organized opposition; and his consecration in March, 1848, took place in spite of a remonstrance by many of the bishops and the resistance of Dr. Merewether, the dean of Hereford, who went so far as to vote against the election when the *congé d'élire* reached the cathedral. As bishop of Hereford Dr. Hampden made no change in his long-formed habits of studious seclusion, and his episcopate was not characterized in a special degree by any form of churchly activity or zeal. Among the more important of his later literary performances were the articles on Aristotle, Plato, and Socrates, contributed to the eighth edition of the *Encyclopædia Britannica*, and afterwards reprinted with additions under the title of *The Fathers of the Greek Philosophy* (Edinburgh, 1862). In 1866 he had a paralytic seizure which unfitted him for severe mental exertion, and he died at London on the 23d of April, 1868.

Plate VII. HAMPSHIRE, Hants, or Southampton (most anciently *Hamtanscire*, in Domesday book *Hantesshire*, and in the documents of the Middle Ages *Sudhamtescire*, *Sudhamtonsire*, and *Sudenhamtonsire*), a maritime county in the south of England, is situated between 50° 34′ and 51° 22′ N. lat. and 0° 43′ and 1° 54′ W. long., and is bounded on the N. by Berkshire, on the E. by the counties of Surrey and Sussex, on the S. by the English Channel, and on the W. by Wiltshire and Dorsetshire. It is of an irregular quadrilateral form, and its greatest breadth from north to south, not including the Isle of Wight, is 46 miles, and its greatest breadth from east to west 41 miles. The total area comprises 1,032,105 imperial acres (mainland portion 938,764 acres, Isle of Wight 93,341), or nearly 1613 square miles. Hampshire in its general aspect presents a beautiful variety of gently rising hills and fruitful valleys, adorned with numerous mansions and pleasant villages, and interspersed with extensive woodland. Two ranges of low chalk hills, known as the North and South Downs, enter the county from Surrey and Sussex respectively, and traverse it in a north-westerly direction into Wiltshire and Berkshire, forming in the north-western corner of the county several picturesque eminences, from which some fine views are obtained. The highest of these summits is Siddown Hill, Highclere, 940 feet. The northern and north-eastern portion of the county, comprising more than 100,000 acres, is in the basin of the Thames; a large portion of the southern district is in the Southampton or Isle of Wight basin; and a portion to the west is in the basin of Wilts and Dorset. The south-western corner from Southampton Water is almost wholly occupied by the New Forest. The coast on the whole is low and irregular. The most easterly part forms a large bay containing Hayling Island and Portsea Island, which divide it into Chichester harbor, Langston harbor, and Portsmouth harbor. From the south-western extremity of Portsmouth harbor it runs about 18 miles inland in a north-west direction, and forms Southampton Water, which has a western shore about 10 miles in length, and an average breadth of nearly 2 miles at high water. From Southampton Water its line is continued irregularly in a south-western direction—for nearly one half of its extent fronting the Isle of Wight, and in its western half forming Christchurch Bay and part of Poole Bay.

Rivers and Canals.—The principal rivers are the Avon, the Boldre, the Exe, the Test with its tributary the Anton, the Itching, and the Hamble. The Avon in the south-west of the county has its source in Wiltshire, and passing Fordingbridge and Ringwood empties itself into Christchurch Bay, where it is joined by the Stour, which rising in Dorset crosses the south-west corner of Hampshire. The Boldre takes its rise in the New Forest, and after collecting the water of several brooks falls into Lymington creek. The Exe near the eastern extremity of the New Forest falls into the Solent at Beaulieu. The Test rises near Overton, and after its junction with the Anton at Fullerton passes Stockbridge and Romsey, and forms the head of Southampton Water. The Itching rises near Alresford, and flowing by Kingsworthy, Winchester, and Twyford falls into the Southampton Water to the north of Southampton. The Hamble rises near Bishop's Waltham, and after a course of about 10 miles falls into the Southampton Water. The Wey, the Enbourne, the Loddon, and the Blackwater have their rise in the north part of the county, but soon pass into Berkshire.

There is one canal, Basingstoke, begun in 1778 and completed in 1794 at a cost of £100,000. It is 37 miles in length and terminates in the river Wey, in Surrey, near its junction with the Thames. Andover canal, begun in 1789, was filled up in 1858 and converted into a railway, forming a junction with the London and Exeter at Andover.

Geology and Soil.—With the exception of the northern and north-eastern corner occupied by the basin of the Thames, another portion about 8 miles in breadth extending along the eastern side, and the New Forest in the south-west, with a small portion to the north of it, Hampshire is occupied by the Chalk formation which runs from Sussex and Surrey north-east into Wilts and Berks. This middle district has a length from north to south of about 22 miles and a breadth from east to west of between 20 and 30 miles. Its soil is in some places of considerable depth, and produces good crops of all kinds, but a great part of it is so thin as to be unfitted for the plough, and is used as sheep pasture. The basin of the Thames to the north of this district is principally strong brown and gray loam, with a considerable number of marshes. The eastern portion forming the Vale of Petersfield, and comprising only about 50,000 acres, rests on the Wealdean formation, and is a gray sandy loam provincially called "malmy" land, lying on a soft sand rock. The southern portion, which includes the ancient Forest of Bere, Waltham Chase, and the New Forest, consists principally of light sandy and gravelly loams intermixed with clay and brick earth, resting chiefly on argillaceous and calcareous marl.

Agriculture.—According to the Agricultural Statistics for 1879, the total area of arable land was 706,927 imperial acres, of which 247,958 were under corn crops, 135,982 under green crop, 112,813 under rotation grasses, 184,141 permanent pasture, and 22,967 fallow. The acreage under woods was 87,229. The principal grain crop is wheat, for which Hampshire enjoys a great celebrity. Its acreage has been gradually increasing, and in 1879 was 100,090. The acreage of barley and oats was 66,228, and 64,957 respectively. Barley is usually sown after turnips, and is more grown in the uplands than in the lower levels. Beans and pease are only grown to a small extent, the acreage in 1879 being respectively 4633 and 10,092. On account of the number of sheep pastured on the uplands a large breadth of turnips is grown, their acreage in 1879 being 81,472. Potatoes are not cultivated beyond what is necessary for home supplies, and had an acreage of only 5039. Rotation grasses are

BERKSHIRE
WILTSHIRE
HAMPSHIRE
Swindon
Wooton Basset
Broad Hinton
Ogbourn St George
Aldbourn
Lambourn
East Ilsley
Compton
Frilsham
Hungerford
Newbury
Woolhampton
Reading
Henley upon Thames
Great Marlow
Maidenhead
Windsor
Eton
Staines
Egham
Chertsey
Weybridge
Kingston
Richmond
Hampton Court
Twickenham
Brentford
Hounslow
Uxbridge
Harrow
Hammersmith
Chelsea
Kensington
Hyde Park
Paddington
Marylebone
Hampstead
Islington
Finsbury
Clerkenwell
Holborn
Strand
Westminster
Lambeth
Southwark
Bermondsey
Rotherhithe
Deptford
Greenwich
Blackheath
Woolwich
Plumstead
Erith
Dartford
Gravesend
Tilbury
Purfleet
Grays
Romford
Ilford
Barking
Stratford
Hackney
Tottenham
Edmonton
Enfield
Waltham Cross
Epping
Chigwell
Woodford
Wanstead
Leytonstone
Walthamstow
Hornsey
Finchley
Hendon
Harrow
Pinner
Ruislip
Northolt
Ealing
Acton
Chiswick
Brentford
Isleworth
Hounslow
Feltham
Staines
Windsor
Slough
Eton
Datchet
Burnham
Taplow
Cookham
Bisham
Marlow
Great Marlow
Wycombe
Amersham
Chesham
Berkhamsted
Tring
Aylesbury
Thame
Watlington
Wallingford
Goring
Pangbourne
Streatley
Reading
Basingstoke
Newbury
Hungerford
Marlborough
Swindon
Cricklade
Highworth
Faringdon
Abingdon
Oxford
Witney
Chipping Norton
Banbury
Brackley
Towcester
Daventry
Rugby
Coventry
Warwick
Leamington
Kenilworth
Birmingham
Solihull
Sutton Coldfield
Lichfield
Tamworth
Atherstone
Nuneaton
Hinckley
Leicester
Loughborough
Melton Mowbray
Oakham
Uppingham
Market Harborough
Kettering
Wellingborough
Northampton
Towcester
Buckingham
Winslow
Leighton Buzzard
Dunstable
Luton
Hitchin
Baldock
Royston
Cambridge
Saffron Walden
Bishop's Stortford
Harlow
Epping
Brentwood
Romford
Upminster
Grays
Tilbury
Gravesend
Dartford
Sevenoaks
Tonbridge
Tunbridge Wells
Maidstone
Ashford
Canterbury
Dover
Deal
Sandwich
Ramsgate
Margate
Whitstable
Faversham
Sittingbourne
Rochester
Chatham
Gillingham
Sheerness
Isle of Sheppey
Isle of Thanet
North Foreland
South Foreland
Beachy Head
Eastbourne
Hastings
Rye
Winchelsea
Romney
Hythe
Folkestone
Dungeness
Lydd
Tenterden
Cranbrook
Hawkhurst
Battle
Bexhill
St Leonards
Pevensey
Hailsham
Uckfield
Lewes
Newhaven
Seaford
Brighton
Shoreham
Worthing
Littlehampton
Arundel
Bognor
Chichester
Selsea Bill
Portsmouth
Gosport
Fareham
Titchfield
Southampton
Netley
Hythe
Lymington
Christchurch
Bournemouth
Poole
Wareham
Swanage
Isle of Purbeck
Isle of Wight
Newport
Cowes
East Cowes
Ryde
Sandown
Shanklin
Ventnor
Freshwater
Yarmouth
Alum Bay
The Needles
Christchurch Bay
Poole Bay
Weymouth Bay
Lulworth Cove
Durdle Door
Portland Bill
Chesil Beach
Abbotsbury
Bridport
Lyme Regis
Axminster
Honiton
Exeter
Crediton
Okehampton
Tavistock
Launceston
Bude
Boscastle
Tintagel
Padstow
Newquay
St Ives
Penzance
Land's End
Falmouth
Truro
Redruth
Camborne
Helston
Lizard Point
Mount's Bay
St Michael's Mount
Plymouth
Devonport
Saltash
Torpoint
Mount Edgcumbe
Eddystone
Start Point
Dartmouth
Kingsbridge
Salcombe
Bolt Head
Bolt Tail
Torbay
Brixham
Paignton
Torquay
Teignmouth
Dawlish
Exmouth
Budleigh Salterton
Sidmouth
Lyme Bay
Portland Bay
Weymouth
Dorchester
Wareham
Poole
Christchurch
Ringwood
Fordingbridge
Salisbury
Amesbury
Andover
Whitchurch
Basingstoke
Odiham
Farnham
Alton
Petersfield
Midhurst
Arundel
Chichester
Havant
Portsmouth
Gosport
Fareham
Titchfield
Southampton
Romsey
Stockbridge

grown chiefly in the uplands, and their acreage is greater than in any other of the southern counties of England. Sanfoin is the grass most largely grown, as it is best adapted to land with a calcareous subsoil. In the lower levels no sanfoin and scarcely any clover is grown, the hay being supplied from the rich water meadows, which are managed with great skill and attention, and give the best money return of any lands in the county. Where a rapid stream of water can be passed over them during the winter it seldom becomes frozen, and the grasses grow during the cold weather so as to be fit for pasture before any traces of vegetation appear in the surrounding fields. Hops are extensively grown in the eastern part of the county bordering on Surrey. Their acreage in 1879 was 3064. Farming is generally conducted on the best modern principles, but owing to the varieties of soil there is perhaps no county in England in which the rotation observed is more diversified, or the processes and methods more varied. Most of the farms are large, and there is a considerable number of model farms. The waste land has been mostly brought under tillage, but a very large acreage of the ancient forests is still occupied by wood. New Forest has 60,000 acres under wood, in addition to which there are in the east Woolmer Forest (5949) and Alice Holt (2744), in the south-east the Forest of Bere (11,000) and Waltham Chase (2000), and in the Isle of Wight Parkhurst Forest (3000). The New Forest was originally formed by William the Conqueror in 1079 after the battle of Hastings, and the greater part of it belongs to the crown. The trees of the forest are principally beech and oak. The oaks, many of which are some hundred years old, do not grow to a great height, but shoot out strong crooked branches which give them a very picturesque appearance. Formerly they were chiefly used for the ships of the royal navy. Herds of small ponies similar to those of Shetland and the Hebrides are still reared in the Forest. It also contains abundance of deer, and at one time it was famed for its pigs. The honey of the county enjoys a special celebrity.

The number of cattle has increased with the improved facilities for railway transport, and in 1879 was 66,059, or an average of 9·3 to every 100 acres under cultivation, as compared with 16·9 for England and 21·0 for the United Kingdom. Of these the number of cows and heifers in milk or in calf was 35,128. The cattle are of no distinctive breed. The number of horses, to the breeding and rearing of which much attention is paid, was 29,247 in 1879, or an average of 4·1 to every 100 acres under cultivation, as compared with 4·5 for England and 4·1 for the United Kingdom. The number of sheep in 1879 was 552,041, or an average of 78·2 to every 100 acres under cultivation, as compared with 75·3 for England and 68·0 for the United Kingdom. The original breed was white-faced with horns, but most of the flocks now are of a Southdown variety which have acquired certain distinct peculiarities, and are known as "short wools" or "Hampshire downs." The number of pigs in 1879 was 57,122, or an average of 8·0 to every 100 acres, as compared with 7·2 for England and 6·7 for the United Kingdom. The breeding and fattening of pigs has long been a most important part of Hampshire industry. The original breed of pigs has been improved by crossing with Berkshire, Essex, and Chinese pigs. In the vicinity of the forests the pigs are fed on acorns and beechmast, and the pork of those so cured is considered the best, although the reputation of the Hampshire bacon depends chiefly on the skilful manner in which it is cured.

According to the Landowners' Return of 1872–73, the land was divided between 27,472 proprietors, holding land the gross annual value of which was £2,469,124. Of the owners 77 per cent. possessed less than one acre, and the average all over was £2, 10s. 2½d. There were no fewer than 35 proprietors holding upwards of 5000 acres, viz.:—Earl of Portsmouth, 16,401; Duke of Wellington, 15,847; Lord Ashburton, 15,330; Sir William Heathcote, Bart., 14,189; Lord Bolton, 13,808; Melville Portal, 10,566; Earl of Carnarvon, 9294; Lord Northbrook, 9236; Earl of Normanton, 9236; Lord Henry Scott, 8922; executors of John B. W. Fleming, 8843; Sir J. B. Simeon, 8724; Thomas Chamberlayne, 8535; Thomas Thistlethwayte, 8084; Thomas Baring, 8058; Sir J. C. Jervoise, 7877; College of Winchester, 7269; Sir H. A. Tichborne, 7270; Sir Henry Mildmay, 6762; Crown Property, 6554; H. P. Delme, 6258; Rev. Thomas Best, 6184; F. J. E. Jervoise, 6183; W. W. B. Beach, 6099; Dean and Chapter of Westminster, 5837, W. F. Cowper-Temple, 5780; John Bonham Carter, 5621; John Morant, 5596; W. H. Kingsmill, 5361; Lord Heytesbury, 5195; Edgar A. Drummond, 5155; W. H. S. Stanley, 5150; William H. Iremonger, 5103; Edward Knight, 5044; Lady Jane Mill, 5040.

Manufactures and Trade.—The manufactures are unimportant except those carried on at Portsmouth and Gosport in connection with the royal navy. There are large steam docks and an extensive shipping trade at Southampton. In many of the towns there are breweries and tanneries, and paper is manufactured at several places. Fancy pottery and terra cotta are made at Fareham and Bishop's Waltham; and Ringwood is celebrated for its knitted gloves. At most of the coast towns fishing is prosecuted, and there are oyster beds at Hayling Island. Cowes in the Isle of Wight is the station of the royal yacht squadron and has building yards for yachts and large steamers. The principal bathing-places, besides those in the Isle of Wight, are Southsea, Southayling, Bournemouth, and Anglesea, a suburb of Gosport. At Portsmouth there is a convict prison, at Parkhurst a prison for convict boys, and at Aldershott a large military camp.

Railways.—The London and South-Western Railway enters the county at Farnborough, passing by Winchester and from thence to Southampton, a branch diverging from Bishopstoke to Gosport, and again to Portsmouth, Havant, and Emsworth, *via* the South Coast Railway, by a branch from Fareham. A branch of the Great Western from Reading joins the South-Western at Basingstoke, about a mile south-west from which a line diverges to Whitchurch, Andover, and Salisbury. The Guildford and Reigate branch of the South Coast Railway communicates with Alton and New Alresford, 6 miles west of which it joins the South-Western. Southampton communicates with Dorchester by the Dorchester Railway which, after branching to Lymington, passes Ringwood, from which there is another branch to Christchurch and Bournemouth. Another line connects Southampton with Salisbury, and from this line a branch 4 miles north of Romsey communicates with Andover.

Administration.—Hampshire, including the Isle of Wight, comprises 38 "hundreds," 10 "liberties," 1 city, that of Winchester (16,366), which is also a municipal and parliamentary borough; 5 other boroughs which are both municipal and parliamentary, viz., Andover (5744), Lymington (5356), Newport (8522), Portsmouth (113,569), and Southampton (53,741); 2 parliamentary boroughs, viz., Christchurch (15,415) and Petersfield (6104); and 3 municipal boroughs—Basingstoke (5574), Romsey (2056), and Ryde (11,260).

For parliamentary purposes Hants is formed into three divisions, viz., North Hants, South Hants, and the Isle of Wight. Winchester which returns 2 members, and Andover and Petersfield which return 1 member each, are in the northern division, which returns in all 6 members; in the southern division are included the boroughs of Christchurch and Lymington returning 1 member each, and the boroughs of Portsmouth and Southampton returning 2 each, and it returns in all 8 members; the Isle of Wight returns 1 member, and also contains the borough of Newport returning one member. The total representation of the county is thus 16 members.

The county has one court of quarter sessions, and is divided into 14 petty sessional divisions. The city of Winchester, and the boroughs of Andover, Portsmouth, and Southampton (a county of itself), have commissioners of the peace and separate courts of quarter sessions; and the boroughs of Basingstoke, Newport, Romsey, and Ryde have commissions of the peace. In the borough of Lymington the mayor and ex-mayor are magistrates, and the county justices have concurrent jurisdiction. The county is included in the western circuit, and ecclesiastically is almost entirely in the diocese of Winchester.

Population.—The total population of the county amounted in 1841 to 354,682, in 1851 to 405,370, in 1861 to 481,815, and in 1871 to 544,684 (males, 275,393; females, 269,291). The increase in 30 years from 1841 has been 54 per cent., and since 1801 it has been 97 per cent. The excess of males over females is accounted for by the naval and military establishments situated in the county. In 1901 the mainland portion contained a population of 798,756, and the Isle of Wight, 82,387.

History and Antiquities.—Before the Roman invasion the Welsh Celts of Hampshire had been driven out or subdued by incursions of Gauls, who first took possession of the country round Winchester to the west of the great forest of Andresweald, stretching into Hampshire from Sussex, and gradually occupied the greater part of the southern shires from Surrey and Sussex to Devon. It was probably during this prolonged contest that the intrenched camps were formed at Beacon Hill, Bury Hill, Danebury, Quarley Mount, and Worldbury Mount. The Gauls whom the Romans found in South Britain were divided into three tribes—the *Regni* on the coast, the *Belgæ* in the middle, and the *Atrebates* in the north. Their chief town occupied the site of the modern Winchester, and was known as *Venta Belgarum* by the Romans, who made it one of their principal stations. From it roads, traces of which may yet be seen, were constructed to Sorbiodunum (Old Sarum), Silchester, and Southampton, and to Porchester (Portsmouth) and Chichester. Next to *Venta Belgarum* the most important Roman station in Hampshire was *Calleva* (probably Silchester), where there are yet very extensive remains; traces of a large station (*Clausentum*) are still to be seen at Southampton; at Portsmouth portions of an old Roman fort are incorporated in the castle of Porchester; at Broughton, near Stockbridge, slight traces of a station are still visible; and an intrenchment at Egbury Hill, near Whitchurch, is regarded by some as the remains of the ancient *Vindomis*, although others place the site of that town at Silchester. Even before the Roman conquest of Britain the southern shores of England had been frequently attacked by Saxon pirates, and afterwards, in 475, the warriors Hengist and Horsa had succeeded ultimately and with great difficulty in establishing themselves in Kent; but the real conquest of southern

Britain was accomplished by a Saxon tribe called *Gervissa* or *Gervissi*, who about the year 495, under Cerdic and his son Cynric, landed from five ships on the shores of Southampton Water, and concluded a stubborn contest by defeating the Britons at Charford in 519, from which period is generally dated the origin of the kingdom of Wessex, which had for its capital Winchester, then known as Wintanceaster or Winteceaster. The establishment of the bishop's see at Winchester, after the conversion of King Kynegils of Wessex about 635, falls more appropriately to be noticed in the article on that city. In 755, according to the Saxon chronicle, Sigebert, king of Wessex, was deprived by the witan of the whole of his kingdom, with the exception of *Hamtunscire*, the first time that the name occurs. Hampshire played a prominent part in the contest with the Danes or Northmen, who about 860 stormed Winchester, but were afterwards worsted, in 871 defeated Ethelbert at Basing, and in 878 compelled King Alfred to retreat to the woods and fastnesses. The devastation of the Isle of Wight by the Danes in the reign of Ethelred II., and the other historical events connected with that island, will be noticed in the article WIGHT, ISLE OF. Under Edward the Confessor and Harold II. the seat of government had been transferred from Winchester to Westminster, but the honor was again restored to Hampshire by William the Conqueror, who made Winchester his principal residence, and for the purposes of sport devastated a large part of the county to form the New Forest. The superstitious fancies of the time traced a necessary connection between this violent exercise of his prerogatives and the sudden death of his sons and grandson within the boundaries of the scene of his ruthless devastations: his son Richard was smitten with sudden death in the New Forest while hunting; a second Richard, a natural son of Robert his eldest son, met his death there accidentally; and William Rufus, his second son and his successor, while hunting within it was shot by an arrow in 1100. The loss which the shire sustained by the final transference of the seat of government to London was partially compensated for by the rise of the ports of Southampton and Portsmouth, which have been an important element in its prosperity down to the present time. The principal other historical events of the shire are connected either with these two towns or with Winchester or the Isle of Wight, the only exception of importance being the siege and capture of Basing House by the troops of Cromwell in 1645.

The principal monastic institutions in Hampshire, dissolved by Henry VIII., were the priory of St. Swithin, who was bishop of Winchester from 852 to 862; the monastery of Hyde, outside the walls of Winchester, founded by King Alfred; the nunnery of St. Mary's, Winchester; St. Elizabeth's College, Winchester; the nunnery of Wherwell, founded by Elfrida; the Augustinian priory of Southwick, founded by William of Wykeham; the Præmonstratensian abbey of Tichfield, founded in the time of Henry III.; the Augustinian priory of Twyneham, Christchurch, founded according to some authorities by King Athelstan; the Augustinian priory of Breamore, founded by Baldwin de Redvers; the nunnery of Romsey, founded by Edward the Elder about 910; the Augustinian priory of Mottisfont, endowed soon after the Conquest, but by whom is uncertain; the Cistercian abbey of Beaulieu, founded by King John about 1204; the Cistercian abbey of Netley, founded in the time of Henry III.; the Augustinian priory of St. Denis, near Southampton, founded by Henry I.; the abbey of Quarr, Isle of Wight; and the preceptory of Baddesley. The most important monastic remains are those at Winchester; the priory church at Christchurch in the Norman and Perpendicular style; the Norman church at Romsey; the remains of Netley Abbey, with a church in the Early English style; the ruins of Beaulieu Abbey, of which a gateway is in good preservation (the abbot's house has been converted into a private residence, and the great hall or refectory, in the plain Early English style, is now used as a parish church); the ruins of the priory of St. Denis, and the Norman church at Porchester, near Portsmouth. Corhampton church, near Exton, is the only Saxon church in Hampshire which is entire, but Saxon masonry is found in Headbourne Worthy church, which also contains an old brass of the 15th century. The principal other old churches not mentioned under Winchester, Southampton, and other towns, nor already referred to in connection with monastic remains, are—in the Norman style, Chilcombe, Hamble, Kingsclere, and Tichbourne; in the Norman style, with Early English additions, Alton, Basing, Bishop's Sutton, Brockenhurst, Clatford, Hambledon, Milford, and Warnford; in the Early English, Boldre, Cheriton, Grately, Sopley, which is partly Perpendicular, and Thruxton, which contains a brass to Sir John Lisle (died 1407), affording the earliest example of complete plate armor in England; and in the Perpendicular, Basingstoke, Fordingbridge, which is also partly Decorated, Tichfield, Selborne, and Warblington.

The principal old castles are Calshot Castle, built in the time of Henry VIII., and used by the coast-guard; Carisbrook Castle (see WIGHT, ISLE OF); Hurst Castle, near Southampton, where Charles I. was for a short time imprisoned, now transformed into a fortress; and Porchester Castle (see PORTSMOUTH). The modern residences of the gentry are more than usually numerous.

Among the eminent persons connected with Hampshire may be mentioned Young, author of the *Night Thoughts;* Warton, author of the *History of English Poetry;* Dibdin, Bishop Wykeham, Pococke the traveller, Sir William Petty, Jonas Hanway, Brunel, Gilbert White, John Keble, and Charles Dickens.

See the papers regarding the early history of South Britain by Dr. Guest in the *Archæological Journal*, and in the *Transactions of the Archæological Institute; Hampshire, extracted from Domesday Book*, by Richard Warner, 1789; Moody, *Hampshire in 1086* (1862), and the same author's *Antiquarian and Topographical Sketches*, 1846, and *Notes and Essays relating to the Counties of Hants and Wilts*, 1851; R. Mudie, *History of Hampshire*, 2 vols., 1840; J. Duthie, *Sketches of Hampshire*, 1840; P. J. Martin, *Geology of Hampshire*, 1851; *Michaelmarsh and its Antiquities*, 1867; Woodward's important *History of Hampshire*, 3 vols., 1869; and White's *History and Directory of Hampshire and the Isle of Wight*, 1879.

HAMPSTEAD, a suburb of London, is situated in the county of Middlesex, on the slope of Hampstead Hill, 4 miles N. W. of the city. The village is irregularly built, and the streets are narrow and tortuous, but it has preserved more than any other London suburb its sylvan appearance, and is still noted for its fine groves and avenues. From the side of the hill there issue chalybeate springs, whose virtue was first discovered in the 17th century, and which at the beginning of last century rivalled those of Tunbridge Wells and Epsom in popularity. Their reputation, however, gradually declined after the middle of the century, and now the supply of mineral water has been greatly diminished by the cutting of deep drains and of railway tunnels. Hampstead Heath, an irregular sandy tract occupying the summit and northern slope of the hill, and extending to 240 acres, is much frequented by excursionists and picnic parties. The hill is the highest in the vicinity of the metropolis, being 443 feet above the level of the Thames, or 36 feet higher than the cross of St. Paul's. At one time the village was a favorite resort of poets and other men of letters; and among the more famous of its old taverns was the Flask Inn, now converted into a private residence, the meeting-place of the Kit-Cat club, of which the more celebrated members were Addison, Steele, Richardson, Marlborough, and Walpole. The parish church of St. John, consecrated in 1747 and enlarged in 1844, is a plain brick structure in the Italian style with a picturesque tower. The graveyard contains a number of monuments of eminent persons, including those of Sir James Mackintosh, Joanna Baillie, and Constable the artist. Near the village a large militia barracks was erected in 1863, and there are a number of charitable institutions, including a soldiers' daughters' home, a sailors' daughters' home, an orphan working school, and the North London Consumptive Hospital. The population of the parish in 1901, was 82,329.

HAMPTON, a village in the county of Middlesex, England, is situated on the north bank of the Thames, 12 miles W. S. W. from Hyde Park Corner. The parish church erected in 1830, with a square tower at its western end, is without architectural merit, but the churchyard contains a number of interesting old monuments. Among the many fine residences in the vicinity is Garrick Villa, formerly, under the name of Hampton House, the residence of Garrick the famous actor. In the neighborhood there are a number of large pumping works for supplying London with water. The free grammar school founded in 1556 was reopened in 1878 as a middle-class school, for which the usual fees are charged. The population of the village in 1901 was 6,812.

About a mile from Hampton village and close to the river stands Hampton Court Palace, one of the finest extant specimens of the Tudor style of architecture, and formerly a royal residence. It was originally erected by Cardinal Wolsey, who in 1515 received a lease of the old mansion and grounds for 99 years. As the splendor of the building seemed to awaken the cupidity of Henry VIII., Wolsey in 1526 thought it prudent to make him a present of it. It became Henry's favorite residence, and he made several additions to the building, including the great hall and chapel in the Gothic style. Of the original five quadrangles only two now remain, but a third was erected by Sir Christopher Wren for William III. The fine gardens, extending to 44 acres, were laid out at the desire of William III. in the Dutch style, with elevated

terraces, long shady walks, and a labyrinth called the "Maze," which is the source of great amusement to visitors. Bushy Park, opposite the palace gardens, is open to the public, and contains a celebrated avenue of chestnut trees. The palace was sold by the parliament in 1641, but afterwards came into the hands of Cromwell; and it continued to be one of the principal residences of the English sovereigns until the time of George II. It was the birthplace of Edward VI., and the meeting-place of the conference held in the reign of James I. to settle the dispute between the Presbyterians and the state clergy. It is now partly occupied by persons of rank in reduced circumstances; but its state apartments, picture gallery, and gardens are open to the public free of charge. The celebrated cartoons of Raphael which it formerly possessed have lately been removed to the South Kensington Museum, but it still contains a valuable collection of pictures, including a number of fine specimens of the old masters, and a large collection of portraits of persons famous in English history.

HAMSTER (*Cricetus*), a genus of rodent mammals belonging to the *Muridæ* or mice family, and characterized by the possession of large cheek pouches. The common hamster (*Cricetus vulgaris*) is somewhat larger and stouter than the Norway rat, but with a much shorter tail. Its fur, which varies somewhat in color, is generally of a reddish-brown above and black beneath, with several white spots on the sides. It is found throughout the dry regions of central Europe and Asia, from the Rhine eastward to the river Obi and southward to Persia and the Caucasus. It is a burrowing animal, its subterranean dwellings consisting of several vaults, most of which are used as storehouses for the grain and seeds which the hamster lays up in autumn for consumption during winter and spring. In collecting this store it makes use of its cheek pouches, which are said to be large enough to contain a quarter of an English pint, while the hoard of a single individual will sometimes contain about two bushels of grain. It is thus specially obnoxious to the farmer, who loses no opportunity of destroying the creature and of ransacking its stores. Like many other rodents, the hamster is exceedingly prolific, the female producing several broods in the year, each consisting of over a dozen young, and these when not more than three weeks old are turned out of the parental burrow to form underground homes for themselves. The burrow of the young hamster is only about a foot in depth, while that of the adult descends 4 or 5 feet beneath the surface. On the approach of winter the hamster retires to its subterranean abode, the various entrances to which it carefully closes, and there it remains until the advent of milder conditions, feeding for a while on its well-garnered store, but becoming torpid during the coldest period of winter. Although feeding chiefly on roots, fruits, and grain, it is also to some extent carnivorous, attacking and feeding upon small quadrupeds, lizards, and birds. It is exceedingly fierce and pugnacious, the males especially fighting with each other for possession of the females. The numbers of these destructive vermin are kept in check by their many natural enemies, the foxes, dogs, cats, and polecats, which feed upon them. The skin of the hamster is of some value, and its flesh is used as food. Its burrows are sought after in the countries where it abounds, both for capturing the animal and for rifling its store.

HANAU, a town of Prussia, capital of a circle in the government district of Cassel, province of Hesse-Nassau, is situated at the confluence of the rivers Kinzig and Main, 12 miles E. of Frankfort. It consists of what are called an old and a new town. The streets of the former are narrow and irregular, but the latter, founded at the end of the 16th century by refugee Walloons and Netherlanders, is built in the form of a pentagon with broad streets crossing at right angles, and possesses several fine squares, among which may be mentioned the market-place, adorned with handsome fountains at the four corners. The town is the seat of a circle court, a head tax-office, a chamber of commerce, and a branch of the imperial bank. Among the principal buildings are the ancient castle, formerly the residence of the counts of Hanau; the church of St. John, dating from the 17th century, with a rather imposing tower; the old church of St. Mary, formerly a collegiate church, and containing the tomb of the counts of Hanau; the church of the new town, built in the beginning of the 17th century, whose ground plan is in the form of two circles intersecting each other; the beautiful new Catholic church, the synagogue, the theatre, the barracks, the arsenal, the orphanage, and the infirmary. Its educational establishments include a gymnasium, a school of design, a real-school, and a higher girls' school. There is a Wetteravian society of natural history and an historical society, both of which possess considerable libraries and collections connected with their respective branches of knowledge. Hanau is the birthplace of the brothers Grimm, and the house in which they were born is now adorned with a medallion. In the neighborhood of the town are the electoral palace, with an extensive park and large orangeries, and the watering-place of Wilhelmsbad. Hanau is the principal commercial and manufacturing town in the province, and stands next to Cassel in point of population. Its staples are ornaments of various kinds, cigars, leather, paper, playing cards, silver and platina wares, chocolate, soap, woollen cloth, hats, silk, gloves, stockings, ropes, and matches. It has also three large foundries and a number of breweries, and in the neighborhood there are extensive powder-mills. It carries on a large trade in wood, wine, and corn, in addition to its articles of manufacture. The population of the town in 1905 was 31,637.

From the number of urns, coins, and other antiquities found near Hanau it would appear that it owes its origin to a Roman settlement. It was raised to the rank of a town in 1393, and in 1528 it was fortified by Count Philip, who rebuilt the castle. At the end of the 16th century its prosperity received considerable impulse from the accession of the Walloons and Netherlanders. During the Thirty Years' War it was in 1631 taken by the Swedes, and in 1636 it was besieged by the imperial troops, but was relieved on the 13th June by Landgrave William V. of Cassel, on account of which the day is still commemorated by the inhabitants. Napoleon on his retreat from Leipsic defeated the Germans under Marshal Wrede at Hanau, October 30, 1813; and on the following day the allies vacated the town, when it was entered by the French. In 1429 Hanau became the capital of a province of the empire, which on the death of Count Reinhard II. was in 1451 partitioned between the Hanau-Münzenberg and Hanau-Lichtenberg lines, but was reunited in 1692 when the elder line became extinct. The younger line received princely rank in 1696, but, as it also became extinct, Hanau-Münzenberg in 1736 was joined to Hesse-Cassel and Hanau-Lichtenberg to Hesse-Darmstadt. In 1785 the whole province was united to Hesse-Cassel, and in 1803 it became an independent principality. In 1813 it again came into the possession of Hesse-Cassel, and in 1866 it was joined to Prussia.

HANCOCK, John (1737–1793), American revolutionary statesman, was born at Quincy, Massachusetts, January 12, 1737. Having taken his degree at Harvard college in 1754, he began a mercantile career, and on the death of an uncle in 1764 succeeded to a large fortune and a prosperous business. In 1768, two years after his election to the Massachusetts house of representatives by the city of Boston, his sloop "Liberty" was seized for contravention of the commercial laws, and in the riot which followed the royal customs commissioners barely escaped with their lives. After the "massacre" of Boston in 1770, Hancock inveighed with such spirit and bitterness against the troops and their officers, demanding their removal from the town, that he became obnoxious to the Government; and five years afterwards the attempt to seize his person led to the first revolutionary battle at Concord, Massachusetts. In 1774 Hancock was president of the provincial congress, and from 1775 to 1777 of the general congress at Philadelphia, where he was the first to sign the declaration of independence. Returning to Massachusetts he assisted in framing the constitution, and in 1780 was chosen first governor. He was annually elected to this dignity till 1785, and again from 1787 to 1793, sitting as an ordinary member of the legislature in the interval. He received the degree of LL.D. from Harvard university in 1792. He died at Quincy, 8th October, 1793.

HANDEL, George Frederick (1685–1759), one of the greatest names in the history of music generally, is absolutely paramount in that of English music. His influence on the artistic development of England and his popularity, using that word in the most comprehensive sense, are perhaps unequalled. He has entered into the private and the political life as well as into the art life of Englishmen; without him they cannot bury their dead or elect their legislators; and never has a composer been more essentially national than the German Handel has become in England. It may on the other hand be said that but for his sojourn in

that country Handel would never have been what he was. It was under the influence of English poetry, and of English national and religious life, that his artistic conception broadened and gained the dignity and grandeur which we see in his oratorios, and which was wanting, and, seeing the style of art, could not but be wanting, in his Italian operas. The day of Handel's arrival in London, late in the autumn of 1710, was indeed an eventful day in the life of Handel as well as in the annals of English music, and the facts of his biography preceding that date may be summed up with comparative brevity. George Frederick Handel (in German the name is always Händel) was born at Halle in Saxony on February 23, 1685, the same year which gave birth to his great fellow composer Johann Sebastian Bach.[1] He was the son of George Handel, who according to the custom of the time combined the occupations of barber and surgeon, and subsequently rose to be valet-de-chambre to the elector of Saxony. His second wife, Dorothea Taust, was the daughter of a clergyman, and to her the great composer remained attached with all the ties of filial affection. His father was sixty-three years old when Handel was born, and the musical talent shown by the youth at a very early age found little encouragement from the stern old gentleman, who looked upon art with contempt, and destined his son for the law. Many are the anecdotes relating to the surreptitious way in which the youth practised the forbidden art on a little spinet smuggled into his attic by the aid of a good-natured aunt, and fortunately of too feeble tone to be audible in the lower part of the house. At the age of eight the boy accompanied his father on a visit to Saxe-Weissenfels, and it was there that the proficiency acquired in the manner above described was turned to excellent account; for, having made acquaintance with the court musicians, and being allowed to practise on the organ, he was on one occasion overheard by the duke himself, who immediately recognizing his talent spoke seriously to the father on his behalf. To such a remonstrance coming from such a quarter the valet-de-chambre had of course to submit, and henceforth Handel was allowed to practise his art, and after his return to Halle even received musical instruction from Zachau, one of the best organists of the town. It was under his somewhat mechanical but thorough tuition that Handel acquired his knowledge of counterpoint; he also soon became an excellent performer on the organ. His first attempts at composition date from an equally early period, and in his twelfth year he made his début as a virtuoso at the court of Berlin with such success that the elector of Brandenburg, afterwards King Frederick I. of Prussia, offered to send him to Italy, a proposal declined by Handel's father for unknown reasons. In 1697 the latter died, and the young artist was henceforth thrown on his own resources. For some years he remained in Halle, where in 1702 he obtained a position as organist; but in the following year we find him at Hamburg, at that time one of the musical centres of Germany. There the only German opera worth the name had been founded by Reinhold Keiser, the author of innumerable operas and operettas, and was flourishing at the time under his direction. Handel entered the orchestra, and soon rose from his place amongst the second violins to the conductor's seat at the clavicembalo, which he occupied during Keiser's absence, necessitated by debt. It was at Hamburg that he became acquainted with Mattheson, a fertile composer and writer on musical subjects, whose *Vollkommener Kapellmeister* (1739) and *Ehrenpforte* (1740) are valuable sources for the history of music. The friendship of the two young men was not without some curious incidents. On one occasion they set out together on a journey to Lübeck, where the place of organist at one of the churches was vacant. Arrived at Lübeck, they discovered that one of the conditions for obtaining the place was the hand of the elderly daughter of the former organist, the celebrated Buxtehude, whereat the two candidates forthwith returned to Hamburg. Another adventure might have had still more serious consequences. At a performance of Mattheson's opera *Cleopatra* at Hamburg, Handel refused to give up the conductor's seat to the composer, who was also a singer, and was occupied on the stage during the early part of his work. The dispute led to an improvised duel outside the theatre, and but for a large button on Handel's coat which intercepted his adversary's sword, there would have been no *Messiah* or *Israel in Egypt*. In spite of all this the young men remained friends, and Mattheson's writings are full of the most valuable facts for Handel's biography. He relates in his *Ehrenpforte* amongst other things that his friend at that time used to compose "interminable cantatas" of no great merit, but of these no trace now remains, unless we assume that a "Passion" according to St. John (German words by Postel), the MS. of which is at the Royal Library, Berlin, is amongst the works alluded to. It was composed in 1704. The year after this witnessed Handel's first dramatic attempt — a German opera, *Almira*, performed at Hamburg on January 8, 1705, with great success, and followed a few weeks later by another work of the same class, *Nero* by name. In 1706 he left Hamburg for Italy, at that time still the great school of music, to which indeed Handel himself owed his skill and experience in writing for the voice. He remained in Italy for three years, living at various times in Florence, Rome, Naples, and Venice. He is said to have made the acquaintance of Lotti, of Alessandro Scarlatti, and of the latter's son Domenico, the father of modern pianoforte playing. His compositions during his Italian period were two operas, two oratorios, *Resurrezione* and *Il Trionfo del Tempo e del Disinganno*, afterwards developed into the English oratorio *The Triumph of Time and Truth*, and numerous other choral works. It was during these years that the composer's earlier or Italian style reached its full maturity, and that his name became widely known in the musical world. In the chief cities of Italy "il Sassone," as Handel, like his countryman Hasse twenty years later, was nicknamed, was received with every mark of favour and esteem. But his own country also began to acknowledge his merits. At Venice in 1709 Handel received the offer of the post of capellmeister to the elector of Hanover, transmitted to him by his patron and stanuch friend of later years Baron Kielmansegge. The composer at the time contemplated a visit to England, and he accepted the offer only on condition of leave of absence being granted to him for that purpose. To England accordingly Handel journeyed after a short stay at Hanover, arriving in London towards the close of 1710. Curiously enough he came as a composer of Italian opera, and in that capacity he earned his first success at the Haymarket with the opera *Rinaldo*, composed it is said in a fortnight, and first performed on February 24, 1711. The beautiful and still universally popular air "Lascia ch'io pianga" is from this opera. A similar air in the form of a *sarabande* occurs in *Almira*. After the close of the season in June of the same year Handel seems to have returned to Germany for a short time; but the temptation of English fame or English gold proved too powerful, and in January, 1712, we find him back in London, evidently little inclined to return to Hanover in spite of his duties at the court there. Two Italian operas, the celebrated Utrecht *Te Deum* written by command of Queen Anne, and other works belong to this period. It was in such circumstances somewhat awkward for the composer when his deserted master came to London as George I. of England. Neither was the king slow in resenting the wrongs of the elector. For a considerable time Handel was not allowed to appear at court, and it was only through the intercession of his patron Baron Kielmansegge that his pardon was at last obtained. Commissioned by the latter, Handel wrote his celebrated *Water-Music*, which was performed at a great fête on the Thames, and so pleased the king that he at once received the composer to his good graces. A salary of £200 a year granted to Handel was the immediate result of this happy consummation. In 1716 he followed the king to Germany, where he wrote a second German "Passion," the words this time being supplied by Brockes, a well-known poet of the day. After his return to England he entered the service of the duke of Chandos as conductor of his private concerts. In this capacity he resided for three years at Cannons, the duke's splendid seat near Edgeware, and produced the two Te Deums and the twelve Anthems surnamed *Chandos*. The English pastoral *Acis and Galatea* (not to be mistaken for the Italian cantata of that name written at Naples, with which it has nothing in common), and his first oratorio to English words *Esther*, were written during his stay at Cannons. It was not till 1720 that he appeared again in a public capacity, viz., in that of impresario of an Italian opera at the Haymarket Theatre, which he managed for the so-called Royal Academy of Music. Senesino, a celebrated singer, to engage whom the composer specially

[1] The date, 23d February, 1684, given on his tombstone in Westminster Abbey is incorrect.

journeyed to Dresden, was the mainstay of the enterprise, which opened with a highly successful performance of Handel's opera *Radamista*. *Muzio Scevola*, written in conjunction with Buononcini and Ariosti, *Tamerlane*, *Rodelinda*, and other operas composed for the same theatre, are now forgotten, only detached songs being heard at concerts. To this time also belongs the celebrated rivalry of Handel and Buononcini, a gifted Italian composer, who by his clique was declared to be infinitely superior to the German master. The controversy raised a storm in the aristocratic teapot, and has been perpetuated in the lines generally but erroneously attributed to Swift, and in reality written by John Byrom :—

> Some say, compared to Buononcini,
> That Mynheer Handel's but a ninny;
> Others aver that he to Handel
> Is scarcely fit to hold a candle.
> Strange all this difference should be
> 'Twixt Tweedle-dum and Tweedle-dee.

Although the contempt for music, worthy of Chesterfield himself, shown in these lines may seem absurd, they yet contain a grain of truth. Handel differed from his rival only in degree not in essence. In other words, he was an infinitely greater composer than Buononcini, but had he continued to write Italian opera there is no reason to conclude from his existing works of that class that he would have reformed or in any essential point modified the existing *genre*. The contest was therefore essentially of a personal nature, and in these circumstances it is hardly necessary to add that Handel remained victorious. Buononcini for a reason not sufficiently explained left London, and Handel was left without a rival. But in spite of this his connection with Italian opera was not to be a source of pleasure or of wealth to the great composer. For twenty years the indomitable master was engaged in various operatic ventures, in spite of a rival company under the great singer Farinelli, started by his enemies—in spite also of his bankruptcy in 1737, and an attack of paralysis caused by anxiety and overwork. Of the numerous operas produced by him during this period it would be needless to speak in detail. Only the name of the final work of the long series, *Deidamia*, produced in 1741, may be mentioned here. That Handel's non-success was not caused by the inferiority of his works to those of other composers is sufficiently proved by the fact that the rival company also had to be dissolved for want of support. But Handel was in more than one way disqualified for the post of operatic manager, dependent in those days even more than in ours on the patronage of the great. To submit to the whims and the pride of the aristocracy was not in the nature of the upright German, who even at the concerts of the princess of Wales would use language not often heard at courts when the talking of the ladies during the performance irritated him. And, what was perhaps still more fatal, he opposed with equal firmness the caprices and inartistic tendencies of those absolute rulers of the Italian stage—the singers. The story is told that he took hold of an obstinate *prima donna* and held her at arm's length out of window, threatening to drop her into the street below unless she would sing a particular passage in the proper way. Such arguments were irresistible at the time, but their final results were equally obvious, in spite of Handel's essentially kindly nature and the ready assistance he gave to those who really wished to learn. No wonder therefore that his quarrels with virtuosi were numerous, and that Senesino deserted him at a critical moment for the enemy's camp.

It is a question whether Handel's change from opera to oratorio has been altogether in the interest of musical art. The opera lost in him a great power, but it may well be doubted whether dramatic music such as it was in those days would have been a proper mould for his genius. Neither is it certain that that genius was, strictly speaking, of a dramatic cast. There are no doubt in his oratorios—for in these alone Handel's power is displayed in its maturity—examples of great dramatic force of expression; but Handel's genius was in want of greater expansion than the economy of the drama will allow of. It was no doubt for this reason that from an inner necessity he created for himself the form of the oratorio, which in spite of the dialogue in which the plot is developed is in all essentials the musical equivalent of the epic. This breadth and depth of the epic is recognized in those marvellous choral pieces expressive either of pictorial detail (as the gnats and the darkness tangible and impenetrable in *Israel in Egypt*) or of the combined religious feeling of an entire nation. By the side of these even the finest solo pieces of Handel's scores appear comparatively insignificant, and we cannot sufficiently wonder at the obtuseness of the public which demanded the insertion of miscellaneous operatic arias as a relief from the incessant choruses in *Israel in Egypt* at the second performance of that great work in 1740. Handel is less the exponent of individual passion than the interpreter of the sufferings and aspirations of a nation, or in a wider sense of mankind. Take, for instance, the celebrated *Dead March in Saul*. It is full of intense grief, in spite of the key of C major, which ought once for all to dispel the prejudice that sorrow always speaks in minor keys. Even Chopin himself has not been able to give utterance to the feeling in more impressive strains. And yet the measured and decisive rhythm, and the simple diatonic harmonies, plainly indicate that here a mighty nation deplores the death of a hero. It is for the same reason that Handel's stay in England was of such great influence on his artistic career Generally speaking, there is little connection between politics and art. But it may be said without exaggeration that only amongst a free people, and a people having a national life such as England alone had in the last century, such national epics as *Judas Maccabæus* and *Israel in Egypt* could have been engendered. In the same sense the *Messiah* became the embodiment of the deep religious feeling pervading the English people, and Handel, by leaving Italian opera for the oratorio, was changed from the entertainer of a caste to the artist of the people in the highest and widest sense. The *Messiah* is indeed the musical equivalent of Milton's *Paradise Lost*. This leads us to another and equally important aspect of the same subject—the important influence of English poetry on Handel's works. Not only are some of the greatest names of English literature —Milton (*Allegro and Penseroso*), Dryden (*Alexander's Feast*), Pope (*St. Cecilia's Ode*)—immediately connected with Handel's compositions, but the spirit of these poets, and especially of Milton, pervades his oratorios even when he has to deal with the atrocious doggerel of Morrel or Humphreys. In addition to this Handel received many a valuable suggestion from the works of Purcell and other early English musicians with which he was well acquainted. No wonder therefore that Englishmen claim Handel as one of themselves, and have granted him honors both during his lifetime and after his death such as have fallen to the share of few artists. But in spite of all this it is impossible to deny that the chances of a national development of English music were, if not absolutely crushed, at least delayed for centuries by Handel. Under Elizabeth and James England had a school of music which, after the storms of the civil war, was once more revived by such masters as Pelham Humphrey and his great pupil Purcell. The latter, although cut off in his youth, had left sufficient seed for a truly national growth of English music. But Handel soon concentrated the interest of connoisseurs and people on his own work, and native talent had to abandon the larger sphere of the metropolis for the comparative seclusion of the cathedral. The following is a chronological list of Handel's English oratorios taken from the catalogue of his works appended to Mr. J. Marshall's article in Grove's *Dictionary of Music and Musicians*, vol. i. p. 657. *Esther* (1720), *Deborah* (1733), *Athalia* (1733), *Saul* (1738), *Israel in Egypt* (1738), *Messiah* (1741), *Samson* (1741), *Joseph* (1743), *Hercules* (1744), *Belshazzar* (1744), *Occasional* (1746), *Judas Maccabæus* (1746), *Alexander Balas* (1747), *Joshua* (1747), *Solomon* (1748), *Susanna* (1748), *Theodora* (1749), *Jephtha* (1751), *Triumph of Time and Truth* (1757). The sequence of these dates will show that the transition from Italian opera to sacred music was very gradual, and caused by circumstances rather than by premeditated choice. It would lead us too far to enter here into the genesis of each of these works, but a few remarks must be added with regard to Handel's *summum opus* the *Messiah*. It was written in twenty-four days and first performed April 18, 1742, at Dublin, where Handel was staying on a visit to the duke of Devonshire, lord-lieutenant of Ireland. Its first performance in London took place on March 23d of the following year. Its introduction into Handel's native country was due to Philip Emanuel Bach, the son of the great Bach, who conducted it at Hamburg. At Berlin it was for the first time given in April, 1786, under the leadership of

Adam Hiller, who also introduced it a few months later at Leipsic against the advice of all the musicians of Saxony. At the Berlin performance Signora Carrara, the celebrated singer, inserted in the first part an aria by Traetta, in which, according to a contemporary account, "she took much trouble to please the public, and the bravura passages of which she delivered with great success." Two years before this had taken place the great Handel commemoration at Westminster Abbey, when on the third day of the festival, May 29, 1784, the *Messiah* was splendidly performed by an orchestra and chorus of 525 performers. In the appreciation of Handel England thus was far in advance of Germany. The remainder of Handel's life may be told in few words. Owing to the machinations of his enemies he for a second time became a bankrupt in 1745, but nothing, not even his blindness during the last six years of his life, could daunt his energy. He worked till the last, and attended a performance of his *Messiah*, a week before his death, which took place on April 14, 1759. He was buried in Westminster Abbey. His monument is by Roubilliac, the same sculptor who modelled the statue erected during Handel's lifetime in Vauxhall Gardens.

Handel was a man of character and high intelligence, and his interest was not, like that of too many musicians, confined to his own art exclusively. He liked the society of politicians and literary men, and he was also a collector of pictures and articles of vertu. His power of work was enormous, and the list of his works would fill many pages. They belong to all branches of music, from the simple air to the opera and oratorio. His most important works of the two last-named classes have already been mentioned. But his instrumental compositions, especially his concerti for the organ and his *suites de pièces* for the harpsichord, ought not to be forgotten, Amongst the contrapuntists of his time Handel had but one equal—Bach. But he also was a master of the orchestra, and, what is more, possessed the rare gift of genuine melody, unfortunately too often impeded by the rococo embellishments of his arias. The extraordinary rapidity with which he worked has been already referred to. It is true that when his own ideas failed him he helped himself to those of others without the slightest compunction. The system of wholesale plagiarism carried on by him is perhaps unprecedented in the history of music. He pilfered not only single melodies, but frequently entire movements from the works of other masters, with few or no alterations and without a word of acknowledgment.

A splendid collection of Handel's MSS., six volumes in all, is in the possession of her Majesty at Buckingham Palace. The Fitzwilliam Museum at Cambridge also possesses seven volumes, mostly sketches and notes for greater works, in the composer's handwriting. The German and English Handel Societies (the latter founded in 1843 and dissolved in 1848) have issued critical editions of his more important works. Three biographers of Handel deserve mention—an Englishman, Mainwaring, *Memoirs of the Life of the late G. F. Handel* (1760), a Frenchman, M. Victor Schœlcher, and a German, Herr Chrysander. (F. H.)

HAND TOOLS. Within the limits of the present article it would be impossible to describe even the majority of the instruments which may come under this designation, including as it does (in its popular if not in its technical sense) the whole of the appliances used by the handicraftsman in the treatment, by means of his muscular energy, of the natural substances used in the arts and manufactures,—whether in the preliminary operations of setting-out and measuring his materials, in reducing his work to the required form by cutting tools or otherwise, in gauging it and testing its accuracy, or in duly securing it whilst being thus treated. Omitting therefore the large but by no means unimportant class of measuring and gauging instruments, straight edges, templates, etc., we will confine our attention to examples of those in the use of which an actual expenditure of force is necessary. According to the structure and other properties of the materials to be treated by them, these act almost without exception either by impact, by pressure, or by cutting, the last being effected sometimes with impact and sometimes with pressure. The principal tools acting purely by impact are noticed under HAMMER (*q. v.*). Those which depend solely on pressure are for the most part of an auxiliary character only, and their consideration will be deferred till we have glanced at a few of the much more numerous and more important class known as cutting or edge tools.

It should be observed that the term "cutting" is applied to processes which have but little in common, the great differences of structure in the materials operated upon demanding equally great differences in the modes of effecting the desired end, which is in almost all cases the forcible separation of their particles in some regular and definite manner. If we regard, for example, the action of a sharp knife upon a piece of chalk as one of true cutting,—*i. e.*, the separation of its particles by the forcible insertion of a wedge-like blade of superior hardness to itself,—we shall find that in by far the larger proportion of instances this simple action is rendered complicated, either through the substance under treatment being insufficiently compact to afford in itself the necessary resistance, or through its want of homogeneity causing a tendency in it to part more readily in some directions than in others. Thus all kinds of wood and the generality of both vegetable and animal substances, being cellular or fibrous in their structure, offer so much less resistance in a direction parallel to their fibres than in one transverse to them that in the former case many of them may be parted by fissure without any true cutting at all. So also with crystalline materials—as is beautifully exemplified by the diamond, which lends itself to cleavage in certain planes in the most perfect manner, though the steel chisel which is employed for the process is very much inferior in hardness to itself. Metals also are frequently not homogeneous; indeed they are sometimes said to be fibrous in structure, but it is only to a very limited extent, if at all, that they are so, and their great natural tenacity even then prevents the separation of their particles except by a true cutting process. Lastly, some stones and minerals, such as sandstones, are said to be cut, though they are formed of material considerably harder than the tools which are used upon them, the fact being that their hard particles are not cut at all, but are merely separated from one another when the cementing material which holds them together is compelled to give way.

I. *Cutting or Edge Tools.*—These, the term "cutting" being thus qualified, are mainly of two classes—(i.) cutting tools used with impact, and (ii.) cutting tools used mainly with pressure. These again may be subdivided into tools used (1) for wood and soft materials, (2) for metal, and (3) for stone and hard substances.

i. 1.—*Wood-tools cutting by impact* comprise all the varieties of axes and adzes, such as the ordinary English pattern of carpenter's axe (*a*, fig. 1), the woodman's felling axe (*b*), the wedge

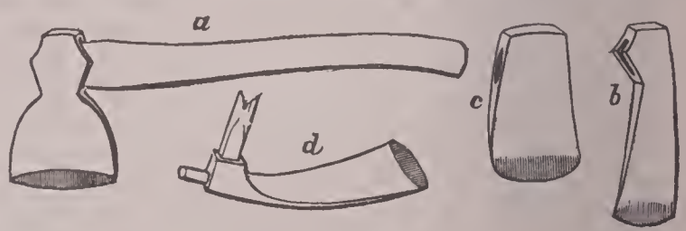


FIG. 1.—Axes.

axe (*c*) (which was one of the first American improvements in edge tools introduced into Europe), and the shipwright's adze (*d*), which last is a particularly rapid and efficient tool in skilful hands. All these when used in the direction of the grain of the wood act by cleaving rather than by cutting, except when the thickness of the chip removed is so small that its transverse strength is inferior to the lateral tenacity of the fibres. So also

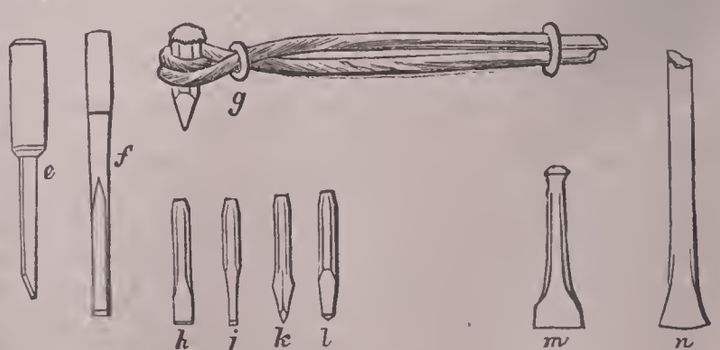


FIG. 2.—Chisels.

do chisels and gouges when driven by blows from a hammer or mallet. The ordinary mortice chisel (*e*, fig. 2) and the socket chisel (*f*) are specially adapted for being used in this way.

2. In the case of *metals* their hardness in general almost pre-

cludes the possibility of employing upon them any tools corresponding to the above. If we except a few special tools such as plumbers' knives, etc., chisels will be found to be almost the sole representatives of this class. A blacksmith's chisel (*g*) held in a hazel withe, and used for hot iron, and some common forms of chisel for chipping it cold are shown in fig. 2, these being known as a chipping chisel (*h*), a cross-cut (*j*), a diamond point (*k*), and a round-nose (*l*).

3. Tools of this class for *stone* also consist chiefly of chisels, the mason's chisel (*m*) varying greatly in width of edge according to the variety of stone and the depth of the cut to be taken. Frequently they are brought quite to a point like the mason's pick, when they cease to be cutting tools from our point of view. The jumper (*n*), employed for rock drilling, with which the hole is produced by means of successive cuts radiating in all directions from its centre, which are delivered with the impact due either to its own weight or to the blows of a hammer on its outer end, is also a form of chisel.

ii. *Edge tools operating by pressure.*—Of this class the ordinary clasp-knife is perhaps the best known example. A sharp knife serves well for showing the different kinds of treatment by cutting or by fissure to which any particular wood or other moderately soft material is capable of submitting itself. The "thickness" of the cutting edge, or in other words, the angle which the intersecting planes which include it form with one another, the degree of smoothness or roughness of edge which best effects the clean division or separation of the fibres, and the possibility or otherwise of producing a smooth surface by "scraping," can all to a great extent be judged of with the aid of a knife. And the subject is by no means an unimportant one. Consideration of the action which takes place at the edge of a cutting-tool, and the strain which this action produces on particular portions of it are frequently of service in enabling us successfully to meet the special cases which arise in practice, and may sometimes guide us towards remedying the defective action of the hand-tools in use for ordinary work. America has long taken the lead in originating thoughtful improvements of this kind, and the result is apparent in the rapid manner in which the use of edge tools and appliances of American patterns is now everywhere extending.

1. In fig. 3 are shown a few of the ordinary English *wood-tools*. They include the firmer chisel (*o*) used by carpenters, and a carver's chisel (*p*) and gouge (*q*). A wood-engraver's

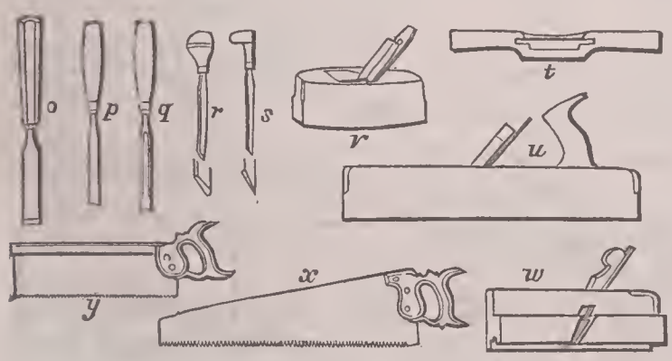


Fig. 3.—Chisels, planes, and saws.

scooper (*r*) and knife (*s*) are examples of special tools, being intended only for cutting hard wood in a direction transverse to the grain, cross-cut blocks of box-wood being alone used for the finer kinds of wood-engravings. The spoke-shave (*t*) affords a good example of what has just been said as to the result obtainable by a well-directed effort towards the improvement of an old established hand tool. In the form figured (*t*), which is the ordinary one in use in England, the blade or "iron" is rather complicated in shape and is not very easy to sharpen; each successive sharpening moreover impairs the efficiency of the tool by widening the "mouth," the unequal wear of the wooden sole, which very speedily takes place, having also a similar effect. Thus three essential conditions of a good cutting-tool, viz., constant maintenance of its proper action, durability of the parts exposed to wear, and facility in sharpening, are all unfulfilled. On the other hand those manufactured in America fulfil them admirably; iron is substituted for wood as the material for the sole and handle, and the blade, which is merely a piece of flat steel, is firmly held in its place by a set screw, half a turn of which at once releases it.

Planes are to be met with in great variety, the most usual for ordinary carpentry being the jack plane (*u*), the trying plane, and the smoothing plane (*v*). Of these the first is used for taking off the rough, or for reducing the thickness of a board; the second, which resembles it, except in being of much greater length, for correcting inequalities of the surface; and the third, as its name implies, for the final smoothing. Planing being chiefly performed in the direction of the grain of the wood, a smooth surface can only be obtained when its fibres are cut instead of being allowed to separate from one another by cleavage, the tendency to which, in soft woods more especially, must therefore be carefully resisted. With this object the planes above mentioned, and many others also, are provided with what is called a "double iron," an inverted blade or "iron" being securely attached to the upper side of the cutting iron, with its edge at a short distance only from the cutting edge. This causes the shaving to be continually broken transversely, and so prevents the fibres of which it is composed from tearing up those in advance of the cut. The width of the "mouth" or space between the cutting edge and the portion of the plane stock in front of it is also kept as small as possible in planes intended for smoothing, so as to increase to the utmost their breaking action by supporting the as yet undisturbed fibres in advance of the cutting edge. Wear of the mouth is sometimes prevented by letting in a metal plate or by forming the stock entirely of iron or steel. Planes of great length, which are known as jointers, are used for some purposes, coopers' planes of this kind being sometimes over 6 feet long.

The use of moulding planes (*w*) is indicated by their name. Each is adapted only for producing one particular pattern of moulding. Hollows and rounds resemble them, but have the cross section of their soles simply concave and convex respectively. For planing work which is hollowed or rounded in the direction of its length compass planes are employed, each of which, as ordinarily made, cannot deviate much from its own particular curvature. American ingenuity has here again stepped in, and has got over this objection by making the sole of a springy plate of steel, which can be adjusted to any curve either convex or concave within very wide limits, so that this one tool takes the place of an entire set of ordinary compass planes. Ploughs are somewhat complicated planes which are used for forming grooves of various widths, depths, and distances from the edge of the work.

The "pitch" of a plane is the angle at which the blade or iron is inclined to the sole, and the inclination is greater in hard-wood than in soft-wood planes. Some of the former, indeed, have their irons so nearly erect that their action is what would ordinarily be described as scraping and not cutting—a difference which appears to be undefinable, and to be due to the structure of the materials which can be so treated, and not, as has been suggested, to any peculiarity in the form of the cutting edge. The action of a razor in shaving seems to favor this view, the sections of hair thus obtained being seen under the microscope to be beautifully cleanly sliced, though the blade is applied at a great angle to the plane of the cut.

The following may be taken as good examples of saws—the hand saw (*x*), the rip saw and half-rip saw, which differ from it only in size and size of tooth, and the dovetail saw and tenon saw (*y*), of which the first three all have sufficient stiffness of blade to resist the force exerted in using them, and the last two are thin and unable to do this without the support of the iron or brass "back," which of course limits the depth to which a cut can be made with them. Pit saws and cross-cut saws are the largest representatives of saws used by hand, being employed for large work, such as cutting timber in the log, and worked generally by two men. Frame saws of all sizes, from those of 8 feet or 10 feet used by pit sawyers down to the fret saws of but a few inches in length and scarcely thicker or wider than a horse hair, and compass saws, for cutting out curves, must also here be mentioned amongst hand-saws, though technically they are not included in the term.

In fig. 4 are some diagrams of saw teeth,—A being the usual form for all the smaller kinds that are used single-handed, which is varied however as to size and also as to the angle at which the "three square" file used in bringing the teeth to an edge is applied, while B is the gullet-tooth, for pit saws working

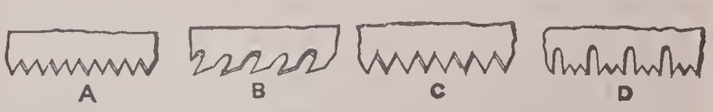


Fig. 4.—Varieties of saw teeth.

with the grain of the wood, and C the ordinary cross-cut tooth, for transverse cuts. It is evident that a saw tooth which is well adapted for producing a clean cut in one of these directions would be ill adapted for doing so in the other, at least in the case of the softer kinds of timber,—for in sawing with the grain the readiness and the uniformity with which the short section of fibres sliced off by each tooth parts from the fibres by its side (owing to their slight lateral cohesion already alluded to) assists in the operation, and a fairly clean cut results. But in cross-cutting special provision is required for cleanly dividing the fibres at each side of the cut, after which the removal of the intervening fragments can be accomplished readily by cleavage rather than by cutting. The rationale of the gullet-tooth (B) is thus clear, the keen chisel-like edges of the teeth being well adapted for slicing the fibres of the wood transversely, and for this it leaves little to be desired. The cross-cut tooth (C), consisting as it does of a series of lancet-like points

acting alternately at each side of the cut, divides the fibres, but has no proper provision for their after removal, and the hand saw tooth (A) is a sort of compromise between the two (at least if we neglect the rounded portion of the gullet-tooth, which does not affect its edge), so that it can be used either with the grain or across it, though not with the best possible results. The cross-cut tooth (D), on the other hand, provides both for the clean separation of the fibres and the removal of their fragments.

The "set" of a saw is the slightly increased width given to its toothed edge by alternately bending the teeth towards the opposite sides of the blade; the extent to which this is done, or the width of the set (as it is called), therefore determines the amount of material which a saw wastes in forming its cut, the more perfect its action the smaller being the amount of set required to make it work freely, and the less the power expended in working it.

Some boring tools for wood are shown in fig. 5. The brad-awl (E) is adapted only for soft wood; the gimlet, either in its plain or its twisted form (F), has little to be said in its favor; and the shell-auger (G) requires an expenditure of force altogether disproportionate to the results produced by it. The

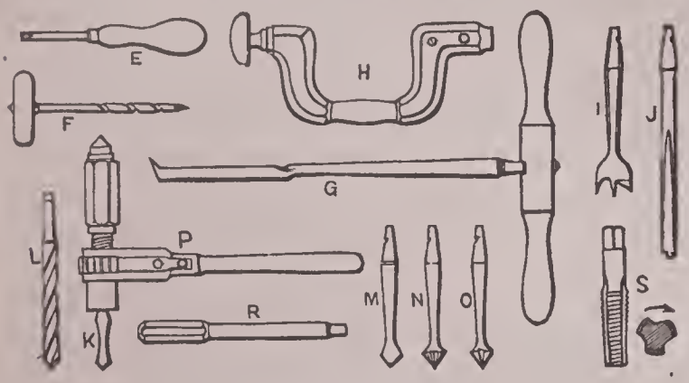


Fig. 5.—Boring tools.

screw-auger is an improvement upon it, although this, as generally made, still leaves a good deal to be desired as regards consumption of power. But the wood-worker's main stand-by for boring is the stock or brace (H) and set of bits. Those ordinarily supplied for boring across the grain consist mainly of centre-bits (I) for the larger and quill bits for the smaller holes,—neither of which are thoroughly efficient tools,—also nose-bits (J), which resemble shell-augers and share their defects, for boring with the grain. The English wood-boring tools indeed offer a considerable field for improvement. Imported substitutes for the above are already to be met with, amongst others being the twisted centre-bits, of which the stems resemble the twist drill referred to below, and the expanding centre-bits, both of which appear to be an advance in the right direction, though they have not as yet come largely into use.

2. Cutting tools for *metal* analogous to the foregoing are but few as regards surface work. Their chief characteristic—at least in the case of those used for the harder metals—is the greatly increased thickness of their edges. Files of various cross sections, lengths, and degrees of fineness of tooth, and scrapers (which are merely thick knife-edges, made not unfrequently from worn-out files by sharpening them at the extremity), constitute almost the only edge tools at the disposal of the fitter or mechanic for finishing work that he has roughly surfaced with his chipping chisels. For boring he has drills of various sizes, too often of the antiquated pattern (K), which in boring deep holes cannot be kept straight, though the very superior twist drill (L) is now often to be met with. Countersinks, either of the flat (M), rose (N), or snail-horn pattern (O), are generally included with carpenters' sets of bits, for enlarging holes in metal work to receive the heads of screws. They are used with the wooden brace figured above. The smith's brace resembles it, but is all made of iron, and a heavy pressure is applied to its upper end by means of a screw. A ratchet brace (P) is a more powerful instrument, and carries in itself the screw for obtaining the requisite pressure. Small holes can be drilled under a light pressure with rapid rotation on the part of the drill, which is then generally of the form K, but sharpened from both sides, so as to form a knife-edge which operates equally well in whichever direction the drill revolves. The drill bow, of which the string takes one turn round a bobbin either on the stem of the drill itself or on its holder, is a ready means of obtaining a rapid reciprocating motion for this purpose, and is not yet superseded, though various ingenious substitutes have been devised. For enlarging holes throughout their length broaches or rimers are used; these may be either simply half round or polygonal in section, or may have any desired number of longitudinal or spiral flutings, each of which forms a cutting edge which removes successive portions from the sides of the hole to be enlarged. A parallel rimer with four flutings is shown at R, the square end when in use being inserted in a hole in the centre of a wrench, which affords the requisite leverage.

An internal screw thread is formed in an analogous manner by a tap, which bears on its surface the counterpart of the required thread, so that by successive cuts it produces a helical groove of the correct form and depth. Such a tap (S) is represented in the engraving, together with a diagram of its cross section, showing the three cutting edges by which the screw thread is formed. Three such taps constitute a set for any one size of screw, the first being known as a taper, the second as an intermediate, and the third as a plug-tap, this last being almost parallel throughout. By a reverse process with dies fixed in a stock (T, fig. 6) external screws are cut, the particular form shown being the improved pattern of Sir J. Whitworth, who has done much to correct the faults of the earlier screwing tools. Screw plates, however, some of which cannot be regarded as cutting tools at all, are still much used for small and fine screw threads.

Cutting pliers and cutting nippers (U) have a pair of knife edges so arranged as to work exactly opposite to one another, —the handles, on being tightly grasped, affording sufficient leverage for these edges to be forced to a short distance into the two opposite sides of a nail or wire, which, if of small diameter or of soft metal, can thus be cut asunder. Tube-cutters are an ingenious device which the extensive use of wrought-iron tubing for gasfitting has rendered necessary. They effect their object by cutting a groove round the tube to a sufficient depth to enable it to be fractured at the desired point.

3. *Stone* and hard materials cannot in general be treated by cutting tools simply with hand pressure, though some of the softer kinds of stone are carved with chisels used almost or altogether without impact, and are sawn with toothed saws resembling the cross-cut saws used for wood. Glaziers' diamonds were till recently the only tools for producing the peculiar "cut" requisite for starting the clean fracture by which sheet glass is divided, theirs, however, being a case of fissure rather than of true cutting. But of late years steel glass cutters have been introduced which act—as long as the sharpness of their edges is maintained—in a manner precisely similar. In one form of these glass cutters (V) a cast-iron handle carries at its extremity a small freely revolving wheel of carefully hardened

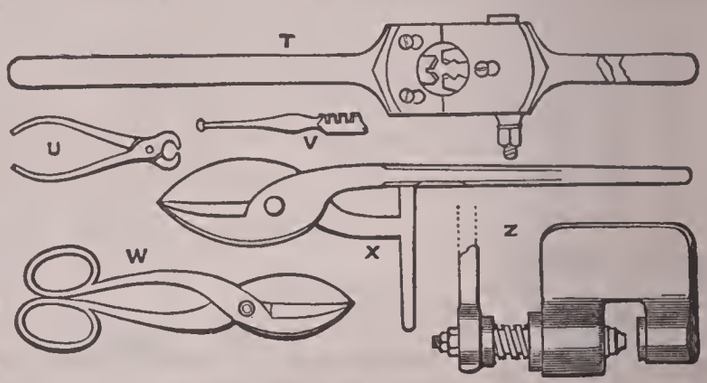


Fig. 6.

steel, round the circumference of which is the cutting edge, which can be sharpened on an oilstone when necessary. The so-called cut is produced by simply running this with a light pressure over the surface of the glass. Diamonds, however, are used for cutting glass, stone, etc., by actually detaching their particles; writing diamonds and diamond drills have this kind of action.

II. *Hand-tools without cutting action.*—With the exception of hammers and a few tools which are dependent on impact,—such as cleaving wedges amongst wood tools, and embossing and similar punches amongst those for metal,—tools of this class play in general only a subsidiary part to some cutting or other process.

Amongst those used with pressure which cannot be considered as auxiliary may be instanced—draw-plates, with which wire is made by drawing it through holes of conical form and of successively smaller diameters till the required size or "gauge" is reached; and burnishers, which reproduce on metals softer than themselves their own highly polished surfaces. Both of these act by inducing a flow of the metal under treatment for which, when it is not effected by impact, great force is required in proportion to the extent of the action. Metal shears and cutting punches of all kinds have been omitted till now, as their mode of operating cannot be regarded as true cutting from our point of view. It may be more correctly described as tearing, more or less completely localized according to circumstances. The ordinary sheet-metal shears (W) merely resemble very powerful scissors, and, their action being quite local, they serve well for dividing the plates or other thin sheets for which alone they

are suitable. Block shears (X) act with additional leverage, and can consequently be used for rather thicker metal, the upper bow being replaced by a long straight handle, and the lower one by a stake which can be firmly fixed in a block of wood or otherwise. With these the tearing action begins to be apparent, though its imperfection is of no great importance with the thicknesses of metal capable of being treated by any hand shears (for some tools of this class, which by hydraulic or other means accumulate the power of one man to a sufficient extent to operate on bars or plates of comparatively great substance, are machines rather than hand tools, and in their case the mere slowness of the operation produces better results than would otherwise be obtained). The same may be said of the various punches used in combination with dies or bolsters, as in the punching bear (Z), of which the action exactly resembles that of shears, the punch taking the place of the upper blade, and the bolster that of the lower one.

Of subsidiary tools (figs. 7) the vice is an absolute essential for the generality of metal workers. The ordinary tail-vice (α) used by mechanics has not yet been largely superseded, though many ingenious arrangements have been devised for remedying its main defect, viz., the want of parallelism in the movement

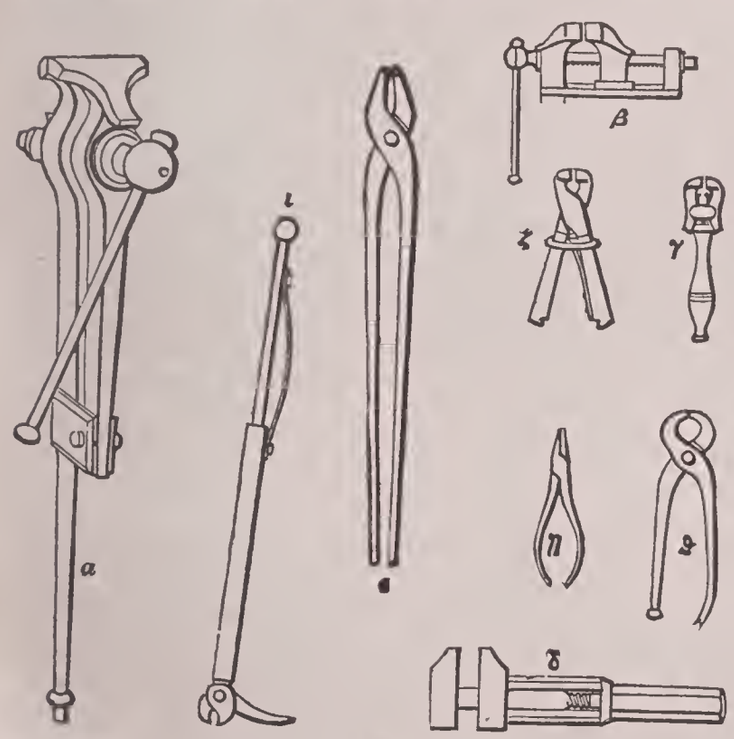


Fig. 7.

of the jaws. The English parallel vice (β) has not this objection, but its construction is not good mechanically, and it is but little used except for small work. In some patterns of vice, jaws are provided with a horizontal adjustment so as to grip tapering or other irregular forms, and in others the whole body of the vice can be swivelled either vertically or horizontally. Hand-vices are used in the manner implied by their name, without being attached to a bench like the foregoing. An ingenious form of hand-vice (γ) is shown in fig. 7. The screw wrench (δ), which is used for turning nuts, etc., of various sizes has of late been deservedly the subject of various improvements in which weight is sought to be saved without sacrifice of strength; and the shifting spanner, of which the duty is the same, has led to the exercise of much ingenuity without any perfectly satisfactory solution of the problem how it may best be constructed. The merit and simplicity of the ordinary screwdriver, on the other hand, are well known.

Instances of tools which afford a powerful grip by simple means are the blacksmith's tongs (ε), the vice-chop tongs (ζ), the pliers (η), and the pincers (ϑ). A very powerful modification of the last-mentioned tool has lately been introduced into use under the name of the nail-puller (ι). With this ingenious instrument very largely increased leverage is obtained, and the pull is given in a direction much more advantageous to the attainment of the desired object. (C. P. B. S.)

HANG-CHOW-FOO, a city of China in the province of Che-Keang, about two miles north-west of the Tseen-tang-Keang, at the southern terminus of the Imperial Canal, by which it communicates with Peking. It lies about 100 miles south-west of Shanghai, in 30° 20′ 20″ N. lat. and 120° 7′ 27″ E. long. Towards the west is the Si-hu or "Western Lake," a beautiful sheet of water, with its banks and islands studded with villas, monuments and gardens, and its surface traversed by gayly-painted pleasure boats. To the Chinese it is a very paradise. Exclusive of extensive and flourishing suburbs, the city has a circuit of 12 miles; its streets are well-paved and clean; and it possesses a large number of arches, public monuments, temples, hospitals, and colleges. It has long ranked as one of the great centres of Chinese commerce and Chinese learning. In 1869, the silk manufactures alone were said to give employment to 60,000 persons within its walls, and it has an extensive production of gold and silver work and tinsel paper. On one of the islands in the lake is the great Wan-lan-ko or pavilion of literary assemblies, and it is said that at the examinations for the second degree twice every three years from 10,000 to 15,000 candidates come together. In the north-east corner of the city is the Nestorian church which was noted by Marco Polo, the façade being "elaborately carved and the gates covered with elegantly wrought iron." There is a Roman Catholic mission in Hang-chow, and the Church Missionary Society, the American Presbyterians, and the Baptists have likewise stations. The local dialect differs from the Mandarin mainly in pronunciation. The population, which is remarkable for gayety of clothing, was formerly reckoned at 2,000,000, but is now variously estimated at 300,000, 400,000, or 700,000.

Hang-chow-foo is the Kinsai of Marco Polo, who describes it as the finest and noblest city in the world, and speaks enthusiastically of the number and splendor of its mansions and the wealth and luxuriance of its inhabitants. According to his authority it had a circuit of 100 miles, and no fewer than 12,000 bridges and 3000 baths. The name Kinsai, which appears in Wassaf as Khanzai, in Ibn Batuta as Khansa, in Ordericus as Camsay, and elsewhere as Campsay and Cassay, is really a corruption of the Chinese *King-se*, capital, the same word which is still applied to Peking. From the 10th to the 13th century (960–1272) the city, whose real name was then Ling-nan, was the capital of Southern China and the seat of the Sung dynasty, which was dethroned by the Mongolians shortly before Marco Polo's visit. Up to 1861, when it was laid in ruins by the Taipings, Hang-chow continued to maintain its position as one of the most flourishing cities in the empire, and though for a time it lay comparatively desolate, it has considerably recovered within recent years. It is the seat of the governor of Che-Keang; but the governor-general or viceroy for Che-Keang and Fuh-Keen is now located at Fuh-chow. See Colonel Yule's edition of Marco Polo, vol. ii., for a plan of the city and further details.

HANKA, Wenceslaus or Waklaw (1791–1861), a Bohemian philologist, was born at Horeniowes, a hamlet of eastern Bohemia, on June 10, 1791. He attended the village school in winter only, being occupied during the summer on his father's farm. While still young he acquired a knowledge of Polish and Servian from some soldiers billeted in the neighborhood, and in 1807 he was sent to school at Königgrätz, to escape the conscription. Proceeding then to Prague, he engaged in the study of philosophy, and founded a society for the cultivation of the Czech language. At Vienna, where he afterwards studied law, he established a Czech periodical; and in 1813 he made the acquaintance of Dobrowsky, the eminent philologist. On September 16, 1817, Hanka made the discovery of some ancient Bohemian manuscript poems of the 13th and 14th century in the church-tower of the village of Kralodwor, or Königinhof. These were published in 1818, under the title *Kralodworsky Rukopis*, with a German translation by Swoboda. Great doubt, however, was felt as to their genuineness; and Dobrowsky, by pronouncing *The Judgment of Libussa*, another manuscript found by Hanka, an "obvious fraud," confirmed the suspicion. But some years afterwards Dobrowsky saw fit to modify his decision; and in 1840, after a careful examination of the manuscripts by two eminent antiquaries, Hanka was ultimately vindicated. A translation into English, *The Manuscript of the Queen's Court*, was made by Wratislaw in 1852. The originals were presented by the discoverer to the Bohemian Museum at Prague, of which he was appointed librarian in 1818. In 1848 Hanka took part in the Slavonic congress and other peaceful national demonstrations, being the founder of the political society Slovanska Lipa. He was elected to the imperial diet at Vienna, but declined to take his seat. In the winter of 1848 he became lecturer and in 1849 professor of Slavonic languages in the university of Prague, where he died, January 12, 1861.

His chief works and editions are the following:—*Hankowy Pjsne* (1818), a volume of poems; *Starobyla Skladanie* (1817–1823), in 5 vols.,—a collection of old Bohemian poems, chiefly from unpublished manuscripts; *A Short History of the Slavonic Peoples* (1818): *A Bohemian Grammar* (1822) and *A Polish Grammar* (1839),—these grammars were composed on a plan suggested by Dobrowsky; *Igor* (1821), an ancient Russian epic, with a translation into Bohemian; a part of the Gospels from the Rheims manuscript in the Glagolitic character (1846); the old Bohemian Chronicles of *Dalimil* (1848) and *Procop Lupac* (1848); *Evangelium Ostromis* (1853).

HANKOW (that is, the "Mouth of the Han"), the great commercial centre of the middle portion of the Chinese empire, and since 1858 one of the principal places opened to foreign trade. It is situated on the northern side of the Yang-tse-kiang at its junction with the Han river, about 450 miles west of Shanghai in 30° 32′ 51″ N. lat. and 114° 19′ 55″ E. long., at an absolute height of 150 feet. By the Chinese it is not considered a separate city, but as a suburb of the now decadent city of Hanyang; and it may almost be said to stand in a similar relation to Wu-chang the capital of the province of Hupeh, which lies immediately opposite on the southern bank of the Yang-tse-kiang. Hankow extends for about a mile along the main river and about two and a half along the Han. It is protected by a wall 18 feet high, which was erected in 1863 at an expense of £250,000, and has a circuit of about 4 miles. In 1861 the port was declared open by James Hope and Sir Harry S. Parkes, C. B., and the site of a British settlement was selected in the east end of the town, with a river frontage of 2400 feet, and a depth of from 1200 to 1500. The building area, divided into 108 lots, was quickly bought up, and houses after the Shanghai style were erected. Leases were granted to foreigners as well as to British subjects. A municipal council was formed, and by 1863 a great embankment and a roadway were completed along the river, which has the awkward fashion of rising as much as 50 feet or more above its ordinary levels, and not unfrequently, as in 1849 and 1866, lays a large part of the town under water. On the former occasion little was left uncovered but the roofs of the houses. The success of the foreign settlement has not been so great as was anticipated: even in 1866 the number of foreign residents was 125 instead of 150 as in 1863. Chinese merchants have rapidly got even the foreign trade into their hands: in 1873 they began to run steamers on the river; in 1875 they purchased the property of the Shanghai Steam Navigation Company; and in 1876 they had 57 steamers flying the national flag. Besides tea, which is the staple, the exports of Hankow are leaf tobacco, of which 6,700,000 lb was sent to Europe in 1876, raw silk mainly obtained from Szechuen, rhubarb, gall-nuts, and musk. Of this last the quantity was as much as 2937 lb at £20 sterling per lb. Tea was first sent direct to London in 1864–65; in 1876 this market received from Hankow no less than 34,540,000 lb out of a total export of 86,402,271 lb. The Russian merchants, who are fixing their brick-tea factories in the town, obtained 12,844,476 lb in the same year. They send their goods by water to Tientsin, and thence to Kalgan partly by land and partly by water. A public assay office was established at Hankow in 1864. The Roman Catholics, the London Missionary Society, and the Wesleyans have all missions in the town; and there are two missionary hospitals. Before the Taiping wars, the full brunt of which fell on this part of the country, the sister cities of Hankow, Hanyang, and Wu-chang-fu had a population, it is said, of over 5,000,000. At present Hankow has from 600,000 to 800,000 (Sossnoffsky says only 300,000), and the other two from 400,000 to 700,000.

HANLEY, a market-town and municipal borough of Staffordshire, England, is situated in the centre of the pottery district, 2 miles E. N. E. of Stoke-upon-Trent, and 18 miles N. of Stafford. It is indebted for its rise and prosperity to its pottery manufactures, which include porcelain, encaustic tiles, and earthenware, and give employment to the greater part of the population, women and children being employed almost as largely as men. In the neighborhood coal and iron are obtained. The streets, which are paved with brick, are wide and regular, and in the suburbs there are a number of fine villas. The principal public buildings are the six churches (St John's being a handsome structure with a tower 100 feet in height) and the dissenting chapels, the town-hall, the mechanics' institute, the museum, the theatre, and the national and board schools. There is also a flourishing Government school of art. Hanley, which includes the former township of Shelton, received a municipal constitution in 1857. It is the central and most important of the group of towns constituting the parliamentary borough of Stoke-upon-Trent. The population of Hanley in 1861 was 31,953, and in 1901, 61,524.

HANNAY, James (1827–1873), critic, novelist, and publicist, was born at Dumfries in 1827, and came of the Hannays of Sorbie, an ancient Galloway family. He entered the navy in 1840 and served till 1845, when he adopted literature as his profession. In 1857 Hannay contested the Dumfries burghs in the Conservative interest, but without success. He edited the *Edinburgh Courant* from 1860 till 1864, when he removed to London. In July, 1868, he was appointed British consul at Barcelona, a post which he occupied till his death on the 8th of January, 1873. While at Barcelona he contributed to English periodicals; and his letters to the *Pall Mall Gazette* "From an Englishman in Spain" were highly appreciated. Hannay's best books are *Singleton Fontenoy, Satire and Satirists, Eustace Conyers*, and *Essays from the Quarterly Review*. *Satire* not only shows loving appreciation of the great satirists of the past, but is itself instinct with wit and fine satiric power. The book sparkles with epigrams and apposite classical allusions, and contains admirable critical estimates of Horace (Hannay's favorite author), Juvenal, Erasmus, Sir David Lindsay, George Buchanan, Boileau, Butler, Dryden, Swift, Pope, Churchill, Burns, Byron, and Moore. The *Essays* are full of learning and historical knowledge, and are lit up with sunny humor and brilliant flashes of wit and poetry. Hannay passionately admired three things—learning, literary genius, and good blood. He showed great interest in the history and fortunes of aristocratic families; and his wonderful skill in matters of heraldry and genealogy is recognized by highly competent authorities (see Masson's *Life of Milton*, vol. i. p. 8). He was a ripe Latin scholar; and his style is marked by grace, vivacity, and poetical feeling. He was intimate with his leading literary contemporaries, and wrote the valuable notes to Thackeray's *English Humorists*.

In addition to contributions to *Punch* and the leading reviews, Hannay issued the following works:—*Biscuits and Grog, Claret Cup*, and *Hearts are Trumps* (1848); *King Dobbs* (1849); *Sketches in Ultramarine; Singleton Fontenoy* (1850); an edition of the *Poems* of Edgar Allan Poe, to which he prefixed an exquisite essay on the poet's life and genius (1852); *Sands and Shells* and *Satire and Satirists* (1854); *Eustace Conyers* (1855); *Essays from the Quarterly Review* (1861); *Characters and Criticisms*, consisting mainly of his contributions to the *Edinburgh Courant* (1865); *A Course of English Literature* (1866); and a family history entitled *Three Hundred Years of a Norman House* (1867).

HANNIBAL. Hannibal was a very common Carthaginian name. Its final syllable *bal* occurs repeatedly, as a suffix, in Punic names, and is in fact taken from the chief Phœnician deity, Baal. The entire name denotes, according to a probable interpretation, "the favor of Baal."

The famous Hannibal, the hero of the Second Punic War, was the son of Hamilcar Barca, and was born in 247 B. C. He and his two brothers, Hasdrubal and Mago, were called by the father "the lion's brood." At the age of nine he begged his father, who was leaving Carthage for Spain, to take him with him. The request was granted, but not before he had sworn at that father's bidding on the altar of sacrifice eternal enmity to Rome. That vow determined his life's future. In Spain he was bred up in camps under his father's eye. He was present at the battle in which his father fell in 228 B. C., being then in his nineteenth year. Hamilcar's son-in-law, Hasdrubal, succeeded to the command. Eight years afterwards, in 221 B. C., he was struck down by an Iberian assassin. Meantime the young Hannibal had proved himself thoroughly able both "to obey and to command." It was a matter of course that the soldiers with one voice at once hailed him as their general.

His first object was to complete the work of his father and his father's successor. Spain, he felt, must be more thoroughly overawed, if it was to be a base of operations against Rome. He pushed into the heart of the country, crossed the Tagus, and crushed the resistance of the tribes of the interior. Two campaigns sufficed for the conquest of all Spain to the south of the Ebro, except Saguntum, a town considerably south of the Ebro and some way to the

north of the modern Valencia. It was a Greek colony from Zacynthus (Zante), and had grown into a rich and prosperous place, but, what was now far more important, it was in friendly relations with Rome. To attack it therefore would be like throwing down the gauntlet to the Roman senate and people. But Hannibal was able to tell the home Government at Carthage that the Saguntines were molesting Carthaginian subjects in the neighborhood. Without awaiting an answer, he began the siege. Roman ambassadors at the solicitation of envoys from Saguntum landed on the coast, but were told by Hannibal that he could not see them. They went on to Carthage, but their remonstrances, though the subject of a long debate, were in vain. Eight months passed away, and Saguntum, after a gallant defence, was forced to surrender. Hannibal got a rich booty for his army, and went into winter quarters at New Carthage (Cartagena). Again a Roman embassy went to Carthage and insisted on his being given up. The demand was refused. By the close of the year 219 B. C. the Second Punic War was in fact begun.

Hannibal's resolution was now taken. He prepared at once to invade Italy. He had a numerous and efficient army and a well-filled exchequer. All who shrank from the expedition he dismissed to their homes. In the spring of 218 B. C. he began his great march from New Carthage with an army of 90,000 foot, 12,000 horse, and 37 elephants. The Ebro was easily crossed. In the country beyond he had some fighting with the native tribes, and there he left Hanno, with a force of 10,000 foot and 1000 horse to secure the passes between Spain and Gaul. Again he sent back all in whom he saw signs of hesitation. With a considerably diminished army he passed the Pyrenees at Bellegarde and encamped at Iliberris (Elne). Some Gallic tribes, alarmed at his advance, had assembled in the neighborhood, but he soon conciliated their chiefs and persuaded them that he meant them no mischief. So he continued his march without molestation to the Rhone.

Meanwhile the Romans had done little or nothing to check their enemy. At last the consul, Publius Cornelius Scipio, arrived at Massilia (Marseilles), and was surprised to find that Hannibal was about to cross the Rhone. But he was too late to oppose the passage, and Hannibal crossed the river probably at some point near the village of Roquemaure. He then followed its course, marching up its left bank to its junction with the Isère at Valence, and entered what was known as the "Island of the Allobroges." It was from thence that he began his famous passage of the Alps.

The narrative of Polybius, though it raises some difficult questions, has conveyed to most modern students and scholars the impression that Hannibal crossed by the pass of the Little St. Bernard. If so, he must have entered Italy by the valley of Aosta. The subject has had a literature of its own devoted to it. The result is that the Little St. Bernard Pass may be almost said to have made good its claims to the honor of Hannibal's memorable march. It was familiar to the ancients, and more than once Gauls had passed through it into the plains of Italy. Such high authorities as Arnold, Niebuhr, and Mommsen regard the question as settled in its favor.

Fifteen days in all were occupied in the passage. If the view above indicated is correct, Hannibal at first made his way over Mont du Chat through the Chevelu Pass, then continued his march up the valley of the Isère, and mounted the St. Bernard. He must have descended the mountain by the valley of the Doria. Part of his route, that by which he climbed to the summit, was a narrow defile, and there he was threatened by the mountain tribes which appeared on the heights. At the "white rock," *la roche blanche*, as it is still called, he halted his infantry, while the cavalry and beasts of burden were making their way during the night to the top of the pass. Next day, the ninth day, he stood with his whole army on the highest point and spoke, it is said, some cheering words to his half-frozen Africans and Spaniards. The descent proved trying and dangerous. From the mountain tribes he had little to fear; it was the mountain slope, covered with recent snow, which caused delay and anxiety. The Italian side of the Alps is considerably steeper than the French side, and a road had to be constructed for the passage of the elephants and horses. This was a work of three days. In three more days they arrived in the valley of Aosta, and were welcomed by the Salassi, a friendly tribe of the Insubrian Gauls. The October of the year 218 B. C. saw the passage of the Alps accomplished and Hannibal with his army encamped in northern Italy.

Thus far he had been successful, but at a tremendous cost. His army was shrunk to a force of 20,000 infantry and 6000 cavalry,—the former being composed of Libyans and Spaniards in about the proportion of three to two, and the latter being chiefly Numidians, and admirably efficient.

It was now five months since he had set out from New Carthage. His men of course sorely needed rest, and this they had for a brief space amid the friendly tribes of Cisalpine Gaul. One tribe indeed, the Taurini, was hostile, but he soon captured their chief city, thus overawing the remaining tribes in the upper valley of the Po. It was now high time for the Romans to exert themselves. Scipio after quitting Marseilles, whence he had sent on his army into Spain, had hurried back to Italy, and on reaching Placentia took command of the Roman army quartered there. He was indeed numerically weaker than Hannibal, and was deficient in cavalry. Still he advanced up the Po to meet him, and on the Ticino, somewhere, it would seem, near Vercelli, was fought the first engagement of the Second Punic War. It was a cavalry action, and the inferiority of the Romans in this arm was decisively proved. They were driven back with heavy loss, and Scipio himself was severely wounded, being rescued, it is said, by his son, a lad of seventeen, who subsequently became as famous as Hannibal himself, and had the good fortune to be his conqueror. He has gone down to posterity as Scipio Africanus. The defeated general fell back to the walls of Placentia. The Trebia, a southern tributary of the Po, was between him and the enemy, and he was soon joined by the other consul, Sempronius. Their united armies numbered not less than 40,000 men. Sempronius was for instantly giving battle; Scipio was still disabled by his wound. Sempronius had his way, and on a bitterly cold December day the Romans plunged into the swollen waters of the Trebia in the face of a sleet storm and a cutting wind. They fought well, but when taken in flank by Hannibal's brother Mago, who was lying in ambush amid brambles and bushes in a watercourse, they broke and fled in utter rout.

This decisive victory gave nearly all northern Italy to Hannibal. He let his troops rest during the winter, and added to them a number of Gauls. Early in the spring of 217 B. C. he decided to cross the Apennines and to penetrate into the heart of Italy. The route which he took brought him into the marshy lowlands of the Arno near Lucca and Pisa, and here he and his men had to wade through water for four days. Many of them perished miserably, and Hannibal himself lost an eye from ophthalmia. At last he encamped at Fiesole on high ground. The two consuls Flaminius and Servilius were, with their armies, respectively at Arezzo and Rimini. Flaminius was an impetuous man, and eager to win the glory of settling the war once for all. Hannibal, quitting the valley of the upper Arno, marched past him towards Perugia, ravaging the country and so provoking the Roman general to pursue him. The road from Cortona to Perugia skirts the northern shore of Lake Trasimene, and into this road, which is in fact a mountain defile, the Roman column unwarily entered. They were caught in a trap. Hannibal had posted his light troops on the hills on either side, while he himself blocked the outlet near Passignano with the best of his infantry. As soon as the Romans were in the pass they were assailed on all sides, and the battle soon became a mere massacre. The Roman army was in fact destroyed, and Flaminius was among the slain. We might suppose that Hannibal would have now done well to have marched straight on Rome, and this the Romans expected. But he may well have thought that it would be better to wait the chance of insurrection among the Italian communities. So he marched through Umbria, and again crossed the Apennines into Picenum. He then marched southwards along the coast into Apulia and encamped at Arpi. Meanwhile the Romans had made the famous Fabius Maximus their dictator. After levying an army of four legions, Fabius marched in pursuit of the enemy, having first effected a junction with the army under Servilius at Rimini.

From the first Fabius had decided on the policy which earned for him the name of the *Cunctator*, the Delayer. He dogged his enemy's steps, but would never risk an engagement. The richest districts of Southern Italy were laid waste under his very eyes. But he could not be provoked

into any rash movement. Once indeed it seemed as if Hannibal was himself entrapped. He had been ravaging Campania, and was on the point of retreating into Samnium, when Fabius posted a force at the head of the pass which afforded the only available means for his retreat. Hannibal is said to have driven a multitude of oxen with lighted faggots on their horns up the hills overhanging the road, so as to give the impression that he and his army were retreating over the heights. Fabius's detachment quitted its position to check the supposed movement, and thus gave Hannibal an opportunity of escaping through the pass. The tactics of Fabius disgusted his men, and when he had to leave them for a time, he found on his return that his master of the horse, Minucius, on the strength of a small success won in his absence, was eager to bring on a general engagement. Fabius gave him a part of the army, with which Minucius ventured on an attack. He was on the brink of destruction when he was rescued by the dictator's timely interposition. After this Hannibal went into winter quarters at Geronium in the north of Apulia.

In the spring of the next year, 216 B. C., he moved south and pounced on Cannæ, where Roman supplies were stored up in great abundance. The town is about 6 miles from the mouth of the Aufidus and about 8 from Canosa. The Romans were now again eager to strike a decisive blow. So a vast army was raised by the consuls of the year, Æmilius Paulus and Terentius Varro, numbering 80,000 infantry and 6000 cavalry. Hannibal's army was probably far inferior numerically. The consuls on arriving in Apulia made Canusium (Canosa) their headquarters. For some few days the armies faced each other on the banks of the Aufidus. There were some preliminary manœuvres and skirmishes, till at last Varro, when it came to his turn to command, determined to fight. Both armies crossed the river, and Hannibal's men were drawn up within a loop which it forms near Cannæ. On either flank he stationed a strong body of his veteran infantry. His other infantry, ranged in the centre in a crescent form, was soon driven in by the Roman legions, which had advanced to the attack in very deep formation. But meanwhile Hannibal's cavalry had put the Roman horse to rout, and had fallen on their rear. The Roman columns were now attacked also on either flank by the Carthaginian infantry. Pressed into a dense mass they were cut down without the possibility of resistance. The carnage is said to have been prolonged for eight hours. The Roman army was all but utterly destroyed. The consul Æmilius Paulus, nearly all the officers, and eighty senators, perished in the slaughter. Varro indeed escaped with a few horsemen to Venusia. The remainder were slain or made prisoners. It was at a comparatively small cost to himself that Hannibal won this great victory.

It might well be thought that such a victory would prove decisive, and that it must have been had Hannibal instantly pushed on to Rome. But he had probably good reasons for not doing so. He was, it must be remembered, as much as 200 miles from Rome; he would have had to march through still hostile populations, and by the time he would have arrived, he must have known that the first panic would have abated, and that the notion of carrying the city by a *coup de main* was simply preposterous. What he counted on was the dissolution of the Italian confederacy, and a widespread revolt throughout Italy. Nor was he altogether deceived. The disaster of Cannæ shook the loyalty of the Italian peoples. Rome was deserted by most of Apulia and Samnium, and almost wholly by the Lucanians and Bruttians. She retained indeed some strong fortresses, as Cales, Fregellæ, Casinum, Beneventum, Venusia, and these enabled her armies to maintain their ground. But Capua, in Campania, the richest and most powerful city in Italy after Rome itself, was lost to her. Thither Hannibal made his way from Cannæ, and there he went into winter quarters, which were perhaps too comfortable and luxurious. But the story that his men became utterly demoralized is absurd. They proved in the subsequent years of the war that they could move rapidly and fight bravely. We may indeed well suppose that by this time many of his veteran Spaniards and Africans had been replaced by native Italian soldiers. It is, however, clear that he still had a fine army. It is true indeed that after Cannæ his star seems rather to decline, but the explanation of this is that the Romans again reverted to the steady cautious tactics which they had learnt under Fabius. They too were for the most part well officered. The ablest of the generals was Marcellus. Yet even he never beat his antagonist in anything like a pitched battle. The Romans after Cannæ made prodigious efforts. They sent three armies into the field, to watch and to check the enemy's movements. They kept themselves in strongly entrenched camps near fortresses which Hannibal had not the means of taking. Some indeed he did capture, as Nuceria, Acerræ, and Casilinum in Campania. At Cumæ, Neapolis, and Nola he was foiled. The two years after Cannæ, 215 and 214 B. C., passed without much being achieved on either side. Hannibal was vaguely hoping for reinforcements from Carthage, and for the aid of Philip, king of Macedon.

Next year, 213 B. C., he gained a considerable success. Tarentum surrendered, and so did Metapontum and Thurii. At Tarentum indeed the Roman garrison still clung to the citadel, and Hannibal could not dislodge it. From Carthage he had received a reinforcement of some elephants and of 4000 Numidian cavalry, but this did not enable him to resume the offensive with much effect. Meanwhile Capua, besieged by two consular armies, seemed doomed to fall again into Roman hands. One of Hannibal's subalterns, Hanno, was defeated in the attempt to revictual the place. Hannibal himself hurried to its aid, but he could not bring the Romans to a battle, though he did temporarily raise the siege. The year 212 B. C. was one of mingled success and disaster for Rome. Syracuse that year had to surrender to Marcellus, and Carthage seemed to have quite lost Sicily. Here was an important gain for Rome. But in Spain the two brother Scipios had been cut off by Hasdrubal, who could now cross into Gaul and advance on Italy. And in Italy there had been some serious reverses. It would appear that there were actually six Roman armies in the field against Hannibal. One of these under Fulvius he destroyed in Apulia; another, made up of enfranchised slaves under Gracchus—a proof this of the extremity to which Rome was reduced—he put to rout, Gracchus himself perishing in an ambuscade.

By the spring of 211 B. C. the Romans were besieging Capua with three armies. It was clear that the city must fall, unless Hannibal could come to its rescue. He made the attempt indeed, but he could not break the hostile lines, so strongly were they entrenched. Then he conceived the idea of drawing them off by menacing Rome itself. Now for the first time he marched through Latium and made it taste all the horrors of war. At last he encamped 3 miles from Rome on the Anio. But the Romans did not lose their presence of mind, or even relinquish the siege of Capua; they simply recalled Fulvius with one of the armies. There were two legions within the city, and Hannibal probably never meditated a serious assault. He ravaged the country up to the walls, but he did nothing more. Through Samnium he again marched into Apulia and thence into Bruttium, where he unsuccessfully attacked Rhegium and the citadel of Tarentum. Capua meanwhile was forced to surrender. This greatly discouraged Hannibal's Italian allies. Marcellus too had come back from Sicily after his capture of Syracuse. Altogether the year 211 B. C. was a very unpromising one for Hannibal. Next year, 210 B. C., however, he partly recovered lost ground by completely defeating the Roman prætor Cneius Fulvius at Herdonea, the modern Ordona, in Apulia. But he could not follow up this success, and his evident weakness led to the speedy return of Samnium and Lucania to the Roman confederacy. The following year saw Tarentum slip from his grasp. But he soon had his revenge. Next year the two consuls, Crispinus and Marcellus, were both cut off and slain by the Numidian cavalry in the neighborhood of Venusia. Another disaster soon followed. A Roman army was besieging Locri in the extreme south. It was routed and indeed destroyed by Hannibal. Thus at the close of the year 208 B. C. the struggle was clearly by no means decided.

Rome had been making immense efforts. We hear of her having twenty-three legions under arms, and possibly the total number of her armies may have reached 200,000 men. The patriotic spirit of her citizens was still at the highest. But her finances were in a deplorable plight, and corn had risen to an almost famine price. The country round must have been woefully wasted, and multitudes reduced to beggary. One thing indeed the Romans had had to console them during these trying years. The Latin communities in Etruria and Latium had stood by them with wonderful fidelity. This had been their salvation. But

now in the years 209 and 208 B. C. came signs of discontent and wavering. Of the Latin colonies several declared that they could no longer furnish contingents or contributions. There were rumors too of a disloyal movement in Etruria. Bnt, worst of all, there came news in the autumn of 208 B. C. that Hasdrubal had crossed the Pyrenees. By next summer he would have passed the Alps. Should the two brothers unite their forces, Rome's fate, it could hardly be doubted, would be sealed. She was now in far greater jeopardy than she was even after the disastrous day of Cannæ. The year 207 was thus a very anxious one. Claudius Nero and Marcus Livius were the consuls. The first was to watch Hannibal in Apulia, the other was to encounter Hasdrubal in Cisalpine Gaul. Livius retreated before the new invader, and let him reach Sena in Umbria, to the south of the river Metaurus, without opposition. Thence Hasdrubal sent despatches to his brother, who was at Canusium in Apulia. The plan was that they should join their armies at Narnia on the Flaminian road, between 50 and 60 miles from Rome. Unluckily for the two brothers the despatches fell into the hands of Nero. His resolution was formed in a moment. Leaving the bulk of his army in its camp, he hurried northwards with 7000 of his best troops, and after a rapid march of 200 miles he joined Livius. The two generals forced Hasdrubal to a battle. The Carthaginian was utterly defeated, and he was himself slain. Nero returned with all speed to his army, and informed Hannibal of the defeat and death of his brother by having the head of Hasdrubal flung into his camp. With that sight all hope must have died in Hannibal's heart. The battle of the Metaurus was indeed one of the decisive battles of the world. It decided the Second Punic War. From that time, for four more years, Hannibal could but stand on the defensive in the southernmost corner of the Italian peninsula. But even to the last no Roman general dared to close with him. Never in a single battle, as Polybius says, was he beaten while in Italy. Before quitting the country, he left a memorial of his wonderful achievements. In the temple of Juno on the Lacinian promontory, near Crotona, he inscribed on brazen tablets in Punic and in Greek an account of his expedition and his campaigns. Polybius saw the inscription and doubtless availed himself of it for his history. For fifteen years Hannibal had maintained himself in Italy, ravaging it from end to end, and inflicting on the Romans according to their own calculation a total loss of 300,000 men. Now all was clearly over. After Nero's victory the Romans could afford to wait the course of events. Scipio had been victorious in Spain, and early in 204 B. C. he was allowed to cross into Africa. Soon it was clear that he would threaten Carthage more effectively than Hannibal had ever threatened Rome. He received the order of recall at Crotona, and thence embarked for Africa. He landed at the smaller Leptis, on the coast of Tunis, late in the year 203 B. C., and lingered during the winter at Hadrumetum, the modern Susa. His brothers Hasdrubal and Mago had both fallen, and he was now the last of the "lion's brood." Fugitive as he was, his presence roused the Carthaginian spirit. The people would not hear of peace. Hannibal indeed attempted to negotiate, and had an interview with Scipio, but in vain. When he saw that he must fight, he could not have felt any of his old confidence. He had some good troops, but he was numerically inferior to the enemy. Of his veterans but few could have remained. The armies at last met at Zama, somewhere near the modern Kef. The battle was obstinately contested, and Hannibal's old soldiers died fighting in their ranks. But he never really had a chance of victory. Many of his men were raw mercenaries, and some of them deserted to the enemy. His army was utterly discomfited, and indeed annihilated. The defeat was not discreditable to him, but it was decisive. With a handful of men he escaped to Hadrumetum, and in the year 202 B. C. the Second Punic or, more properly, the Hannibalian War was at an end.

He was still only in his forty-sixth year. He soon showed that he could be a statesman as well as a soldier. Peace having been concluded, he was appointed chief magistrate of the state. The office had become rather insignificant, but Hannibal restored its power and authority. The oligarchy, always jealous of him, had even charged him with having betrayed the interests of his country while in Italy, and neglected to take Rome when he might have done so. The dishonesty and incompetence of these men had brought the finances of Carthage into grievous disorder. So effectively did Hannibal reform abuses that the heavy tribute imposed by Rome could be paid by instalments without additional and extraordinary taxation. Carthage grew prosperous, and again the Romans trembled. Seven years after the victory of Zama they demanded Hannibal's surrender. They were still in mortal dread of their old enemy. Hannibal did not wish his countrymen to disgrace themselves, and he therefore at once became an exile. First he went to Tyre, the mother-city of Carthage, and thence to Ephesus, where he was honorably received by Antiochus, king of Syria, who was then preparing for war with Rome. Hannibal soon saw that the king's army was no match for the Romans. He advised him to equip a fleet and throw a body of troops on the south of Italy, adding that he would himself take the command. But he could not make much impression on Antiochus, who was a conceited man, quite ignorant of the strength of Rome. The story was told that, pointing to the great army he had assembled at Ephesus, he asked Hannibal if he did not think that these were enough for the Romans. Hannibal's reply was, "Yes, enough for the Romans, however greedy they may be." The great army in which Antiochus had trusted was in 190 B. C. routed by Scipio at Magnesia near Smyrna. Again Rome demanded the surrender of Hannibal.

The end was now at hand. From the court of Antiochus Hannibal fled to Crete, but he soon went back to Asia, and sought refuge with Prusias, king of Bithynia. Once more the Romans were determined to hunt out the old man, and they sent Flamininus to insist on his surrender. Prusias was but a poor paltry princeling, and he promptly complied. Hannibal did not choose to fall into his enemies' hands. At Libyssa, on the eastern shore of the Sea of Marmora, he took poison, which, it was said, he had long carried about with him in a ring. The precise year of his death was a matter of controversy. If, as Livy seems to imply, it was 183 B. C., he died in the same year as his great and victorious antagonist, Scipio Africanus.

As to the transcendent military genius of Hannibal there cannot be two opinions. The man who for fifteen years could hold his ground in a hostile country against several powerful armies and a succession of able generals must have been a commander and a tactician of supreme capacity. Wonderful as his achievements were, we must marvel the more when we take into account the grudging support he received from Carthage. As his veterans melted away, he had to organize fresh levies on the spot. We never hear of a mutiny in his army, composed though it was of Africans, Spaniards, and Gauls. He who could throw a spell over such rough and various natures must indeed have been an extraordinary man. Again, all we know of him comes for the most part from hostile sources. The Romans feared and hated him so much that they could not do him justice. Long after the peril had passed away, we may well believe that Horace accurately reflected their sentiment in describing him, as he does more than once, as the *dirus Hannibal*. Livy speaks of his great qualities, but he adds that his vices were equally great, among which he singles out his "more than Punic perfidy" and "an inhuman cruelty." For the first there would seem to be no further justification than that he was consummately skilful in the use of ambuscades. For the latter there is, we believe, no more ground than that at certain crises he acted in the general spirit of ancient warfare. Sometimes he contrasts most favorably with his enemy. No such brutality stains his name as that perpetrated by Claudius Nero on the vanquished Hasdrubal. Polybius merely says that he was accused of cruelty by the Romans and of avarice by the Carthaginians. He had indeed bitter enemies, and his life was one continuous struggle against destiny. For steadfastness of purpose, for organizing capacity and a mastery of military science, he has perhaps never had an equal.

Considering his fame, we should have expected to find a number of anecdotes about him. There are, however, only a few. One is given by Cicero (*De Oratore*, ii. 18); and may fairly find a place here. When he was an exile at Ephesus, he was invited to hear a lecture from one Phormio, a philosopher. The lecturer discoursed on things in general and on the duties of a commander-in-chief in particular, and was warmly applauded by his audience. Some of the hearers turned to Hannibal and asked him what he thought of it. "I have seen," said he, "plenty of old fools in my time, but this man beats them all."

Our chief sources for the life of Hannibal are Polybius and Livy. With Polybius we are generally on safe ground, but unfortunately we have not his guidance throughout. Livy's narrative is too much devoted to his country to be impartial; but he is minute, and his entire history of the Second Punic War has come down to us. There are besides the meagre epitomes of Florus and Orosius, and the remains of the abridgment of Dion Cassius by Zonaras. We have also Plutarch's lives of Fabius Maximus and Marcellus, in which of course Hannibal figures conspicuously, and a life by Cornelius Nepos. To these must be added Appian, whose book on the *Wars of Hannibal* is not without some value. (W. J. B.)

HANNIBAL, a city of the United States, in Marion county, Missouri, is situated on the west bank of the Mississippi river, 150 miles above St. Louis. Owing to its position on the river and its extensive railroad connections, it has become a busy commercial town; and evidence of the prosperity of many of its inhabitants is afforded by the number of fine residences on the surrounding slopes. It possesses a city hall, a Roman Catholic seminary, and a high school. The river is crossed by a splendid iron bridge, which has provision both for ordinary and for railway traffic. The principal shipping trade is in lumber with other parts of the State, as well as with Kansas and Texas; but tobacco, pork, and flour are also extensively shipped. The manufactories include foundries, car-works, machine-shops, tobacco-works, beef-curing establishments, and flour-mills. In the neighborhood there are lime-works and coal-pits. The population, which in 1860 was 6505, and in 1870 was 10,125, of whom 1616 were colored and 1632 foreigners, is now (1900) estimated at 12,780.

HANNO (a very common Carthaginian name, Greek Ἄννων), according to the title of the *Periplus* that passes under the name, was a king (basileus) of the Carthaginians who undertook an exploring and colonizing expedition along the north-western coasts of Africa beyond the Pillars of Hercules, and on his return inscribed a narrative of his voyage in the temple of Saturn. There are no data to fix with any precision the time at which he flourished, the most definite statement about the matter being Pliny's "Punicis rebus florentissimis." Bougainville and Vivien de Saint Martin are disposed to assign him to *circa* 570 B. C.; Heeren, Kluge, and others make him contemporary with a Hanno, father of Hamilcar (*c.* 510 B. C.); and Müller thinks he may be possibly identified with Hanno the son of Hamilcar (*c.* 470 B. C.). According to the *Periplus*, which is the only detailed notice of the expedition that has come down to us, he sailed with sixty galleys (*pentecontoroi*) and 30,000 (?) men and women, and in the course of his voyage south founded the city of Thymiaterium and settled colonies at Gytte, Acra, Melitta, Arambys, and in the island of Cerne or Kerne. The terminus of the voyage was an island beyond a gulf called the Noti Cornu, in which they found a number of "hairy women" whom the interpreters named *gorillas*.

The identification of the various points mentioned in the narrative has given scope to abundant dissertation and conjecture, and the question as to the site of the gorilla island, or southmost limit of the exploration, has been discussed with special interest. Bougainville and Dureau de la Malle maintain that Hanno reached the Bight of Benin; Müller and Vivien de Saint Martin find his *ultima Thule* in the Gulf of Sherboro; Mannert decides in favor of Bissagos, Heeren for the mouth of the Gambia, Malte Brun for the Bay of Cintra, and Quatremère for the neighborhood of the Senegal, while Gosselin would go no further south than Cape Nun. But while authorities differ so much in the matter of identification, almost all agree that the narrative is one of the most remarkable records of early exploration that have been preserved. "In its original form," says Vivien de Saint Martin, "it was only a commemorative inscription of barely a hundred lines, and yet in spite of this extreme conciseness there is not one of its details, whether of localities or distances, which is not rigorously conformable to the very accurate acquaintance which we now have of these coasts." In the 18th century Dodwell called the authenticity of the *Periplus* in question, but it was considered that his arguments had been disposed of by Falconer[1] and others. Recently, however, M. Tauxier has renewed the attack, maintaining that in reality we have nothing before us but "a compilation due to an ignorant Greek of the 1st century B. C., brought to its present form by some Christian of the time of Theodosius, probably a student to whom the task was assigned of adapting the old *Periplus* to the geographical ideas of the day."

The editio princeps of the *Periplus* of Hanno issued from the press of Frobenius at Basel in 1533 (Ἀρριανοῦ περίπλους, κ.τ.λ.; Ἀννωνος περίπλους Λιβύης, κ.τ.λ.). Of more recent editions it is enough to mention that in Hudson's *Geographiæ veteris scriptores Græci minores*, vol. i., Oxford, 1698, with Dodwell's dissertations prefixed; Arnold Schmidt, *Arrians Indische Merkwürdigkeiten und Hannons Seereise*, Brunswick and Wolfenbüttel, 1764; Thomas Falconer, *The Voyage of Hanno translated . . . and defended against the objections of Mr. Dodwell*, London, 1797: Kluge, *Hannonis Navigatio*, Leipsic, 1829; and Carl Müller, *Geographi Græci Minores*, Paris, 1855. For further details see Müller's *Prolegomena*; Bougainville in *Acad. des Inscr. et Belles Lettres*, tome xxvi.; Vivien de Saint Martin, *Le Nord de l'Afrique dans l'Antiquité*, Paris, 1863; Dr. Judas in *La Revue d'Orient*; and M. Tauxier in *La Globe*, Geneva, 1867, and *Comptes Rendus de l'Acad. des Inscr.*, Paris, 1875.

HANNO, the chief opponent of Hamilcar and Hannibal at Carthage. Few details are known of his life; his influence on the history of his country, which for more than forty years was very great, can be appreciated only from a detailed history of the period. During the First Punic War he conducted successfully a campaign against some African nation, and he soon became the most trusted leader of the aristocratic party. When in 240 B. C. Hamilcar's veterans returned from Sicily, clamoring for their promised pay, Hanno was sent to require them to accept partial payment; and on their rebellion he was appointed to the command against them. His unpopularity with the army and his incapacity led to several defeats, and the Government was reluctantly forced to associate Hamilcar with him. After Hamilcar had at length crushed the rebellion, Hanno seems to have remained at Carthage exerting all his influence against the democratic party. During the Second Punic War he advocated peace with Rome; and he even, according to Livy (xxiii. 13), advised that Hannibal should be given up to the Romans. After the battle of Zama (203 B. C.) he was one of the ambassadors sent to Scipio to sue for peace, and after the war he is mentioned among the leaders of the Roman party.

HANOVER (German *Hannover*), formerly an independent kingdom, but since 1866 a province of Prussia, lies between 51° 18′ and 53° 52′ N. lat. and 6° 43′ and 11° 45′ E. long., and is bounded on the N. by the North Sea, N. E. by Holstein, Hamburg, and Mecklenburg, E. and S. E. by Prussian Saxony and the duchy of Brunswick, S. W. by Hesse-Cassel and Westphalia, and W. by Holland. These boundaries include the grand-duchy of Oldenburg, which stretches southward from the North Sea nearly to the southern boundary of Hanover. A small portion of the province in the south is separated from Hanover proper by the interposition of a part of Brunswick. The area of the province extends to 14,870 English square miles.

Physical Features.—The greater part of Hanover is embraced in that extensive plain which, commencing on the shores of the North Sea, terminates on the frontiers of Russia. The most fruitful districts are on the banks of the Elbe and near the North Sea, where, as in Holland, rich meadows are preserved from being immersed in water by broad dykes and deep ditches, constructed and kept in repair at great expense. It is only the southern portion that is mountainous; the district of Klausthal, containing the Harz, is wholly so, as well as some parts near Göttingen, and in the district of Hildesheim. The Harz mountains are not a part of any chain, but rise from a plain in an isolated group, the highest points of which are nearly in the centre (see Harz). They are covered with extensive forests. On their lower slopes the trees are of the deciduous kinds, but pines alone are found on the summits.

The whole of Hanover dips towards the north, and the rivers consequently flow in that direction. The Elbe, which forms the boundary on the N. E., receives the following tributaries:—the Ohre, which rises in the district of Lüneburg; the Aland and the Jetze, which come out of the province of Saxony, and are navigable in their lower course; the Ilmenau, which becomes navigable at Lüneburg; the Este, navigable to Buxtehude; the Lühe, navigable to Hornburg; the Schwinge, by which vessels reach Stade; the Oste, navigable to Kirchosters; and the Medem, which runs through the Hadeln-land, and admits large vessels up to Otterndorf. The Weser enters Hanover at Münden, being there formed by the junction of the Fulda and the Werra. It is navigable for barges from the spot at which its name commences; and it receives the Hamel, the Aller, the Oertze, the Leine, the Bohme, the Eyther, the Wümme, which in the lower part of its course takes the name of Lesum, the Geeste, and the Hunte—all of them purely Hanoverian rivers. The Ems rises in the province of Westphalia, and after entering Hanover receives the waters of the Aa, the Haase, the Else, and the Leda; it falls into the Dollart near Emden, which is the principal

[1] [Thomas Falconer (1772–1839), an Oxford fellow, Bampton lecturer (1810), edited the *Periplus*, and *Strabo*, after notes by his uncle, Thomas Falconer.—Am. Ed.]

seaport in the kingdom. It is navigable for flat-bottomed vessels from Rheina downwards, and for sea-going ships from Halte and Weener. The Vecht, a river of short course, rises in the province of Westphalia, and falls into the Zuyder Zee. A navigable canal from the Vecht to Münster connects that city with the Zuyder Zee. Navigable canals connect the various river systems.

The principal lakes are the Steinhuder Meer, about 4 miles long and 2 broad, and 20 fathoms deep, on the borders of Schaumburg-Lippe; the Dümmersee on the borders of Oldenburg, about 12 miles in circuit; the lake of Bederkesa, and some others in the moorlands of the north; the Seeburger See near Duderstadt; and the Oderteich, in the Harz, 2100 feet above the level of the sea.

Climate.—The climate in the low-lying districts near the coast is moist and foggy, in the plains mild, on the Harz mountains severe and variable. In spring the prevailing winds blow from the N. E. and E., in summer from the S. W. The mean annual temperature is about 46° Fahr.; in the town of Hanover it is higher. The average annual rainfall is about 23·5 inches; but this varies greatly in different districts. In the west the Höhenrauch, a thick fog arising from the burning of the moors, is a plague of frequent occurrence.

Agriculture.—Though agriculture constitutes the most important branch of industry in the province, it is still in a very backward state. The greater part of the soil is of inferior quality, and much that is susceptible of cultivation is still lying waste. Of the entire area of the country 28·2 per cent. is arable, 16·6 in meadow or pasture land, 13 per cent. in forests, 37·2 per cent. in uncultivated moors, heaths, etc.; from 17 to 18 per cent. is in possession of the state. The best agriculture is to be found in the districts of Hildesheim, Calenberg, Göttingen, and Grubenhagen, on the banks of the Weser and Elbe, and in East Friesland. Of the whole area under cultivation in 1878 there was under wheat 1·9 per cent.; rye, 10·9, barley, 0·9; oats, 5·7; buckwheat, 1·4; pease, 0·4; potatoes, 2·8; and meadow, 10·4 per cent. The extent of tillage was 3,295,752 acres of a total area of 9,464,446 acres. The total yield for the season 1878 was—wheat, 2,298,543 cwt.; rye, 10,843,726 cwt.; barley, 1,350,417 cwt.; oats, 7,054,389 cwt.; buckwheat, 1,150,515 cwt.; pease, 348,934 cwt.; potatoes, 17,828,490 cwt.; hay, 34,238,480 cwt. Rye is generally grown for bread. Flax, for which much of the soil is admirably adapted, is extensively cultivated, and forms an important article of export, chiefly, however, in the form of yarn. Hemp, turnips, and hops are also among the exports. There were in 1877 805 acres planted with tobacco, the produce of which was 12,207 cwt., valued at £15,150 Of beet there were 27,700 acres, yielding 5,376,480 cwt. of beet-root, from which was manufactured in 27 sugar-mills, with 211 engines of 2433 horse-power, 581,707 cwt. of raw sugar. Apples, pears, plums, and cherries are the principal kinds of fruit grown. Red bilberries (*Vaccinium Vitis idæa*) from the Harz and black bilberries (*V. Myrtillus*) from the Lüneburg Heath form an important article of export.

Live Stock.—By the returns of 1873 there were in Hanover 191,006 horses, 132 mules, 404 asses, 894,158 head of horned cattle, 1,856,962 sheep (including 511,892 heidschnucken, a very coarse breed), 510,550 pigs, 172,902 goats, and 217,045 beehives. Bees are principally kept on the Lüneburg Heath. The number of sheep was larger before 1867, but the number of horned cattle has increased. Horses are reared in the marshes of Aurich and Stade, in Hildesheim and Hanover; the cattle of Aurich (East Friesland) are famous for their size and quality. The best sheep belong to the country lying between the capital and the Harz. Large flocks of geese are kept in the moist lowlands; their flesh is salted for domestic consumption during the winter, and their feathers are prepared for sale.

Mining.—Minerals occur in great variety and abundance. The Harz mountains are rich in silver, lead, iron, and copper; coal is found around Osnabrück, on the Deister, at Osterwald, etc., lignite in various places; salt-springs of great richness exist at Egestorfshall and Neuhall near Hanover, and at Lüneburg; and petroleum may be obtained south of Celle. In the cold regions of the northern lowlands, peat occurs in beds of immense thickness. The mining returns for the year 1878 give the following quantities and values:—coal, 301,728 tons (£118,765); lignite, 126,714 tons (£33,724); asphalt, 26,000 tons (£28,000); iron ores, 170,969 tons (£16,000); zinc, 5141 tons (£16,944); lead ore, 32,866 tons (£188,785); copper ore, 16,793 tons (£45,286); silver ore, 35 cwt. (£1420); manganese ore, 3070 cwt. (£719); salt from springs, 73,007 tons (£91,493).

Manufactures.—Works for the manufacture of iron, copper, brass, wire, silver, lead, vitriol, and sulphur are carried on to a large extent. About 40,000 persons are employed in these works and in the mines, the yearly revenue from which amounts to £1,200,000. The production of 1878 consisted of—iron, 1,562,231 tons; lead, 8774 tons; copper, 2556 cwt.; silver, 53,932 lb; gold, 171 lb; sulphuric acid, 573 tons; blue vitriol, 788 tons. The iron works are very important; smelting is carried on in the Harz and near Osnabrück; there are extensive foundries and machine factories at Hanover, Linden, Osnabrück, Hameln, Geestemünde, Harburg, Osterode, etc., and manufactories of arms at Herzberg, and of cutlery in the towns of the Harz and in the Sollinger Forest. The textile industries are prosecuted chiefly in the towns. Linen yarn and cloth are largely manufactured, especially in the south about Osnabrück and Hildesheim, and bleaching is engaged in extensively; woollen cloths are made to a considerable extent in the south about Einbeck, Göttingen, and Hameln; cotton-spinning and weaving have their principal seats at Hanover and Linden. Glass houses, paper-mills, potteries, tile-works, and tobacco-pipe works are numerous. Wax is bleached to a considerable extent, and there are numerous tobacco factories, tanneries, breweries, vinegar works, and brandy distilleries. Shipbuilding is an important industry, especially at Papenburg, Emden, Leer, Stade, and Harburg; and at Münden river barges are built.

Commerce.—Although the carrying trade of Hanover is to a great extent absorbed by Hamburg and Bremen, the shipping of the province counts 867 sea-going vessels, the larger vessels all belonging to Geestemünde. Emden is destined to become a very important seaport when the extensive harbor improvements have been completed.

Administration.—The province is divided into six landdrosteien or counties, and these again have been subdivided, since the annexation by Prussia, into smaller districts. There is a provincial assembly representing 43 towns and 101 bailiwicks. A court of appeal for the whole province sits at Celle, and there are 12 superior courts. To the German parliament (reichstag) Hanover sends 19 members; to the Prussian house of assembly (abgeordnetenhaus) 36. The debts of the province, contracted before the occupation by Prussia, amount to £226,622.

Population.—The census of 1871 gave the population as 1,963,618; 1,713,664 belonged to the Evangelical Church, 233,633 were Roman Catholics, and 12,790 Jews. The urban population numbered 503,102, and the rural 1,454,587. By the census of 1905 the population had reached 2,759,544. There are 114 towns, but only 9 have a population exceeding 10,000, viz., Hanover, Osnabrück, Hildesheim, Linden, Harburg, Lüneburg, Celle, Göttingen, and Emden.

Counties.	Extent in English sq. miles	Population, 1st Dec., 1875.			Inhabitants to the sq. mile.
		Males.	Females.	Total.	
Hanover.....	2197·4	215,364	214,695	430,059	196
Hildesheim ..	1941·7	204,010	209,587	413,597	213
Lüneburg.....	4375·6	194,586	192,128	386,714	88
Stade.....	2493·7	154,694	153,515	308,209	123
Osnabrück ...	2358·6	139,761	138,000	277,761	118
Aurich.....	1181·0	99,310	101,743	201,053	170
	14,548·0	1,007,725	1,009,668	2,017,393	139

Education.—Amongst the educational institutions the university of Göttingen stands first, with an average yearly attendance of 900 students. There are besides 18 gymnasiums, a progymnasium, 9 first-class grammar schools, 11 normal and training schools, a polytechnic school at Hanover, a school of mines and forestry at Klausthal, several naval academies and schools of art, 3 asylums for the deaf and dumb, 2 for the blind, and numerous other charitable institutions.

History.—The word Hanover originally applied only to the city so called. It was gradually, however, extended to the country of which Hanover was the capital; and it was officially recognized as the name of the state when in 1814 the electorate of Lüneburg was made a kingdom.

In ancient times the country formed part of Saxony, which remained independent until the time of Charlemagne; and afterwards it was included in the duchy of Saxony. After the extinction of the Billing family, which ruled Saxony for about two centuries, the duchy was granted to Lothair of Supplinburg, who in 1125 was elected emperor. He gave his daughter in marriage to Henry the Proud, duke of Bavaria, of the ancient house of Guelph, which already had important allodial possessions in Saxony. Henry the Proud became duke of Saxony as well as of Bavaria; and his son Henry the Lion, after a time of bitter dispute, was installed by Frederick Barbarossa in his father's great position. In the latter part of Frederick's reign, in 1180, Henry was deprived of both his duchies, but was allowed to keep the allodial possessions of his family, viz., Brunswick and Lüneburg. In 1235 these lands were yielded by Henry's grandson, Otto Puer, to the emperor Frederick II., who granted them to him in fief as a duchy. Otto's two sons divided their inheritance into two duchies in 1267, and thus were formed the old Lüneburg and the old Brunswick lines. There was a fresh division in 1428, whereby were formed the so-called middle lines of Brunswick and Lüneburg. From 1527

Lüneburg was under the sole government of Duke Ernest the Confessor, who was an ardent adherent of Luther, and so persistently labored to promote the Reformation in his country that it has been essentially Protestant ever since. He died in the same year as his friend Luther, 1546; and from him descended the younger lines of Brunswick and Lünehurg, or of Brunswick-Wolfenbüttel and Brunswiek-Lünehurg. For in 1634 Duke Frederick Ulrich of Brunswick-Wolfenhüttel suddenly died childless, and his duchy was inherited hy Augustus the younger, the descendant of Ernest's eldest son Henry; and Brunswick has remained in the hands of this dynasty till the present day. Meanwhile Lünehurg had been ruled over hy William, the younger son of Ernest the Confessor; and when he died in 1592 he left seven sons, of whom four, Ernest, Christian, Augustus the elder, and Frederick, one after the other, became rulers of the land. Frederick, who survived all his hrothers, died in 1648, the year in which the Thirty Years' War was brought to a close. The only one of the seven hrothers who married was George, to whom was granted as a separate duchy a part of Lünehurg called Calenherg, of which he made Hanover the capital, Celle being the capital of Lünehurg. He arranged that his eldest son should he allowed to select either Calenberg or Lüneburg, that the second should take the duchy not chosen hy his hrother, and that the remaining sons should he content without having territory to govern. The result of this settlement was that his eldest son, Christian Louis, chose Lünehurg, where he ruled till his death in 1665. George William, the second son, ruled over Calenherg till 1665, when he transferred himself to Lünehurg, which he governed till 1705. On his going to Lüneburg, the third hrother, John Frederick, became duke of Calenherg, in which position he was succeeded in 1679 hy Ernest Augustus, the fourth brother, who married Sophia the granddaughter of James I. of England. Ernest Augustus was an exceedingly ambitious prince, and in order to increase the power of his country introduced in 1682 the law of primogeniture. Afterwards, in 1692, in consequence of a vast amount of negotiation and intrigue, he managed to secure for himself and his successors the electoral title. He died in 1698, and was succeeded hy his son, George Louis, who, having married his cousin Sophia Dorothea, the daughter of George William of Calenherg, finally united the two duchies on the death of the latter prince. In 1714 George Louis, the elector of Lünehurg, ascended the throne of Great Britain as George I.

After this time, until the death of William IV., Lünehurg or Hanover had the same sovereign as Great Britain; and this personal union of the two countries was not without important results for both. George II., as the ally of Frederick the Great in the Seven Years' War, joined the struggle in the capacity both of elector and of king; and while George III. was on the throne there was hardly a phase of the foreign policy of England by which Hanover was not affected. In 1803, when the Hanoverian troops capitulated at Sulingen, the country was invested by a French corps, which it had to maintain at a heavy cost. The Prussians received temporary possession of Hanover from Napoleon in 1806; hut in 1807 a part of it was annexed to the kingdom of Westphalia, to which the remaining portion was added in 1810. The people never acquiesced in French predominance, and when the final struggle with Napoleon came they distinguished themselves by the ardor with which they flung themselves into it. At the congress of Vienna in 1815 it was demanded in the name of the elector (King George III.) that the electorate should he recognized as a kingdom; and not only was the demand admitted, but the new kingdom received considerable accessions of territory.

Partly through the influence of the French, partly in consequence of the general progress of ideas, Hanover was now, like many other parts of Germany, penetrated hy a desire for freedom; and such had been the sufferings of the people, willingly borne for their sovereign and country, that they felt they had a right to be treated in a conciliatory and generous spirit. Their wishes were, however, disregarded. Count Münster, who virtually ruled the country from London, drew up a constitution which came into force in 1819. It was thoroughly reactionary in tendency, and the more resolutely it was enforced the more completely were the people alienated from the ruling class. Not until 1831, when there were several popular risings of so serious a nature that Count Münster resigned, was it deemed necessary to make important concessions, and even then the constitution which the states assembly prepared was made considerably less liberal by William IV. before he sanctioned it in 1833.

As the law of Hanover prevented a woman from mounting the throne, Ernest Augustus, duke of Cumberland, became king after the death of William IV. in 1837. He proved to he a harsh and narrow-minded despot. In 1837 he arhitrarily aholished the constitution of 1833, and when seven professors of the university of Göttingen protested against the act as unlawful, they were deprived of their chairs, and three of the most distinguished—Gervinus, Jacoh Grimm, and Dahlmann—were hanished from the country. The people were profoundly stirred, and it was hoped that the confederate diet might be induced to protect their rights, but it declined to interfere. A pitiful imitation of a constitution was granted in 1840, but this only intensified the public indignation, which became so strong that in 1848 the revolutionary movement that swept over Europe seemed about to overthrow King Ernest Augustus and his throne together. By hasty concessions he succeeded in preventing this catastrophe, hut no sooner did the agitation begin to abate than he showed a disposition to evade the obligations imposed hy the constitution which had heen wrung from him. The comparatively liheral ministry which had been appointed in the moment of danger was dismissed in 1850, and probahly only the death of the king in 1851 prevented him from engaging in as serious a contest as ever with the progressive forces that surrounded him. In 1849, when the Frankfort diet failed to estahlish the unity of Germany, he joined the kings of Prussia and Saxony in forming what was called "the three kings' alliance;" but he soon withdrew from this connection, and associated himself with the thoroughly conservative policy of Austria.

Ernest Augustus was succeeded hy his blind son, George V. Personally King George was of an amiable disposition, but he shared his father's extravagant conceptions of royal rights, and at once appointed a ministry whose aim was to get rid of the inconvenient constitution of 1848. The second chamber, however, resisted its designs so energetically that in 1852 the more reactionary ministers had to resign, and in 1853 even the modified cahinet was completely defeated. The king then created a Government which advised him to appeal to the confederate diet. This was done, and in 1855 the diet proclaimed the constitution of 1848 to be invalid. That a more easy triumph might be secured, the states assemhly was dissolved, and a ministry was formed which holdly restored the nominal constitution of 1840. This Government spared no effort to obtain an overpowering majority, but, as it still encountered some resistance in the new parliament, fresh elections were ordered, and in 1857 it had the satisfaction of meeting as pliant a hody of deputies as the king himself could wish. The people, however, were not in sympathy with their nominal representatives, and gave many proofs of their discontent with the arhitrary rule to which they were subjected. In 1862, when an attempt was made to impose upon the schools the use of a catechism of the 17th century, the popular feeling was so decisively expressed that the king was compelled to dismiss his ministers. The new cabinet, which was rather less extravagant, included Herr Windthorst,[1] who had for a short time had a seat in the Government that resigned in 1853, and who has since acquired distinction as leader of the Ultramontane party in the imperial parliament of Germany. King George could not long submit even to a slight modification of his absolutist notions, and in 1865 entrusted Herr von Borries, who had done him faithful service in previous administrations, with the task of hringing together a cahinet to his liking.

Meanwhile, however, dangers had arisen in Germany, compared with which the internal troubles of Hanover were of small account. Herr von Bismarck, who now controlled Prussian policy, was devising methods for the realization of his vast schemes; and it became increasingly clear, after the Schleswig-Holstein war, that the minor states of Germany would soon have to accept finally the lead either of Prussia or of Austria. Before the outhreak of that conflict Hanover and Saxony had despatched troops to Holstein for the purpose of executing the will of the hund. Although the federal army was driven hack hy Prussia, Hanover seemed for a time to be favorahle to her rather than to Austria; hut in reality the sympathy of the court was altogether with the latter power. On the 14th of June, 1866, in regard to the decisive question whether the federal army should be mohilized, Hanover voted in the confederate diet with Austria; and hy doing so she irrevocably declared on which side she would range herself in the approaching struggle. In consequence of this vote Prussia addressed an ultimatum to Hanover on the 15th of June, requiring her to maintain unarmed neutrality and to accept the scheme for the reform of the confederation which the Prussian plenipotentiary had suhmitted to the diet before retiring from it. As Hanover rejected these demands, Prussian troops at once crossed the frontier; and on the 17th of June they were in possession of the capital. On the 27th a battle was fought at Langensalza, in which the Hanoverians were victorious; hut they could make no use of their victory, and were soon compelled to capitulate. At the conclusion of the war, hy the treaty of Prague, Hanover, with Hesse, Nassau, and Frankfort, was annexed to Prussia. King George addressed from Hietzing, near Vienna, a protest to the European cahinets, hut it was disregarded; on the 3d of October, 1866, his dominions were formally taken possession of and in the following year the population was subjected to the Prussian constitution. In 1878 George V. died at Hietzing, but his son, Ernest Augustus, duke of Cumberland, maintains his right to the crown; and there is still a party in Hanover which expresses itself favorable to his claims. The mass of the population, however, whether originally willing to he annexed to Prussia or not, have suhmitted to the inevitahle, and there is evidence that they are gradually becoming loyal subjects of the Prussian king.

[1] [Ludwig (1812–91), born in Osnaburg, educated in Göttingen and Heidelberg, became leader of the Ultramontane party in the German Reichstag.—Am. Ed.]

HANOVER, the capital, is situated in the south of the above province, on a sandy but fertile plain on the river Leine, which here receives the Ihme, and is from this point navigable to the Weser. It is 38 miles W. by N. of Brunswick by rail, 157 miles W. of Berlin, 78 S. E. of Bremen, and 107 S. of Hamburg. The Leine flows through the town, having the old town on its right bank, and the Calenberger new town between its left bank and the Ihme. The old town is irregularly built, with narrow streets and old-fashioned houses; while the new town has wide streets, handsome buildings, and beautiful squares. Of the latter the most remarkable are—the square at the railway terminus, with an equestrian statue of King Ernest Augustus in bronze; the triangular theatre square; George Square, with the statue of Schiller; Waterloo Square, with a column 99 feet high, surmounted by Victory, and having inscribed on it the names of 800 Hanoverians who fell at Waterloo. In the gardens near the square an open rotunda has been erected enclosing a marble bust of Leibnitz, and near it a monument of General Alten, commander of the Hanoverian troops at Waterloo. The town has numerous churches; in the chapel of the palace are preserved the relics of saints which Henry the Lion brought from Palestine. The royal

Plan of Hanover.

1. Cavalry Barracks.
2. Bank.
3. Theatre.
4. George Square; statue of Schiller.
5. Royal Palace.
6. Markt Kirche.
7. Town-Hall.
8. Royal Castle.
9. Palace of Ernest Augustus.
10. Library.

palace—built 1636–1640, rebuilt 1837—contains a picture gallery and collection of natural curiosities, and the palace of Ernest Augustus is remarkable for its historic collections, especially the famous Welfen museum. The other principal public buildings are the record office, containing a library of 150,000 volumes; the town-hall, built in the 15th century; the theatre, the museum, the aquarium, the handsome railway terminus, and the exchange. Hanover has a number of colleges and schools, and is the seat of several learned societies. During the last ten years the town has become the seat of various new industries and of an increasing trade. It is connected by rail with Berlin, Harburg, Bremen, Hameln, Cologne, Altenbeken, and Cassel; and the annual fairs for cloth, leather, yarns, linen, wool, etc., are frequented by large numbers of buyers. There are several banks and a chamber of commerce. Almost every industry is at present represented, whilst in former times the inhabitants derived their chief support from the presence of the court and the nobility. The town possesses large cotton mills, iron-foundries, and machine factories, numerous tobacco manufactories, breweries, distilleries, etc. Hanover was the first German town that was lighted with gas. It is the birth-place of Sir William Herschel the astronomer (1822), of the brothers Schlegel, and of the historian Pertz; and the philosopher Leibnitz died there (1716). The population has increased from 49,909 (including suburbs) in 1852 to 250,054 in 1905 (of the adjoining Linden, 57,941. In the vicinity are the royal palaces of Herrenhausen, the unfinished Welfenschloss (formerly Mont Brilliant), and Marienburg, the private property of Queen Marie, all surrounded by gardens.

See Baring, *Notitia Scriptorum rerum Brunsvicensium ac Luneburgensium* (Hanover, 1729); Leibnitz, *Scriptores rerum Brunsvicensium* (Han., 1707–11); Bünting, *Braunschweig-Lüneb. Chronica* (Magdeburg, 1586), continued till 1620 by Meibom (*ibid.* 1620); Hüne, *Gesch. des Königr. Hannover und Herzogth. Braunschweig* (Han., 1825–30); Havemann, *Gesch. der Lande Braunschweig und Lüneburg* (Göttingen, 1853–57); Grotefend, *Gesch. der allg. landständ. Verfassung des Königreichs Hannover*, 1814–48 (Han., 1857); Schaumann, *Handbuch der Gesch. der Lande Hannover und Braunschweig* (Han., 1864); Guthe, *Die Lande Braunschweig und Hannover* (Han., 1867); Oppermann, *Zur Gesch. Hannovers*, 1832–60 (Berl., 1868); Sichart, *Gesch. der Könighl. hannöverschen Armee* (Berl., 1866–71). (E. J.—J. SI.)

HANSARD, LUKE (1752–1828), English printer, whose name is familiar in connection with the parliamentary reports, was born July 5, 1752, in St. Mary's parish, Norwich. Reverses in business compelled his father, a manufacturer there, to apprentice him to Mr. Stephen White, printer. Immediately on the expiry of his apprenticeship Hansard started for London with only a guinea in his pocket, and obtained there in 1772 a situation as compositor in the office of Mr. Hughs, printer to the House of Commons. There his ability and energy commended him so well to his master that in two years, time he was made a partner, and undertook almost the entire conduct of the business, which in 1800 was resigned completely into his hands, through the retirement of Mr. Hughs. Among those whose acquaintance Hansard made in the exercise of his profession and retained by his amiable private qualities, were Orme, Burke, and Dr. Johnson; while Porson eulogized him as the most accurate printer of Greek. The promptitude and accuracy with which Hansard printed parliamentary papers were often of the greatest service to Government,—notably on one occasion when the proof-sheets of the report of the Secret Committee on the French Revolution were submitted to Pitt twenty-four hours after the draft had left his hands. On the union with Ireland in 1801, the increase of parliamentary printing was so great that Hansard was forced to give up all private printing except when parliament was not sitting. He devised numerous expedients for reducing the expense of publishing the reports; and in 1805, when his workmen struck at a time of great pressure, he and his sons did not scruple themselves to work as compositors, and to instruct the new hands they had procured. Shortly after printing the report of the session that rose in July, 1828, Hansard's health, which had been failing, completely gave way, and he died on October 29th of the same year. See the *Gentleman's Magazine* for December, 1828.

HANSEATIC LEAGUE. The word "hansa," when we find it first in the Gothic Bible of Ulfila, signifies a military assemblage or troop. From this comes the general sense of union, and especially in the Middle Ages of union for mercantile purposes. A later but less important meaning is that of a tax paid by traders for the right of forming such an union.

The Hansa, the league which ultimately overshadowed all rivals and usurped the name for itself, was no intentional creation, and we can fix no exact date for its origin. It arose gradually from two elements, the union of German merchants abroad, and the union of German towns at home.

The first impulse to mercantile union came from the dangers of travelling in the early Middle Ages. In those days mariners had neither chart nor compass to guide their course, and were forced to creep timidly along the shore and to avoid as much as possible the open sea. The merchant had also to dread more positive dangers than those of storm and wreck. The coasts of northern Germany harbored numbers of rovers and pirates, who regarded the peaceful trader as their natural prey. To increase their powers of resistance, it was usual for merchants to undertake their voyages in more or less numerous companies. The union thus begun on sea was still further cemented on land. In those days law was personal and not territorial.

The foreign merchant had no share in the law of the land where he sojourned; he brought with him his own law, and administered it as best he could. The legal customs of northern Germany were substantially alike, and this similarity strengthened the bonds of union among the merchants who found themselves for a time settled in a foreign land. Moreover, the state of trade frequently required a long stay, and sometimes a depositing of goods among strangers. This led in time to the acquisition of common possessions abroad, lodgings, storehouses, etc. This common depôt, or "factory," became the central point of the union or Hansa formed by the merchants. The union soon received a corporative constitution. At its head stood the elders, whose chief functions were to administer justice and to represent the society in its relations to the natives of the country It was by means of these orderly unions that the German merchants obtained their important privileges, chiefly advantages in trade and taxes, from the people among whom they sojourned.

The most important German mercantile settlements were founded in Wisby, the capital of Gothland, in London, Novgorod, Bergen, and Bruges. Wisby was the central point of the Baltic trade, the other towns represent the four extreme points of North-German commerce. It was not unnatural that the mercantile settlements should exercise great influence on the towns from which they sprang. In those towns the municipal government was wholly in the hands of merchants. There was no feudal aristocracy as in the Italian cities, and the artisan was always jealously excluded from political power. It is obvious therefore that the policy of the town-councils would often be influenced by the exigencies of foreign commerce. But the influence of the foreign factories was not exercised by all in an equal degree. Wisby differed from the other settlements in the fact that the Germans there were not merchants making a temporary visit, but were real settlers living side by side with the native population. Novgorod was a mere colony of the German settlement in Wisby, and never held an independent position. Bergen was comparatively unimportant, and the German "counter" in Brüges was not formed until some amount of union had been attained at home. But in the German colony in London the majority of the members were merely passing traders, who remained citizens of their native towns. It was therefore the London Hansa which exercised the greatest influence on the growth of the town league.

In the reign of Edgar we find the "people of the emperor" occupying a prominent position in London trade, and joined in a lasting league. The members of this league came mostly from Cologne, the first German town which obtained great importance both at home and abroad. Its citizens possessed at an early date a guild-hall of their own, and all Germans who wished to trade with England had to join their guild. This soon included merchants from Dortmund, Soest, and Münster, in Westphalia; from Utrecht, Stavern, and Groningen, in the Netherlands; and from Bremen and Hamburg on the North Sea. But when, at the beginning of the 13th century, the rapidly rising town of Lübeck wished to be admitted into the guild, every effort was made to keep her out. The intervention of the emperor Frederick II. was powerless to overcome the dread felt by Cologne towards a possible rival to its supremacy. But this obstacle to the extension of the league was soon overcome. In 1260 a charter of Henry III. assured protection to all German merchants. A few years later Hamburg and Lübeck were allowed to form their own guilds. The Hansa of Cologne, which had long been the only guild, now sinks to the position of a branch Hansa, and has to endure others with equal privileges. Over all the branch Hansas rises the "Hansa Alamanniæ," first mentioned in 1282.

The opposition to the exclusive pretensions of Cologne was chiefly the work of Lübeck, and with the rise of Lübeck we must connect the second element, the internal political element, which contributed to the formation of the Hansa. The old capitals of German trade, Cologne and Wisby, took their stand on the unions of German merchants abroad. In opposition to them Lübeck found support in home alliances, in its league with Hamburg and with the Wendish towns. The alliance between Lübeck and Hamburg is generally and with some truth given as the origin of the Hanseatic League. It was well fitted to play this part. These two towns commanded the commerce of the North Sea and the Baltic. By taking the land route between them, a merchant could avoid the dangerous passage of the Sound or the Belts, and could evade the Sound dues which were often exacted by the Danish kings. The first alliance between the two towns, for which there is no exact date, had for its object the defence of the roads between them. From that came agreements as to mutual legal security, and thence they advanced to common political action in London and in Flanders.

The league between Lübeck and Hamburg was not the only, and possibly not the first, league among the German towns. But it gradually absorbed all the others. Besides the influence of foreign commercial interests there were other motives which compelled the towns to union. The chief of these were the protection of commercial routes both by sea and land, and the vindication of town independence as opposed to the claims of the landed aristocracy The first to join this league were the Wendish towns to the east, Wismar, Rostock, tralsund, etc., which had always been intimately connected with Lübeck, and were united by a common system of law known as the "Lübisches Recht." The Saxon and Westphalian towns had long possessed a league among themselves; they also joined themselves to Lübeck. Lübeck now became the most important town in Germany It had already surpassed Cologne both in London and Bruges. It soon gained a similar victory over Wisby. At a great convention in which twenty-four towns from Cologne to Revel took part it was decided that appeals from Novgorod which had hitherto been decided at Wisby should henceforth be brought to Lübeck.

In the 14th century the Hansa changes from a union of merchants abroad to a league of towns at home. In 1330 mention is first made of the Hanse towns, where before it had been the Hanse merchants. In 1343 the league is first designated as the Hansa by a foreign prince, Magnus of Norway, and thus acquires a diplomatic position as a united state. In 1356 a statute about mercantile privileges at Bruges is made, not by the German merchants, but by the towns themselves, through their representatives assembled at Bruges. Henceforth the town-league subordinates to itself the mercantile unions, the factories and depôts of the merchants lose their independence, and become the "counters," as they are called, of the Hanse towns.

The league thus formed would scarcely have held long together or displayed any real federal unity but for the pressure of external dangers. The true function of the Hansa, and especially of the Baltic towns, was to conduct the commerce between the east and west of northern Europe. But the geographical position of the Scandinavian countries enabled them to interpose a bar to this commerce. Thus from an early period the Hansa stood in a position of watchful hostility towards those countries. It was the careful maintenance of this watch over the Baltic which gave Lübeck its position in the league, and which gave the league its political as contrasted with its mercantile character.

The most dangerous of the Scandinavian countries at this time was Denmark. Until the 16th century the southern coast of what is now Sweden was in the hands of the Danes, who were thus enabled to command the important channel of the Sound, and to interfere with the herring fisheries, a great source of wealth to the Hanse merchants. The Danish kings were almost always opposed to German interests, and were especially jealous of the supremacy of German traders in the Baltic. Eric Menved (1286–1319) almost succeeded in making himself master of the southern coast of the Baltic. He captured Rostock and the island of Rügen. Even Lübeck submitted to him, and was for a time practically detached from the empire. Stralsund alone successfully resisted the Danish attack. The league of Wendish towns was for the time wholly broken up, and the growth of the Hansa was arrested; but it was saved from total dissolution by the feuds which distracted Denmark. Eric's successor, Christopher II., an exile from Denmark, fled to the very towns which his predecessor had humbled. After extorting from him numerous privileges, especially the exclusive right to the fisheries on the coast of Schonen, the Hanse towns restored him to his throne, though to only a fraction of his former power. From 1333 to 1340 Denmark was without a king, and a prey to the wildest anarchy. But as it recovered strength it again became formidable to the Hansa. Waldemar III. (1340–1377) devoted the early

part of his reign to the recovery of the lands which Denmark had lost during the recent troubles. To carry out this policy he had to spend large sums of money, and in his straits he determined to enrich himself by the plunder of German commerce. In 1361 he sailed to Gothland, and surprised and captured the town of Wisby. The news of this act reached the representatives of the Hansa as they were assembled at Greifswald. They at once resolved on war, and in 1362 their fleet stormed and captured Copenhagen. But while they were besieging the strong fortress of Helsingborg, Waldemar attacked their defenceless fleet and destroyed it. This defeat was followed by a truce, which recognized the Danish possession of Gothland. Waldemar might easily have turned this truce into an advantageous peace, but his success seems to have inspired him with the hope of crushing German ascendency in northern Europe. In 1367 a Hanseatic assembly at Stralsund was informed that Waldemar had laid new duties on the fishing stations, and that he had robbed German merchants in the Sound and the Belts. Another war was inevitable, and this time the result was different. Waldemar did not await the arrival of the hostile fleet, but fled in 1368 to Brandenburg. Denmark fell entirely into the hands of the League. In 1370 Waldemar was compelled, as the price of his return to his kingdom, to sign the treaty of Stralsund. By this treaty the Hansa obtained possession for five years of all fortresses on the coast of Schonen, and as compensation for its losses was to receive for fifteen years two-thirds of the Danish revenues. It was also stipulated that henceforth no king should ascend the throne of Denmark without the consent of the Hanse towns, and that their privileges should be expressly confirmed at each coronation. The treaty of Stralsund marks the zenith of the power and prosperity of the Hansa. The emperor Charles IV., who had always looked coldly on independent combinations among his subjects, seems to have been induced to alter his policy, and in 1375 he distinguished Lübeck by a personal visit.

The war against Waldemar III. seems to have had a great effect in consolidating the Hanseatic League, and in forcing it to adopt a federal constitution. From 1361 we can date the regular meeting of the general assemblies, whose acts (Recesse) have been preserved in the archives at Lübeck. These assemblies met once a year about midsummer, usually but not exclusively at Lübeck. They were attended by representatives of the various towns, but no one below the rank of councillor could act as representative. The League always endeavored to maintain its aristocratic character. The assemblies busied themselves with all the details of foreign policy as well as of internal management. The penalty for non-observance of their decrees was expulsion from the League (Verhansung). The chief offence which brought this punishment on a town was the admission of democratic tendencies. The struggle between the artisans and the old burgher families, which is so important a feature of European history in the 13th and 14th centuries, necessarily affected the Hanse towns. It was for admitting artisans to the council that Brunswick was expelled from the League in 1375, and was not re-admitted till 1380, when the old constitution was restored.

Besides the central constitution of the Hansa, there are also traces of an internal grouping. At Bruges the German merchants are divided, according as they came from (1) the Wendish and Saxon towns, (2) Westphalia and Prussia, (3) Gothland, Livonia, and Sweden. This division is supposed to refer to a real division of the League, each third being gathered round one of the three chief towns, Lübeck, Cologne, and Wisby. But in later times we find the League divided into four quarters with their respective capitals,—Lübeck, Cologne, Brunswick, and Dantzic.

Although, by comparing the documents which have come down to us, we can trace the existence of a fairly definite system of government, yet we must not imagine that this system was carried out with the regularity of a modern constitution. The composition of the League was always fluctuating, and it is impossible to say at any fixed time how many members it contained. The towns lay scattered over a large territory extending from Revel to the Scheldt, and their interests, both territorial and commercial, must have often clashed. It was only in time of danger that the League displayed any real consistency. When the immediate danger was withdrawn, the want of union soon made itself again manifest. It is true that the towns joined the League of their own accord, but when they had joined, they tried to make their position as independent as possible. They never considered themselves bound to send deputies to the general assemblies. When the deputies did appear they usually came late, and after a matter had been discussed they would insist on referring it to the town-council at home, as their own powers were insufficient. The wonder lies, not in the dissensions which sprang up among the towns, but in the fact that for three centuries they did in a manner hold together, and not infrequently sacrificed their individual advantages for the common good.

From the very moment of the treaty of Stralsund, the weakness of a community founded chiefly on commercial interests began to show itself. The eastern Baltic towns, especially those of Prussia, were indignant at the erection of a staple at Lübeck. They desired to trade directly with England and Flanders. To repress this movement Lübeck as the head of the League entered into the closest relations with the Teutonic order. But the evil of these dissensions lay in the fact that they distracted the attention of the Hanse towns from events in Scandinavia. The influence guaranteed to them by the treaty of Stralsund was never exercised, and their supineness allowed Margaret, Waldemar III.'s daughter, to unite the crowns of the three Scandinavian kingdoms at Calmar in 1397. The erection of a powerful northern state was obviously dangerous to the ascendency of the Hansa. About the same time their allies, the Teutonic knights, were threatened in a similar manner by the accession of the Jagellon dynasty in Poland. The battle of Tannenberg (1410) and the peace of Thorn (1411) were clear signs that the Slavonic race was beginning to turn the tables on its German oppressors. At one time it seemed probable that Slavs and Scandinavians would unite in a great anti-German crusade, and that the Hansa and the Teutonic order—the pioneers of German civilization in northern Europe—would fall victims to the alliance. During the 15th century the Hanse towns were frequently compelled to seek safety in arms. Their constant policy was to break up the union of Calmar. In 1428 they sent a large fleet against Eric, Margaret's successor, who wished to add Schleswig and Holstein to his possessions. The accession of two German princes, Christopher of Bavaria and Christian I. of Oldenburg, to the Danish crown was due in no slight measure to the exertions of the Hansa. On the whole the League held its own in this century, though not without considerable and increasing difficulty.

But with the 16th century the Hansa begins really to decline. The English and Dutch proved formidable rivals for the commercial supremacy in northern Europe. Henry VII. secured in 1489 a treaty from Hans of Denmark, which gave England the right of commerce in the northern seas, and which enabled English merchants to found mercantile establishments in the ports. The herrings no longer came in crowds to the Swedish and Norwegian coasts, where the members of the Hansa had so long held a practical monopoly of the fisheries. These fish made at this time one of their periodical changes of course, and went to the coasts of Holland. The Dutch were not slow to grasp at the advantages thus offered to them. Another great blow was dealt to Hanseatic commerce by the grand discoveries of the age. Most of the German towns were out of the way of the new commercial routes, and could scarcely hope to hold their own with more favorably situated countries.

Besides these causes of decline the domestic position of the Hanse towns had altered very much for the worse. While in other countries the power of the feudal nobles had fallen before the rapid rise of the monarchy aided by the sympathy of the commons, in Germany alone the power of the princes had constantly increased, at the expense of both king and people. The Reformation and the consequent secularization of church property in northern Germany only served to strengthen the hands of the lay princes. Such a state of things was fatal to the independence of a town league which had always stood opposed to the lawless independence of the nobles. Gradually most of the towns fell off from the League. Foreign countries triumphed at the fall of their formerly successful rival. In Elizabeth's reign the Hanse merchants in London lost the privileges which they had held since the time of Henry III.

Religious disturbances and the fearful disasters of the Thirty Years' War completed the work thus begun. The peace of Westphalia restored the form but not the reality of the League. In 1669 the last general assembly was held. Henceforth the name of Hanse towns was kept by Lübeck, Hamburg, and Bremen, but it was to designate their independence, not their union.

References.—*Hanse-Recesse*, 1256–1430, B. i.–iv., and 1431–1476, B. i. and ii.; G. F. Sartorius, *Urkundliche Geschichte des Ursprunges der deutschen Hanse* (edited by J. M. Lappenberg); Lappenberg, *Urkundliche Geschichte des hansischen Stahlhofes zu London* (Hamburg, 1851); Wehrmann, *Die Lübeckischen Zunftrollen* (Lübeck, 1872); Karl von Schlözer, *Die Hansa und der deutsche Ritter-Orden in den Ostseeländern*; the *Hansische Gesichts-blätter*; Schäfer, *Die Hansestädte und König Waldemar von Dänemark* (1878). (R. L.)

HANSEN, Peter Andreas (1795–1874), astronomer, was born on December 8, 1795, at Tondern, in the duchy of Schleswig. When a youth he served an apprenticeship to a clock and watchmaker at Flensburg, with whom he remained several years. During this time he exhibited an intense interest for mathematics and the physical sciences, which was the means of his introduction in 1820 to Schumacher, professor of astronomy at Copenhagen, who, appreciating Hansen's abilities, engaged him to assist in the measurement of an arc of meridian in Holstein. This led to his appointment as assistant to Schumacher at the observatory of Altona, on its foundation in 1823. Hansen's reputation as an excellent mathematician had by this time become generally known, and in 1825 he was selected to succeed Professor Encke as director of the observatory of Seeberg, near Gotha. There he remained for the rest of his life, devoting his talents to the development of the highest branches of mathematical astronomy, with an originality of conception which was acknowledged by the English Royal Astronomical Society on two occasions, by the award of their gold medal for his researches in physical astronomy and his lunar tables. His *Tables de la Lune* appeared in 1857, published at the expense of the British Government; they have been adopted for use in the calculations of the *Nautical Almanac*. In addition to his important volume containing the full details of the formulæ explanatory of his lunar theory, Hansen was the author of a large number of miscellaneous astronomical papers, principally relating to the orbits of comets and planets or to perturbational astronomy. In one of these he was the first to point out that Encke's value of the horizontal equatorial solar parallax required to be increased to reconcile the lunar theory with modern observations,—an opinion which was subsequently confirmed by Le Verrier from his planetary researches, and by the observations of Mars and the transit of Venus of 1874. Hansen was a foreign member of the Royal Society, and an associate of the Royal Astronomical Society. He died on March 28, 1874, at the age of seventy-eight.

HANSTEEN, Christopher (1784–1873), astronomer and physicist, was born at Christiania, Norway, September 26, 1784. From the cathedral school he went to the university at Copenhagen, where first law and afterwards mathematics formed his main study. In 1806 he taught mathematics in the gymnasium of Frederiksborg, Zeeland, and the following year he commenced the inquiries in his favorite branch of science—terrestrial magnetism—which have made his name famous. He took in 1812 the prize of the Danish Royal Academy of Sciences for his reply to a question on the magnetic axes. Appointed lecturer in 1814, he was in 1816 raised to the chair of astronomy and applied mathematics in the university of Christiania. In 1819 he published his researches on terrestrial magnetism, a work which attracted the notice of the physicists of Europe and particularly of England, where the search for a formula by which the variation of the needle might be found at any given time and place was being actively pursued. The researches were translated into German by P. T. Hanson, under the title *Untersuchungen über den Magnetismus der Erde*, with a supplement containing *Beobachtungen der Abweichung und Neigung der Magnetnadel*, and an atlas. The rules there framed for the observation of magnetical phenomena have been generally followed. Hansteen hoped by them to accumulate analyses for determining the number and position of the magnetic poles of the earth. In prosecution of his researches he visited London, and also Paris and other Continental cities, and travelled over Finland and the greater part of his own country; and in 1828–30 he undertook, in company with Ermann and Due, and with the co-operation of Russia, a Government mission to Western Siberia, the chief aim of which was to find the ideal point of the Asiatic pole of magnetism—ten observatories being established in Russia to further the project. The scientific results—magnetic, astronomic, and meteorological—form the bases of many valuable theories. A narrative of the personal adventures soon appeared (*Reise-Erinnerungen aus Sibirien*, 1854; *Souvenirs d'un voyage en Sibérie*, 1857); but the chief work was not issued till 1863 (*Resultate magnetischer Beobachtungen*, etc.). Shortly after the return of the mission, an observatory was erected in the park of Christiania (1833), and Hansteen was appointed director. On his representation a magnetic observatory was added in 1839. In 1835–38 his text-books on geometry and mechanics were published; and in 1842 he wrote his *Disquisitiones de mutationibus quas patitur momentum acus magneticæ*, etc. He also contributed various papers to different scientific journals, especially the *Magazin for Naturvidenskaberne*, of which he became joint-editor in 1823. He superintended the trigonometrical and topographical survey of Norway, begun in 1837. He was a member of the Royal Society of London, the French Institute, the American Academy of Arts and Sciences, and the Academies of Berlin and St. Petersburg. In 1861 he retired from active work, but still pursued his studies, his *Observations de l'inclination magnétique* and *Sur les variations séculaires du magnétisme* appearing in 1865. Hansteen died at Christiania, April 15, 1873.

HANUSCH, Ignaz Johann (1812–1869), Bohemian savant and philosopher, was born at Prague on the 28th November, 1812. He received his early education in his native city, and taught for a short time in a monastic school there. At the universities of Prague and Vienna, where he afterwards studied, he directed his attention successively to theology and law, and finally, under the influence of Hegel's writings, to philosophy. After temporarily supplying in 1835 the place of Lichtenfels, professor of philosophy at Vienna, he was next year appointed ordinary professor of philosophy at Lemberg, whence he passed in the same capacity to Olmütz in 1847, and two years later to Prague. There he began a successful course of philosophy in the Czech language, but in 1852 was abruptly suspended from teaching, owing to his leanings towards Slavism. He still, however, retained his full salary; and in 1860 he was nominated director of the imperial university library at Prague, where he died on the 19th May, 1869.

His chief writings, mainly on philosophic and Slavonic subjects, are the following:—*Wissenschaft des Slavischen Mythus* (1842); text-books in *Logic* (1843), *Ethics* (1866), *Metaphysics* (1846), and *Empirical Psychology* (1849); *Geschichte der Philosophie von ihren Uranfängen bis zur Schliessung der Philosophenschulen unter Justinian* (1850); *Vorlesungen über die Kulturgeschichte der Menschheit* (1849); *Quellenkunde und Bibliographie der böhmisch-slowenischen Literatur* (1868). Besides these and others, Hanusch wrote some works in Czech, and published the works of the old Slavonic philosopher, Ritter Thomas, in 1852.

HANWAY, Jonas (1712–1786), an English traveller and philanthropist, was born at Portsmouth, but he was still a child when the death of his father, a victualler by trade, caused his mother to remove with her family to London. At the age of seventeen the boy was apprenticed to a merchant in Lisbon, and he remained there till he entered business for himself. In 1743, after he had been for some time again in London, he became a partner with Mr. Dingley, a merchant in St Petersburg, and in this way had his attention turned to the trade between Russia and Persia. Leaving St Petersburg on the 10th of September, 1743, and passing south by Moscow, Zuritzin, and Astrakhan, he embarked on the Caspian on November 22d, and arrived at Astrabad on December 18th. Here his difficulties began. The town was attacked and captured by a rebel, Mohammed Hassan Beg; his goods were seized, and it was only after great privations that he reached the camp of the Shah Nadir. Obtaining an order for the restoration of his goods he returned to Astrabad, and succeeded in recovering about 85 per cent. of their original value; but he was obliged to retrace his steps, and after a painful journey, during which he was attacked by pirates, detained by sickness, and obliged to perform six weeks' quarantine, he arrived at St. Petersburg July 9, 1750. The autumn of that year he spent travelling in Germany and Holland.

and on October 28th he landed in England, where the narrative of his travels published in 1753 soon made him a man of note. The rest of his life was for the most part spent in London, and his leisure was devoted to the advocacy and support of all kinds of useful and benevolent enterprises. In 1762 he was appointed one of the commissioners for victualling the navy, and on his resignation in 1783 he received the whole of his salary as a pension. He died September 5, 1786. Hanway was naturally a healthy and active man; in Russia he was known as the handsome Englishman; but the efforts of his travels in Persia rendered him somewhat of a valetudinarian. He is popularly known as the first Englishman to carry an umbrella in his native country; this he persisted in using in spite of all the efforts of the hackney coachmen to hoot or hustle him into conformity. He succeeded in writing down the custom of giving vails; and in his *Journey from Portsmouth to Kingston* he attacked the pernicious habit of tea-drinking, which, however, found an able and ardent defender in Dr. Johnson. In 1757 he took an active part in founding the Marine Society, the object of which was to fit out poor boys and men for the navy; he was one of the originators of the Magdalen Hospital; it was due to his continued efforts that the Act of George III. was passed for the better treatment of the parish infants; and in 1785 he took up the lamentable case of those little chimney-sweeps whose dangerous occupation is now a thing of the past. The method of solitary confinement for prisoners found in him one of its earliest advocates, and in various other ways he sought to improve the chances of the criminal population. "Every man," was his theory, "is capable of good if properly treated. If doing justice to an offender implies an attempt to reform him by using the proper means, by parity of reasoning the using of improper means is doing injustice." Hanway's writings are of little value except for the sake of the causes which they supported; while effective as pamphlets, they lack both style and method, and are apt to run over into platitudinous moralizings. See Pugh, *Remarkable Occurrences in the Life of Jonas Hanway*, 1787.

HAPARANDA, from *Haaparanta*, "Aspen-shore," a small town of Sweden in the district of Torneå, at the northern end of the Gulf of Bothnia, in 65° 51′ N. lat. It lies about a mile from the mouth of the Torneå-Elf, exactly opposite the town of Torneå, which has belonged to Russia since 1809. Haparanda was founded in 1812, and at first bore the name of Carljohansstad or Charles John's Town. It received its municipal constitution in 1842. The inhabitants, who according to the census of 1900 number 1,568, carry on a brisk trade and engage in ship-building. Since 1859 the town has been the seat of a meteorological station, which is one of the most valuable in Europe, not only because it lies so far north, but also because of its position at the head of the Gulf of Bothnia, and immediately to the south of the line of junction between the permanently open sea and the sea which is frozen during the winter months, or, in other words, in the region where at certain seasons there is an extraordinary crowding together of the isothermal lines.

HAPSBURG, or HABSBURG (originally *Habichtsburg*, that is, Hawkscastle), an old German family which has given sovereigns to Germany, Spain, and Austria, takes its name from the old Swiss castle of Hapsburg, now in ruins, situated on the river Aar in the canton of Aargau. The first mention of the countship of Hapsburg is in a document of 1099, where the name Werner, count of Hapsburg, occurs in connection with the consecration of the monastery of Muri as confirming the grants of the pious foundations made by his ancestors. This Werner of Hapsburg was a nephew of Werner, bishop of Strasburg, who built the castle of Hapsburg about the year 1020. The succession of the family cannot be traced between this period and the time of the emperor Frederick Barbarossa, but in a document whose date is 30th May, 1153, Werner II. and his son Albert the Rich are mentioned as counts of Hapsburg. This Albert was by Frederick created landgrave of Upper Alsace, and received the countship of the district of Zürich and the protectorship of the monasteries of Seckingen and Murbach; and on the extinction of the house of Zähringen he also succeeded to a considerable portion of their territories. Albert died in 1199, and was succeeded by his son Rudolph the Old, who, as a reward for placing a large sum of money at the disposal of Frederick II., received from him the countship of Aargau. He held an influential position among the Swabian nobility, and so increased his possessions that they included the territories of the Bishops of Strasburg, Constance, Basel, Coire, Ghent, and Lausanne, and of the abbot of St. Gall, in addition to which he also obtained the countship of Frickgau. Rudolf left behind him two sons, Albert the Wise and Rudolf II., who shared the possessions between them, and founded respectively the lines of Hapsburg-Hapsburg and Hapsburg-Laufenburg,—Albert, besides the castle of Hapsburg, holding the lands in Aargau and Alsace, and Rudolf the countships of Klettgau, Rheinfeld, and Laufenburg, and the possessions in Breisgau. The Laufenburg line also divided into two branches, the former of which became extinct in 1408 and the latter in 1415. Laufenburg thereupon fell to Austria, and Klettgau, through the marriage of the female heiress of the line, to the counts Sutz, from whom it passed by marriage in 1687 to the house of Schwarzenberg. Albert the Wise of Hapsburg-Hapsburg was married to the countess of Kyburg, who was descended from the dukes of Zähringen, and related to the emperor Frederick II. From this union there was born on the 1st May, 1218, Rudolf, the founder of the royal dynasty of Hapsburg. He was elected king of Germany in 1273, and after the defeat and death of Ottocar, king of Bohemia, in 1278, at Marchfeld on the Danube, he annexed to his possessions Austria, Styria, Carinthia, and Carniola. On the death of Rudolf in 1291 Adolf, count of Nassau, was elected his successor to the German crown, but although on the death of Adolf it again reverted to the Hapsburg line in the person of Albert I., it passed on his death to Henry, count of Luxembourg, and with the exception of the doubtful period when Frederick, eldest son of Albert, and Lewis, duke of Bavaria, divided the suffrages of the electors and were crowned, the one at Bonn and the other at Aix-la-Chapelle, the Hapsburg line remained excluded from its possession till the time of Albert II., who succeeded Sigismund as king of Bohemia and Hungary in 1437, and was chosen emperor of the Romans in 1438. The greater part of the original lands of the house were gradually lost by the victories of the Eidgenossen, who finally in 1474 obtained Aargau, in which the castle of Hapsburg was situated. Philip, son of Maximilian I. and of Donna Juana of Spain, ascended the Spanish throne in May, 1506, and on his death in September of the same year, he was succeeded by Charles I., who was chosen emperor in 1519, and was thenceforth known as Charles V. In 1521 Charles granted his Austrian possessions to Ferdinand I., who became the head of the Austrian dynasty. The Spanish branch became extinct in 1700 with the death of King Charles II., and the male line of the Austrian branch became extinct with the death of the emperor Charles VI. in 1740; but the Austrian house was continued in the female line by Maria Theresa, who by her marriage with Francis of Lotharingia, chosen emperor in 1745, founded the line of Hapsburg-Lotharingia, from which the present imperial dynasty of Austria is descended.

The main facts of the history of the house of Hapsburg, from the time of Rudolf I., king of Germany, will be found in th articles AUSTRIA (vol. iii. p. 108), GERMANY (vol. x. p. 444) and SPAIN. See also COXE'S *House of Austria*, 2 vols., London, 1807; Herrgott's *Genealogia diplomatica augustæ gentis Habsburgicæ*, Vienna, 1737–38; Kopp's *Vindiciæ Actorum Murensium*, Leipsic, 1751; Röpell, *Die Grafen von Habsburg*, Halle, 1832; Lichnowski, *Geschichte des Hauses Habsburg*, 8 vols., Vienna, 1836–37; Huber in the *Almanac of the Vienna Academy* for 1873; Münch, "Die Münze zu Laufenburg, nebst einem Abriss der Geschichte der Grafen von Habsburg-Laufenburg," in *Argovia*, vol. vii., 1874; and the same writer's "Regesten der Grafen von Habsburg, laufenburgischer Linie, 1198–1408," in vol. x. of the same publication, 1879.

HÁPUR, or HAPOOR, an ancient town of India in the Meerut district, North-Western Provinces, 28° 43′ 20″ N. lat., 77° 49′ 45″ E. long., lies on the Meerut and Bulandshahr road, 18 miles south of the former city. During the mutiny, Walidád Khán of Málágarh threatened Hápur, but was obliged by the loyal Játs of Bhatona to retire. Several fine groves surround the town, but the wall and ditch have fallen out of repair, and only the names of the five gates now remain. It contains a *tahsíli*, a police station, school-house, dispensary, 3 *saráis*, 28 mosques, and 25 temples. Considerable trade is carried on in sugar, grain, cotton, timber, bamboos, and brass utensils. Population

(1872), 14,544, comprising 8696 Hindus, 5847 Mahometans, and 1 Christian. Municipal revenue (1875–76), £1208.

HARAN, or CHARRAN (Hebrew, חָרָן; LXX., Χαῤῥάν or Χαῤῥά; Strabo, Κάῤῥαι; Pliny, *Carræ* or *Carrhæ*; Arabic, *Harrân*), is the name of a fertile district in the north of Mesopotamia (Padan-aram or Aram-naharaim), and also of a town situated some 10 miles south-eastward of Edessa (Orfa), on the banks of the small river Belik about 50 miles to the north of its junction with the Euphrates. It thus lies immediately on the highway between Arrapachitis and Canaan, and at the point where that highway is crossed by the great western road connecting Media, Assyria, and Babylonia with the Cilician coast. For the Assyrians accordingly it became a strategic position of first-rate importance, and in this aspect it is mentioned in inscriptions as early as the time of Tiglath Pileser I., about 1100 B. C. (see Schrader, *Die Keilinschriften und das alte Testament*, p. 45; and compare 2 Kings xix. 12, Isa. xxxvii. 12). It also, for the same reason, ultimately became the centre of a considerable commerce (Ezek. xxvii. 23), one of the specialties particularly named being the odoriferous gum derived from the strobus (Pliny, *H. N.*, xii. 40). It was here that Crassus in his eastern expedition was attacked and slain by the Parthians (53 B. C.); and here also the emperor Caracalla was murdered at the instigation of Macrinus (217 A. D.). Herodian (iv. 13, 7) mentions the town as possessing in his day a temple of the moon; in the Middle Ages it is mentioned as having been the seat of a particular heathen sect, that of the Haranite Sabeans. It retained its importance down to the period of the Arab ascendency; but by Abulfeda it is mentioned as having before his time fallen into decay. It is now wholly in ruins. According to the patriarchal history (Gen. xi. 31), Haran was the first resting-place of Terah and his family after their migration from Ur of the Chaldees, and here Terah and Nahor remained when Abraham and Lot passed on to Canaan. According to Dr. Beke, indeed, this Haran is not the well-known town on the Belik, but "a place of that name (Harrân el-Awamîd) between Abana and Pharpar, the two rivers of Aram or Syria" (see *Journ. of Royal Geog. Soc.*, vol. xxxii.). His arguments, however, have not been generally accepted as sufficient to set aside the powerful evidence in favor of the Mesopotamian site.

HARAR, HERER, HURRUR, HARRAR-GAY, or ARARGE, a city of north-eastern Africa, in the country of the Gallas, at one time the capital of the province of Hadiyah in the Zayla empire, for a long period a small independent state under an emir of its own, and since 1876 subject to the Egyptian crown. The Somali call it Adari and the Gallas Adaray. According to Burton it stands in 9° 20′ N. lat. and 42° 17′ E. long., but the *Bulletin de l'état major général de l'armée égyptienne* makes the latitude 9° 26′ and the longitude 42° 6′. The height above the sea is according to Burton 5500 feet, and according to the *Bulletin* 5580. A stone wall pierced by five gates and flanked by 24 towers, encloses the city, which occupies an area of 128 acres on the irregular slope of a hill, and comprises 9560 houses and 346 huts, arranged in narrow streets that run up and down hill. There are five mosques within the walls, but only one, the *jami* (or cathedral, so to speak), is a building of considerable dimensions. The palace of the emir is a mere shed, long, single-storied, and windowless. Among the chapels to Mahometan saints it is enough to mention that of Sheikh Umar Abadir El Bakai, the patron of the city. Harar has long been the seat of a considerable commerce, though before the Egyptian conquests the merchants had to submit to the exorbitant exactions of their Galla neighbors, who had command of all the caravan routes. Slaves, ivory, coffee, tobacco, safflower, cotton cloths, mules, holcus, wheat, glue, honey, and gums are mentioned by Burton among their principal articles of trade, in return for which they brought back a great variety of wares for local consumption. The Harar coffee especially has a high repute, and the tobacco also is good. The kât or gât (*Catha edulis* of Forskal), the leaves of which are a favorite stimulant or narcotic in north-eastern Africa, grows abundantly in the neighborhood; and the inhabitants often sit together reading the Koran and enjoying the drug for ten or eleven hours at a time. The rainy season at Harar begins about the 15th of March, and lasts for six months, the heaviest rains occurring about June. In the hot season the thermometer reaches 61° Fahr.; in March and April it is not more than 49°. According to Burton the population of the city was only 8000, of whom 2500 were Somali and 3000 Arabs; but the *Bulletin* states the total at 35,000.

The Harari proper are of a distinct stock from the neighboring peoples, and speak a special language. A small glossary in Salt's *Abyssinia*, and another in the *Philological Journal* for 1845, were the only materials available for the investigation of the language previous to the publication of Burton's sketch in his *First Footsteps in North-Eastern Africa*. By him it is maintained that the Hararese is semi-Semitic or, like the Galla, Dankali, and Somali, "a Semitic graft inserted into an indigenous stock;" and his opinion is followed by Bleek and Lepsius. The older statement, strongly supported by Burton, that the language is fundamentally Semitic, and has a special affinity with Amharic, has in its favor no less authorities than Friedrich Müller (*Sitzungsbericht der Wiener Akademie*, Dec., 1863) and F. Prætorius ("Ueber die Sprache von Harar," in *Zeitschrift der deutschen Morgenländ. Gesell.*, 1869). The Harari are Mahometans of the Shafa'i or Persian sect; and they employ the solar year and the Persian calendar. Monogamy prevails, and the women exercise great social influence; but the moral character of the people is said to be very low. It was in 1521 that Harar became a Mahometan city. Burton, the first European to put foot within its walls, spent ten days there in 1854–55, but it was only under the guise of an Arab that he was able to do so. Mohammed Mokhtar, the Egyptian general, has drawn up a sketch of the history of Harar from the native manuscripts brought with him to Cairo, and in company with Abd' Allah Faouzi he has published a plan of the town in the *Bulletin* already quoted (Cairo, 1876).

HARBORS AND DOCKS.—I. HARBORS.— Plates VIII.–XII.
All harbors may be classed either as havens for the protection of ships during storms, or as ports suited for commercial purposes. Of the first mentioned class, or those which are called harbors of refuge, some are natural and some artificial.

The designing of harbors constitutes confessedly one of the most difficult branches of civil engineering. In making such a design the engineer, of course, avails himself of the information which is derived from past experience, and endeavors, to the best of his power, to institute a comparison between the given locality and some existing harbor which he supposes to be similarly situated. Perfect identity, however, in the physical peculiarities of different localities seldom if ever exists, and all that can be done in deriving benefit from past experience is to select the harbor which seems most nearly to resemble the proposed work.

In order the better to understand the nature of the difficulties which beset the marine engineer, let us suppose that he is called upon to design works for the accommodation of shipping in a given locality. The questions which immediately press on his attention are—(1) What is the cheapest kind of design that is suitable for the place and sufficient for the class of shipping which has to be accommodated? and (2) What are the smallest sizes of materials and thickness of walls that are admissible in its construction? as on these the cost of the work will materially depend. Before considering how far it is possible to answer such questions, let us endeavor to define the varieties of design into which all sorts of harbors may, with propriety, be resolved.

In the first place they may be all classified under two main heads—viz., *interior works* and *exterior works*.

The interior works are provided for the accommodation and repair of vessels, while the exterior works may be conveniently enough divided into the following five classes.

1. *Harbors of Refuge and Anchorage Breakwaters.*—These consist of one or more breakwaters, so arranged as to form a safe roadstead, which shall be easily accessible to the largest vessels in all states of the weather and tide. A breakwater forms a barrier either complete or partial to the progress of the waves, and is intended for sheltering the anchorage ground under its lee. It is not used for commercial traffic as are piers or quays, and therefore a parapet is not necessarily required for preventing the waves from breaking over the top, although this may be useful as a protection against the wind. Different classes of harbors.

2. *Deep-water and Tidal Harbors for Commercial Purposes* (fig. 1, *a*, *b*).—A harbor for commercial purposes is any arrangement of piers or breakwaters, or of both, which encloses and so tranquillizes a sheet of water, that vessels may be

moored at the quay walls or wharves which form the inner sides of the piers. Where the coast line lies open to a very heavy sea it is often found necessary to make a double or compound harbor (fig. 1, *b*). In such a case the entrance to the inner basin is situated within the sheltered area formed by the outer works.

3. *Kanted or Curved Piers* (fig. 1, *c*).—Where there is a single pier of this kind vessels lie under the lee of the kant or kants, and the sheltered side of the pier is therefore finished as a quay. As the outer end of any such single pier is surrounded by the open sea, it may be convenient to call it a "free end" in contradistinction to the outer end of a close harbor, where the sea room in the fairway is limited to the breadth of the entrance, which ought, for sheltering the basin, to be made as narrow as is consistent with the safe passage of vessels. Both extremities of all single insulated breakwaters are of course free ends, as are also the seaward ends of all single breakwaters which are connected with the land.

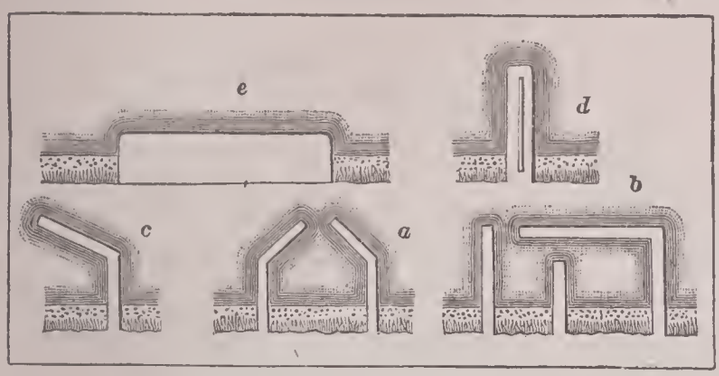


Fig. 1.

4. *Straight Piers* (fig. 1, *d*).—A straight pier generally projects at right angles to the coast line, with a free end at its seaward extremity; and, unless when the wind blows right in upon the shore, a straight pier will always afford some shelter on its lee side.

5. *Quay or Wharf* (fig. 1, *e*).—A quay wall is usually built parallel to the line of shore. It affords no shelter of any kind, and the only advantage which it possesses is that of enabling vessels to load and unload without their having to "beach," or, where the shores are steep, even to take the ground.

It will be observed that all the kinds of piers or harbors just enumerated differ materially from each other in the amount of shelter which they afford, and are suitable for places having very different degrees of exposure. The first step to be taken, therefore, is to select from the different classes of designs which have been enumerated the one which is best adapted to the physical peculiarities of the situation. The engineer in order to make this selection judiciously must keep in view the essential elements of stability, economy, safety of ingress and egress, and convenient accommodation for the trade of the port. If the place be much exposed, he must therefore arrange the different parts of the work so as to produce a harbor which may be easily taken and left in stormy weather, without endangering the tranquillity of the internal area; for it is *the combination of the qualities of an easy and safe entrance and exit, with a good "loose" and a smooth interior, which alone constitutes a good harbor.* Lastly, he must fix the width of the piers and height of the parapets.

Local characteristics.

The local characteristics which at the outset demand our consideration are—(1) the geological and other physical peculiarities of the shore; (2) the exposure; (3) the force of the waves due to the exposure; (4) the strength, direction, and range of the tides; (5) the depth of the bay or sea in which the harbor is to be built; (6) the proximity of deep water to the works, or in other words, the slope of the foreshore; and (7) the angle at which the heaviest waves impinge on the coast line and on the works.

Before considering some of these questions the reader may refer to figs. 2 and 3, on which are marked the technical names of different parts of harbor works.

Generation of Waves.

Level of plane of action of waves.

Mistakes as to the level of the highest tides are sometimes made by drawing too hasty conclusions from the presence of vegetable life. In the Shetland Islands there may often be seen large blocks of rock (and to these reference will afterwards be made), which during storms have been driven over the land at heights much greater than that at which vegetation commences and far above the ordinary run of the surf.

Level of mud a measure of exposure.

The level below the surface of low water at which mud reposes will be found of very considerable value in judging of the exposure of a coast. It may appear unlikely that the disturbance of the surface of the sea occasioned by storms should be propagated to great depths, but there is no want of evidence on this head. Sir G. B. Airy, the astronomer-royal, has shown, on theoretical grounds, that at a depth equal to the length of the wave the motion is $\frac{1}{535}$ of that at the surface, and mentions that heavy ground swells break in a depth of 100 fathoms. Sir J. Coode found, from under water examinations made with the diving dress, that the shingle of the Chesil Bank was moved during heavy winter storms at a depth of 8 fathoms; and Captain E. K. Calver, R. N., has seen waves 6 or 8 feet high change their color from the abrasion of the bottom after passing into water of 7 or 8 fathoms. Captain Cialdi maintains that waves may excavate the bottom at a depth of 655 feet in the ocean, of 163 feet in the Mediterranean, and of 132 feet in the English Channel and Adriatic. From these statements it may easily be inferred that in exposed situations mud cannot repose near the surface. Applying such a test to the German Ocean, it is found that in Shetland mud lies in from 80 to 90 fathoms below low water, and its level gradually rises till, on the coast of Holland, it is found at a depth of from

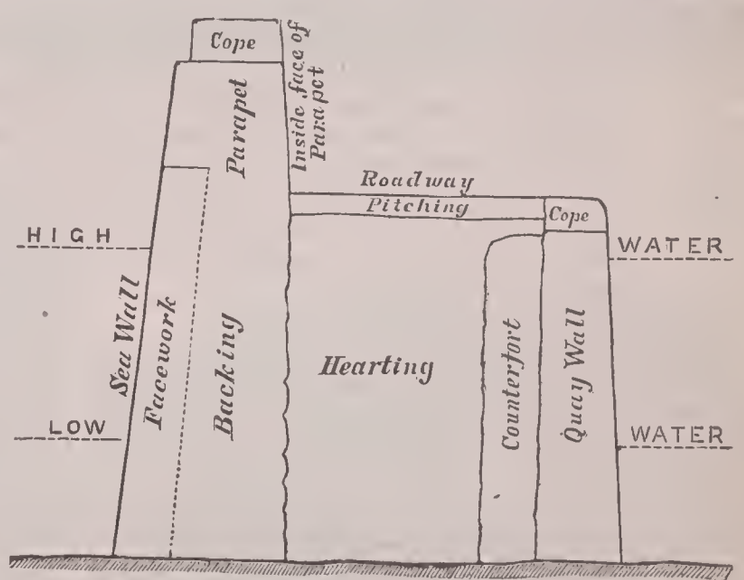


Fig. 2.

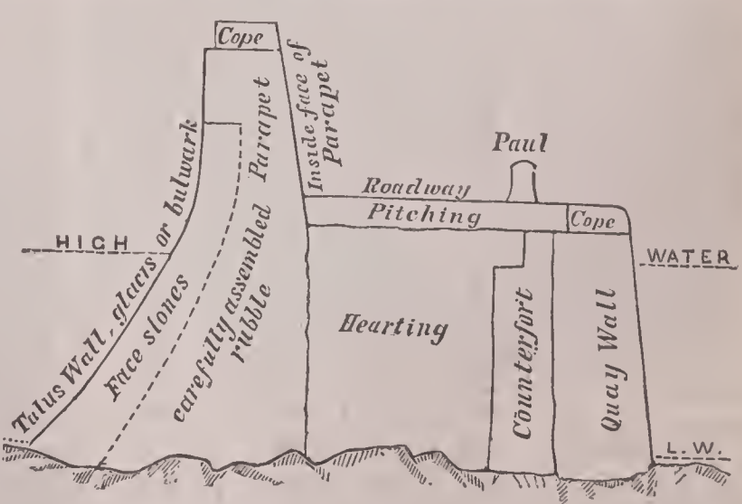


Fig. 3.

16 to 12 fathoms at the mouth of the Elbe. Now, the violence of the waves upon the shores of the German Ocean certainly corresponds with the rise in the level of the mud, there being a gradual decrease as we come from Shetland and the north of Scotland—where, as will be afterwards shown, wonderful energy is displayed by the sea—to the coasts of Holland, where the waves are much modified. Although it is no doubt true that the flat-bottom vessels of the Dutch are built purposely for resisting a heavy surf, still the fact of their being able to take the open beach in nearly all weathers without any protection from harbors proves that the waves are very much reduced before they reach the Dutch coast. Mr. Hyde Clarke says—"On the coast of Zealand the Dutch reckoned 8½ feet as the greatest height to which any wave would be thrown."

Line of maximum exposure.

In comparing an existing harbor with a proposed one, perhaps the most obvious element is what may be termed the *line of maximum exposure*, or, in other words, the line of greatest fetch or reach of open sea, and this can be easily measured from a chart. But though possessed of this information, the engineer still does not know in what ratio the height of the waves increases in relation to any given increase in the line of exposure.

Law of ratio of square roots of the distances from the windward shore.

In 1852, in the *Edinburgh New Philosoph. Journal*, Mr Thomas Stevenson stated as the result of experimental observation that the heights of the waves were most nearly "*in the ratio of the square roots of their distances from the windward shore*;" or, when h = height of wave in feet, d = distance in miles, and a a coefficient varying with the strength of the wind, then

$$h = a\sqrt{d}.$$

The truth of this law has since then been variously tested.[1] The accompanying table contains some of the observations made in 1850–1852, as well as later observations on the effects of heavy gales which could only be made at long intervals of time:—

Place of Observation.	Length of Fetch in Miles Nautical.	Observed Height of Wave.	Height due to Fetch, calculated from Formula $h = 1{\cdot}5\sqrt{d}$.	Height due to Fetch, calculated from Formula $h = 1{\cdot}5\sqrt{d} + (2{\cdot}5 - \sqrt[4]{d})$.
Scalpa Flow	1·0	4·0	1·5	3·0
Firth of Forth	1·3	1·8	1·8	3·2
Granton	2·8	4·0	2·5	3·75
Craignure	3·5	2·0	2·9	8·9
Granton	6·0	4·0	3·7	4·6
Lough Foyle	7·5	4·0	4·1	4·96
Clyde	9·0	4·0	4·5	5·25
Colonsay	9·0	5·0	4·5	5·25
Dysart	10·0	4·2	4·9	5·5
Invergordon	11·0	3·5	5·0	5·7
Lough Foyle	11·0	5·0	5·0	5·7
Glenluce Bay	13·5	5·5	5·6	6·1
Anstruther	24·0	6·5	7·5	7·7
Lake of Geneva, stated by Minard[2]	30·0	8·2	8·2	8·37
Buckie	31·0	7·0	8·4	8·5
"	38·0	7·0	9·2	9·2
"	38·0	8·0	9·2	9·2
"	40·0	8·0	9·55	9·5
Macduff	44·5	8·0	10·02	9·9
"	45·5	10·0	10·20	10·0
Douglas, Isle of Man, St. George's Channel	65·10	10·12	12·0	...
Kingstown[3]	114·0	15·0	16·0	15·25
Sunderland, distance measured from Broken Bank	165·0	15·	19·3	18·15
		149·82	165·57	162·68
	Mean	6·51	7·19	7·39

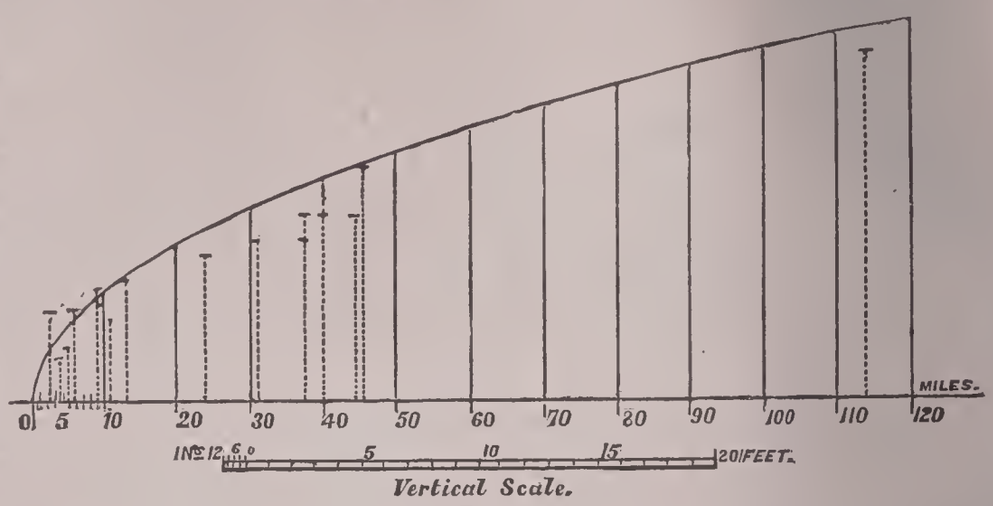
[1] It follows from this law that the heights of embankments of reservoirs above the water surface should, *cæteris paribus*, be proportional to the square roots of the lengths of water over which the wind acts.

[2] *Cours de Construction des Ouvrages Hydrauliques*, Liége, 1852, p. 8.

[3] Mr. Mallet, who made these observations, said that the extreme waves appeared to be about twice this height.

Some of these earlier results have also been laid down in fig. 4, so as to form a storm curve, but since the diagram was made many more observations have been obtained which corroborate the law.

The formula $h = 1{\cdot}5\sqrt{d}$ is represented by the parabolic curve in the diagram, which indicates pretty nearly the height of waves during heavy gales, at least in seas which



Vertical Scale.

FIG. 4.

do not greatly differ in depth from those where the observations were made. This formula is of course inapplicable where the water is not of sufficient depth to allow the waves to be fully formed, or where it becomes so shallow as to reduce their height after they are formed.

It must be observed that in short fetches, as in narrow lochs or arms of the sea, waves are raised higher during very violent gales than the formula indicates; though it does not appear that such waves go on progressing in height in the same high ratio for any considerable distance.

For short reaches and violent squalls, the formula given in column 5 of the foregoing table will be found more suitable, viz.:—

$$h = 1{\cdot}5\sqrt{d} + (2{\cdot}5 - \sqrt[4]{d}).$$

For all ordinary situations the results in the following table will be found sufficient as a general guide.

Table showing approximate Heights of Waves due to lengths of Maximum Fetch by the Formulæ.

Miles.	Heights.	Miles.	Heights.	Miles.	Heights.	Miles.	Heights.
1	3·0	20	7·1	39	9·4	130	17·1
2	3·4	21	7·2	40	9·5	140	17·7
3	3·8	22	7·4	41	9·6	150	18·4
4	4·1	23	7·5	42	9·7	160	19·0
5	4·3	24	7·6	43	9·8	170	19·5
6	4·6	25	7·8	44	9·9	180	20·1
7	4·8	26	7·9	45	10·0	190	20·7
8	5·0	27	8·0	46	10·2	200	21·2
9	5·3	28	8·1	47	10·3	210	21·7
10	5·6	29	8·3	48	10·3	220	22·2
11	5·7	30	8·4	49	10·5	230	22·7
12	5·9	31	8·5	50	10·6	240	23·2
13	6·0	32	8·6	60	11·6	250	23·7
14	6·2	33	8·8	70	12·5	260	24·2
15	6·3	34	8·8	80	13·4	270	24·6
16	6·5	35	8·9	90	14·2	280	25·1
17	6·7	36	9·0	100	15·0	290	25·5
18	6·8	37	9·2	110	15·7	300	26·0
19	7·0	38	9·3	120	16·4		

Maximum recorded height of waves.

The Comte de Marsilli, in 1725, observed waves 14 feet 10 inches in height where the longest possible fetch is 600 miles. At Wick, with much the same exposure, waves of about 40 feet have been seen to strike the breakwater. But the highest which are known to have been accurately measured were by Dr Scoresby in the Atlantic, where they attained the height of 43 feet above the hollow. Cialdi gives observations of others which were from 60 to 108 feet high, but he does not state how the heights were ascertained.

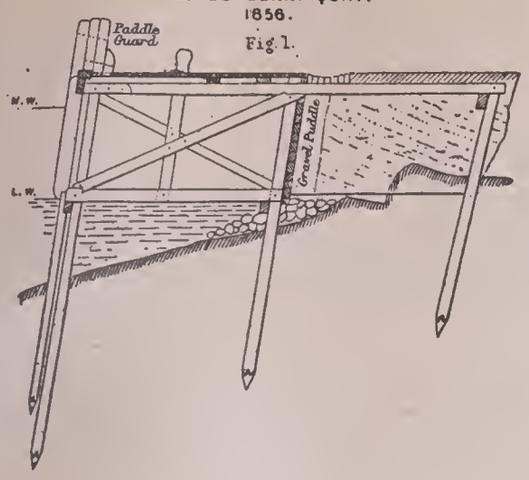
Maximum effective exposure—oblique action of waves.

It does not follow, however, that the line of the maximum exposure is in every case the line of maximum *effective* force of the waves, for this must depend, not only on the length of fetch,

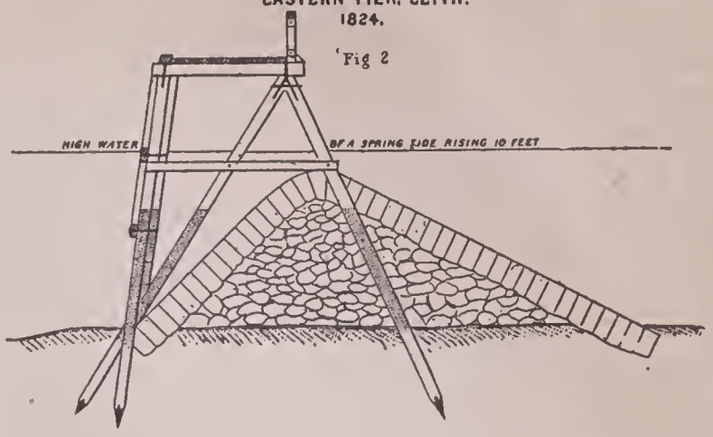
WHITE STAR LINE PIERS IN NEW YORK

THE VIENNA CAFÉ
GRILL ROOM AND
DINING ROOM,
STEAMSHIP "DEUTSCHLAND," OF THE
HAMBURG-AMERICAN LINE

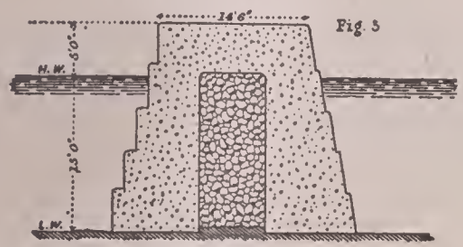
LONDONDERRY QUAY.
1856.
Fig. 1.



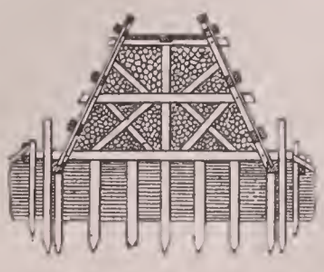
EASTERN PIER, LEITH.
1824.
Fig 2



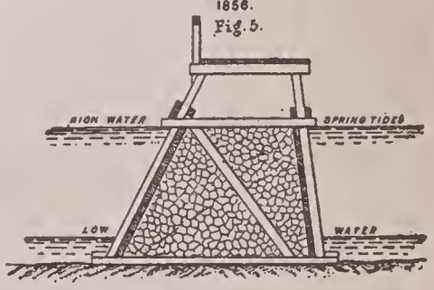
ANSTRUTHER BREAKWATER.
Fig. 3



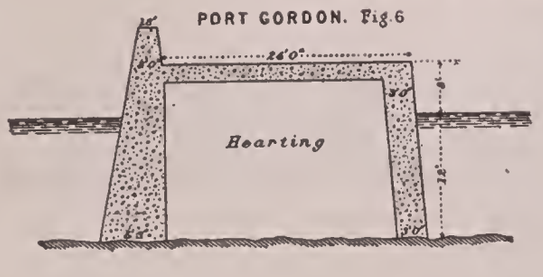
JETTY OF ANCIENT PORT OF DUNKIRK.
1699.
Fig 4.



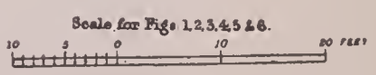
BLYTH BREAKWATER.
1856.
Fig. 5.



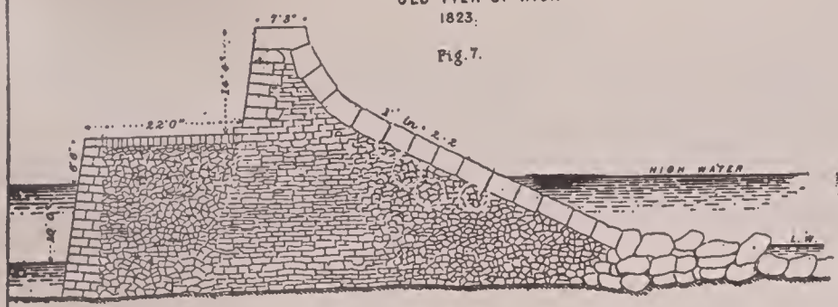
PORT GORDON. Fig. 6



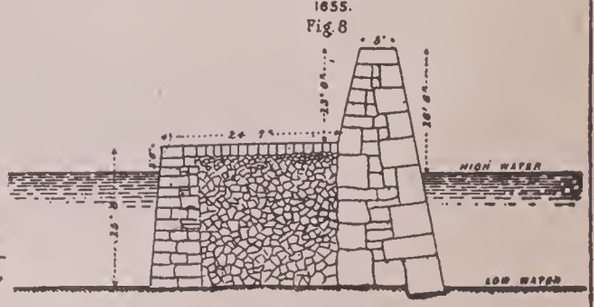
Scale for Figs 1, 2, 3, 4, 5 & 6.



OLD PIER OF WICK
1823.
Fig. 7.

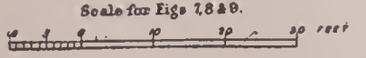


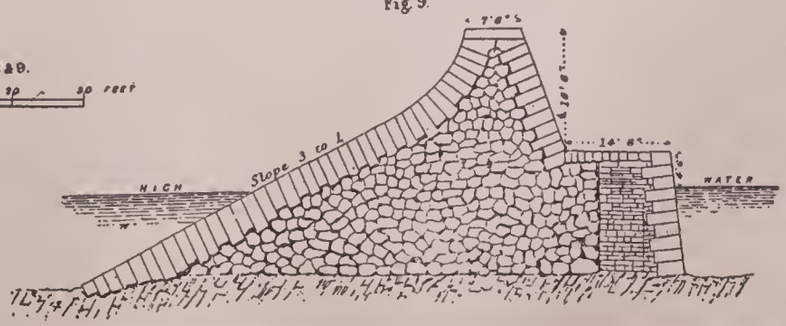
NETHER BUCKIE
1855.
Fig. 8



SARCLET - Co. - CAITHNESS
1833.
Fig. 9.

Scale for Figs 7, 8 & 9.





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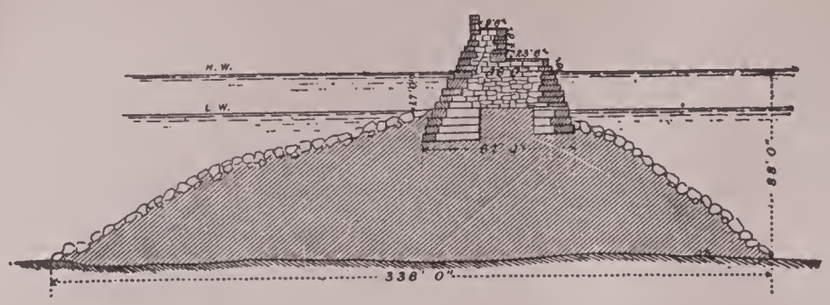
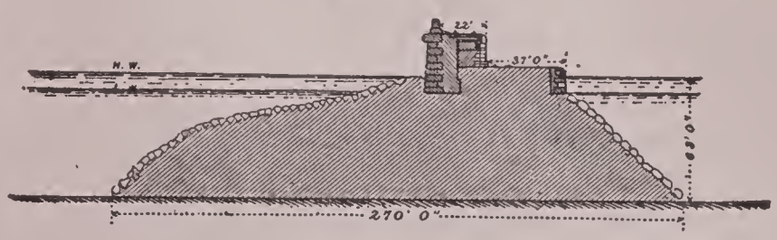
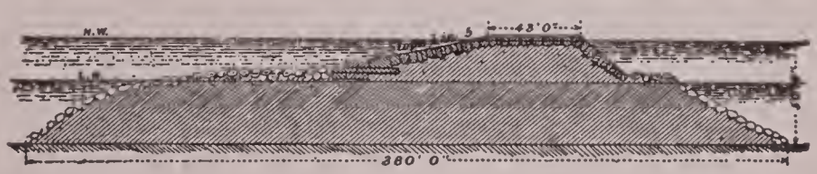
ALDERNEY.



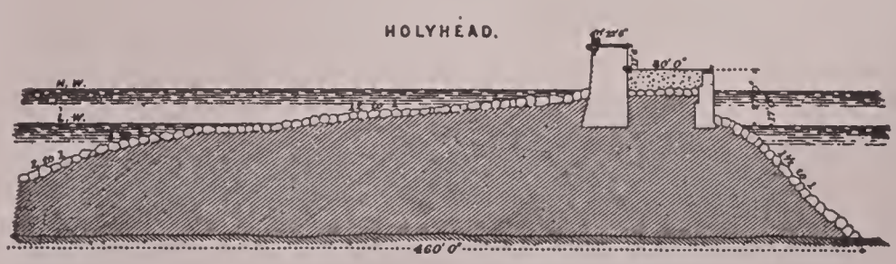
PORTLAND.



PLYMOUTH.



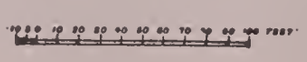
HOLYHEAD.



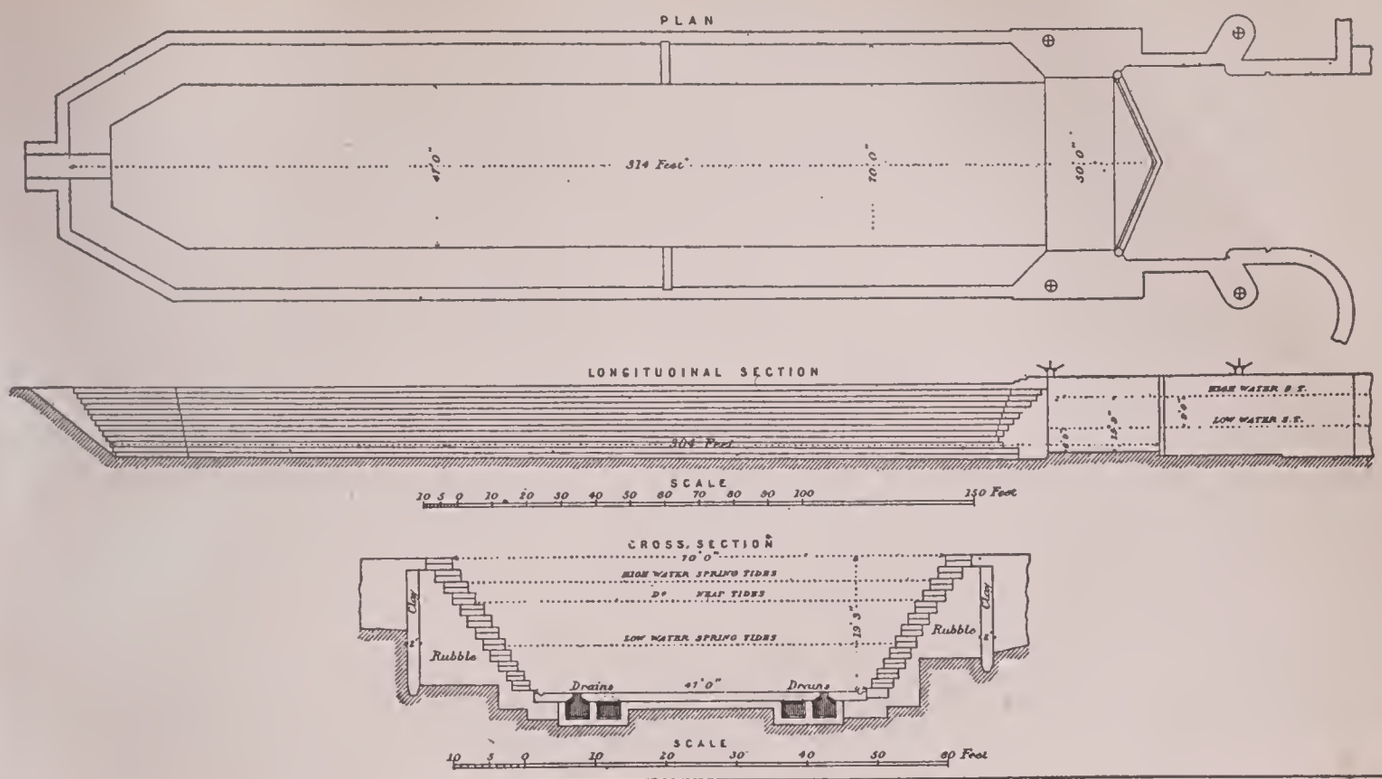
WICK.

ABERDEEN.

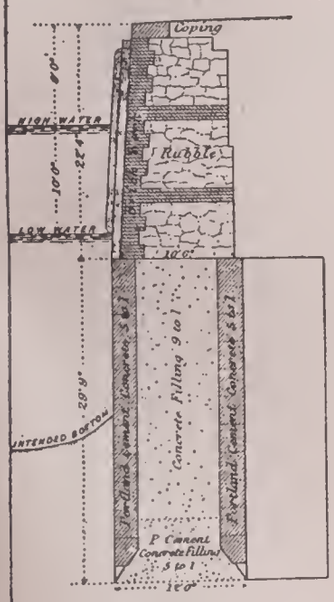
DOVER.



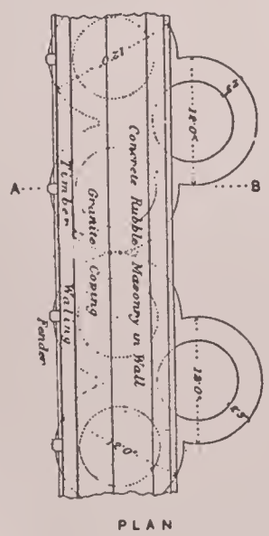
LONDONDERRY GRAVING. DOCK



PLANTATION QUAY. GLASGOW

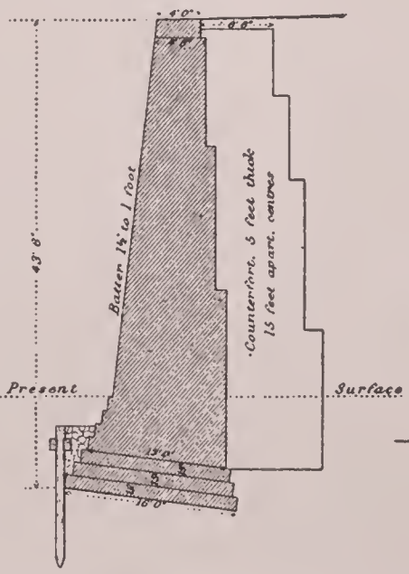


SECTION ON LINE A-B

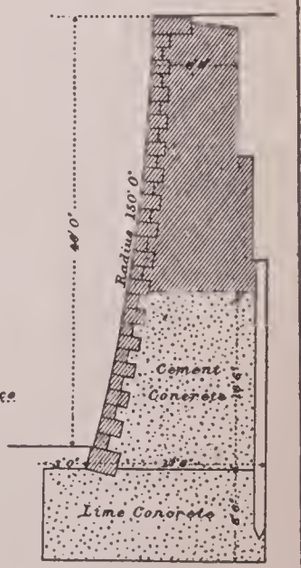


PLAN

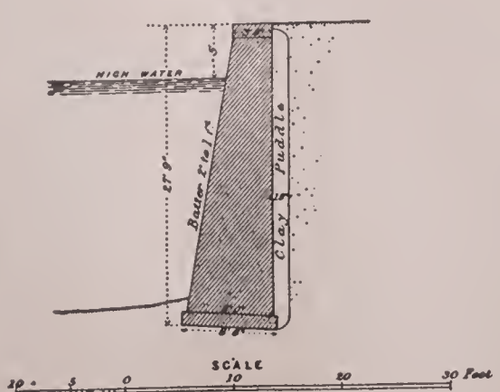
MORECAMBE QUAY



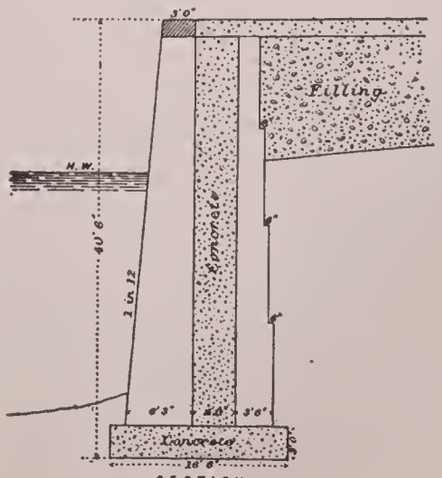
AVONMOUTH DOCK WALL



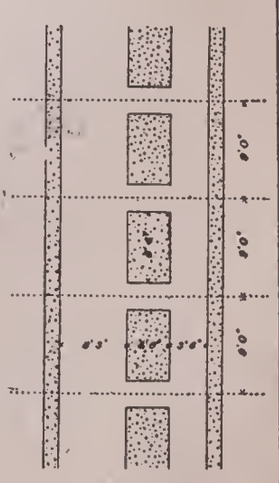
GLASSON DOCK



QUEENS DOCK. WHITEHAVEN.



SECTION



PLAN

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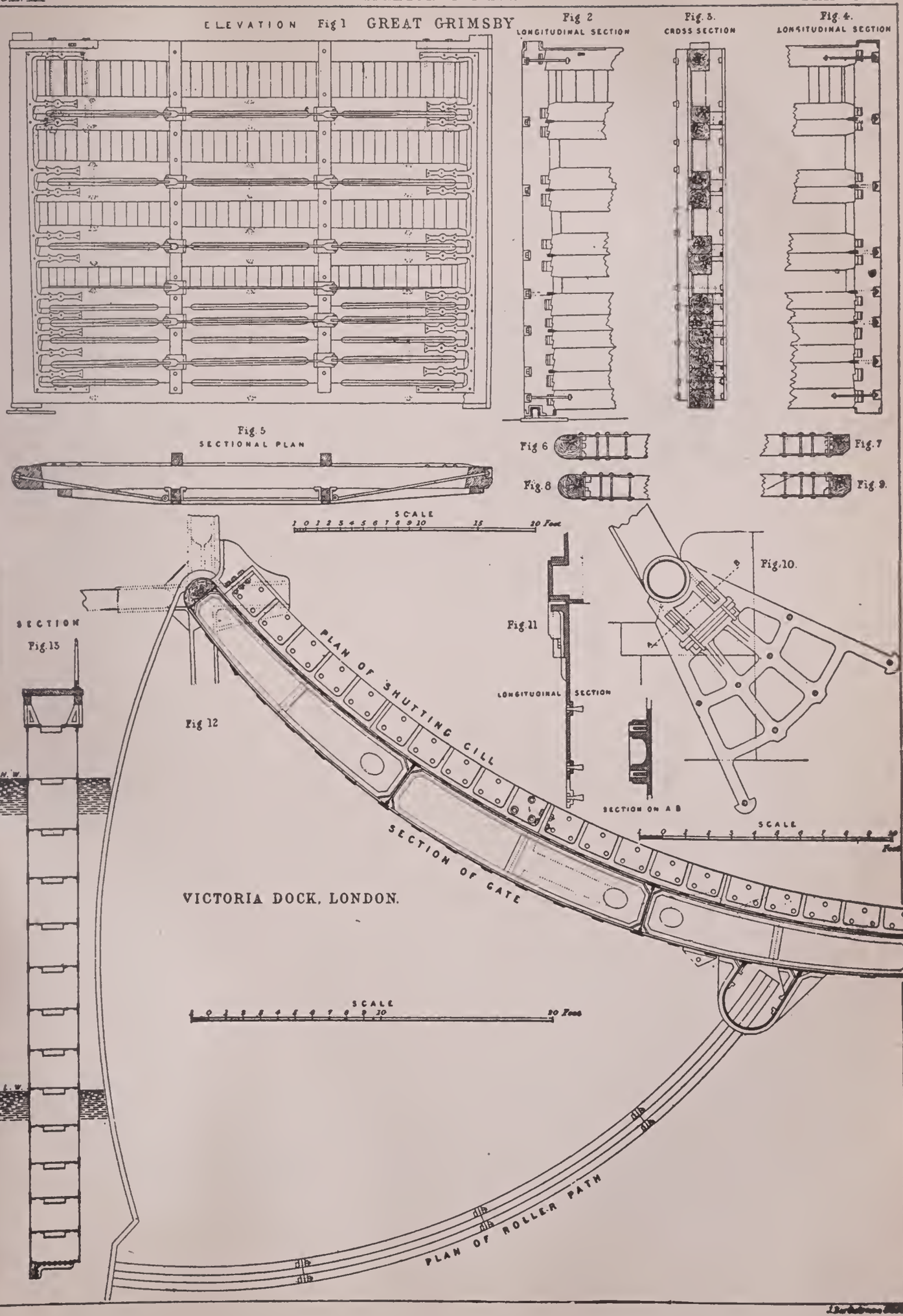
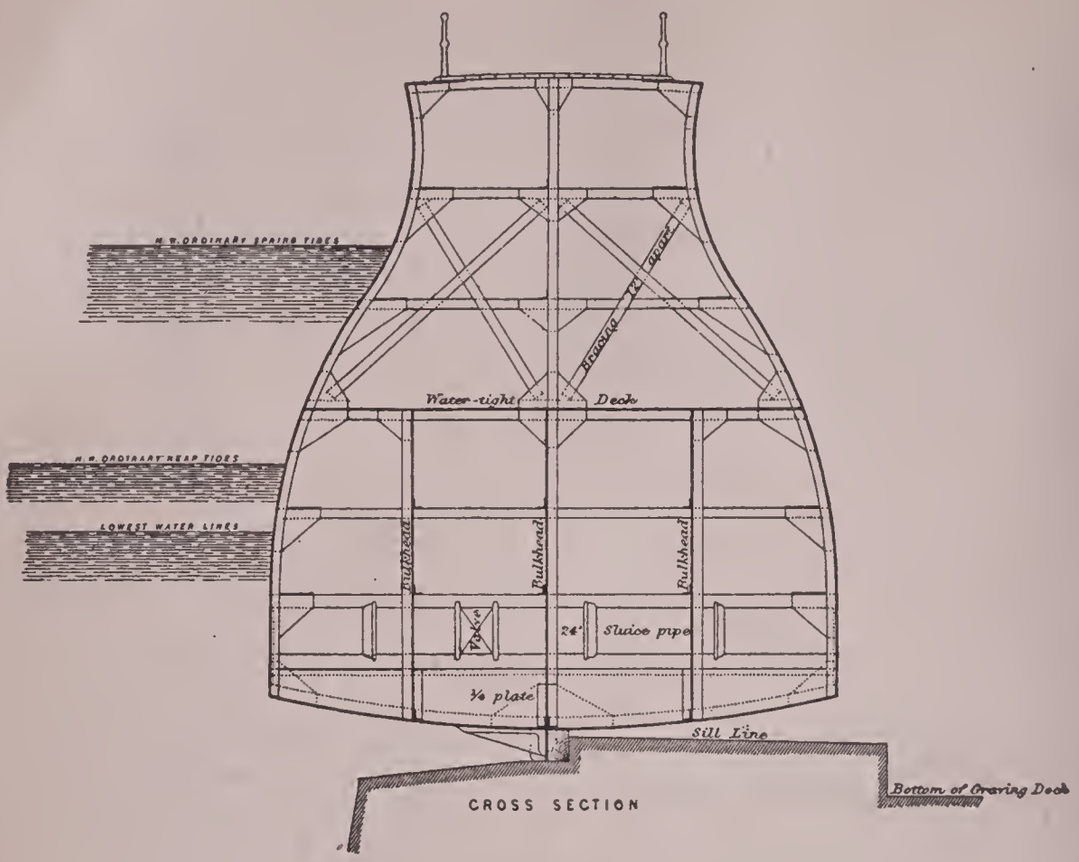
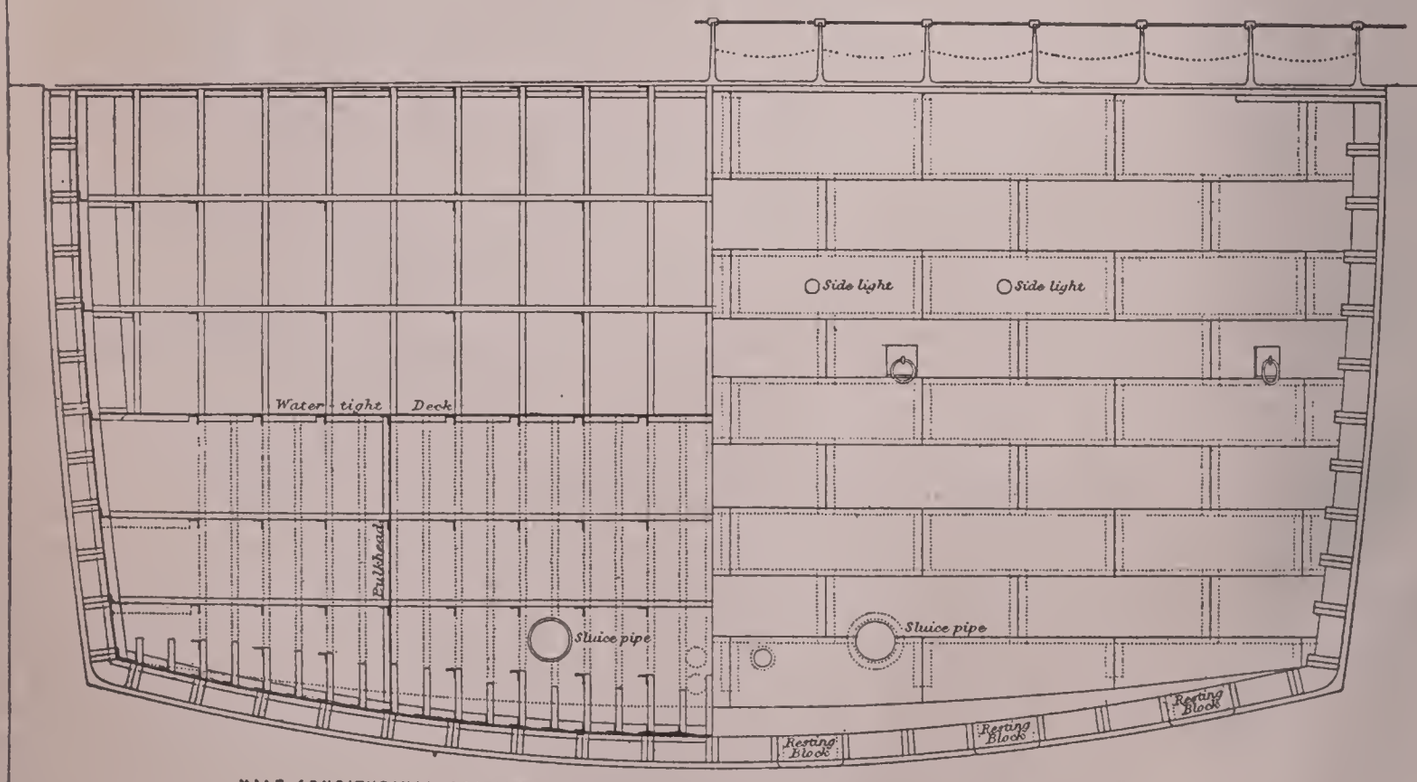

ELEVATION Fig 1 GREAT GRIMSBY
Fig 2
LONGITUDINAL SECTION
Fig. 3.
CROSS SECTION
Fig. 4.
LONGITUDINAL SECTION
Fig. 5
SECTIONAL PLAN
Fig 6
Fig. 7
Fig. 8
Fig. 9.
SCALE
Fig. 10.
Fig. 11
LONGITUDINAL SECTION
SECTION ON A B
SECTION
Fig. 13
Fig 12
PLAN OF SHUTTING CILL
SECTION OF GATE
VICTORIA DOCK, LONDON.
PLAN OF ROLLER PATH

CARDIFF DOCKS

CAISSON FOR GRAVING DOCK



CROSS SECTION



HALF LONGITUDINAL SECTION

HALF ELEVATION

SCALE 1/8"

0 5 10 15 20 Feet

J. Berthiaume Etr.

but on the angle of incidence of the waves on the walls of the harbor. What may be termed the line of *maximum effective exposure* is that which, after being corrected for obliquity of impact, produces the maximum result, and this can only be ascertained from the chart by successive trials.

Let x = the greatest force that can assail the pier, h = height of waves which produce (after being corrected for obliquity) the maximum effect, and which are due to the line of maximum effective exposure, a = azimuthal angle formed between the directions of pier and the line of exposure; then, when the force is resolved normal to the line of pier,—

$$x \propto h \sin^2 a;$$

but if the force be again resolved in the direction of the waves themselves, the expression becomes

$$x \propto h \sin^3 a.$$

It should not, however, be forgotten, in connection with this subject, that in some cases there are modifying elements to which special attention requires to be given. The waves, for example, when approaching the land obliquely, alter their direction when they get close to the shore, in consequence of the change of depth, and from this cause they approach more nearly at right angles to the general line of the beach, and thus strike with greater force than the line of maximum effective exposure would lead us to expect.

The extraordinary difference between waves which impinge at right angles and others which have even a very slight amount of obliquity has been shown in the most unmistakable manner at the Wick breakwater, where all attempts to make the work stand when exactly at right angles to the waves have hitherto been unsuccessful. It was found by observation that while waves coming from the direction of S. by E. struck the outer part at normal incidence, they struck the landward end of the same kant at an angle of 81°, giving 9° of obliquity. This small measure of relief was found to make a great difference in the impact upon the wall.

The value of the line of effective exposure varies in certain localities with the geographical configuration of the land, as in Loch Fyne, where the wind seems to alter its direction with the winding of the loch, so that the effective fetch is greater than the width of free water at the place. On the other hand, where the channel expands, the height of the waves is decreased, as at Craignure in Mull, where the highest wave observed during the winter of 1853–4 was very much less than the formula indicates.

In a case such as represented in fig. 5, the waves which enter the entrance channel or harbor mouth B, though generated apparently in the fetch AB, are largely due to the fetch CB. For the waves generated in the length CA pass round the point A, and are thereafter subject to the impulse of the wind along the line AB. The waves then which enter the harbor mouth, instead of having their point of genesis at A, really take their origin at C, and their height is due to the fetch CB, though reduced by a deflection round the point A.

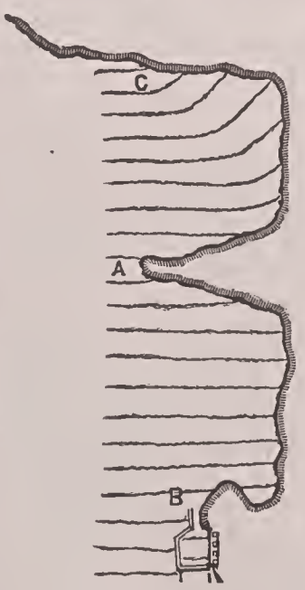


Fig. 5.

Lateral friction and erosion. Lateral friction is due to the passage of the end of the wave along the face of a vertical wall, while lateral erosion is due to the end of the wave breaking as it passes along the face of long talus walls or sloping beaches.

Force of Waves.

Smeaton, in referring to the propriety of using joggles in the masonry of the Eddystone Lighthouse, says—"When we have to do with and to endeavor to control those powers of nature that are subject to no calculation, I trust it will be deemed prudent not to omit, in such a case, anything that can without difficulty be applied, and that would be likely to add to the security." This statement of our greatest marine engineer indicates the propriety of carefully collecting any facts that may help us to a more accurate estimation of those forces which he regarded as being "subject to no calculation."

At the Bishop Rock lighthouse, a bell was broken from its attachments at the level of 100 feet above the high water mark during a gale in the winter of 1860, and at Unst, the most northern of the Shetland Islands, a door was broken open at a height of 195 feet above the sea. To these facts it may be added that, as proved by the testimony of an eye-witness, a block of 50 tons was moved by the sea at Barrahead, one of the Hebrides. But still more extraordinary effects have been observed at Whalsey in Shetland, where heavy blocks have been quarried, or broken out of their beds *in situ*, on the top of the Bound Skerry at a great elevation above the sea. On the south-east side, about 370 feet from the low water mark, and at a height of 62½ feet above its level, there occurs a remarkable beach of angular blocks varying in size from 9½ tons downwards, which are huddled together just as one would have expected to find, had they been elevated only a few feet above the high water level. Towards the north-east at the level of 72 feet above the sea, in addition to many smaller blocks which had evidently been recently detached, there was one 5½ tons in weight. It presented the appearance of recent detachment, having a fresh unweathered look. Within 20 feet of the spot where it lay, there was a comparatively recently formed void in the rock, which upon examination and comparison by measurement was found to suit exactly the detached block. Here then was a phenomenon so remarkable as almost to stagger belief—a mass of 5½ tons not only moved but actually quarried from its position *in situ* at a level of 72 feet above high water spring tides; and higher up still there was another detached rock weighing no less than 13½ tons tilted up in a peculiar position, and underneath which numerous angular masses had been wedged, obviously by aqueous action.

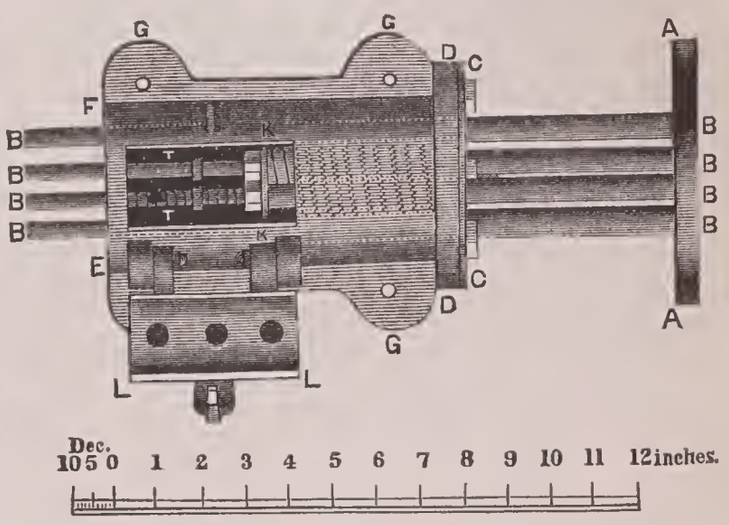


Fig. 6.

But by far the most striking effects as yet recorded were at the harbor works of Wick, which were commenced in 1863, and consisted of blocks of from 5 to 10 tons set on edge, first built above high water neap tides with hydraulic lime, then with Roman and latterly with Portland cement. In October, 1864, 300 feet of the contractor's staging were carried away; and greenheart were afterwards substituted for Memel piles, but these too were broken by the sea. The first portion of the wall was, in conformity with usual practice, founded at 12 feet below low water, but 18 feet was subsequently adopted, and the rubble has since been washed down to 15 feet below that level. In 1872 a huge monolithic block of concrete, weighing in all 1350 tons, was removed *en masse* out of its position and carried to leeward of the breakwater. Extraordinary as this may appear, it was surpassed in 1873, when another concrete mass which had been substituted for the one that was moved, was in like manner carried away, though it contained 1500 cubic yards of cement rubble, the weight of which was about 2600 tons.

Thomas Stevenson's marine dynamometer. The marine dynamometer was constructed by Mr. T. Stevenson for the purpose of ascertaining the force of the waves against an obstacle. DEFD (fig. 6) is a cast-iron cylinder, which is firmly bolted at the projecting flanges G to the rock where the experiments are to be made. This cylinder has a circular flange at D. L is a door which is opened when the observation is to be read off. A is a circular disk on which the waves impinge. Fastened to the disk are four guide rods B, which pass through a circular plate C (which is screwed down to the flange D), and also through holes in the bottom of

the cylinder EF. Within the cylinder there is attached to the plate C a very strong steel spring, to the other or free end of which is fastened the small circular plate K, which again is secured to the guide rods B. There are also rings of leather T, which slide on the guide rods, and serve as indices for registering how far the rods have been pushed through the holes in the bottom EF, or, in other words, how far the spring has been drawn out by the action of the waves against the disk A. These disks were from 6 to 9 inches in diameter.

The greatest result obtained by the dynamometer at Skerryvore Lighthouse, in the Atlantic, was during the heavy westerly gale of 29th March, 1845, when there was registered a force equivalent to 6083 lb, or nearly 3 tons, per square foot, deduced from the area exposed. The next highest was 5323 lb. In the German ocean the greatest result obtained at the Boll Rock was 3013 lb per square foot. But subsequent and much more extended observations at Dunbar, in the county of East Lothian, gave 3½ tons; while at the harbor works of Buckie, on the coast of Banffshire, the highest result of observations, extending over a period of several years, was 3 tons per square foot.

Depth in front of a harbor regulates the height of waves.

Mr. David Stevenson, when referring, in 1835, to the lakes in North America, pointed out that the general depth of water must, in order to allow the waves to be fully formed, be considerable, and that the sea must be unobstructed by shoals, and also of sufficient area to admit of the wind acting fully on the water.

If in front of a harbor shoal water extends seawards for a considerable distance so as to form an extensive flat foreshore, the depth of water above it becomes the true limit of the maximum wave, whatever may be the general depth of the sea outside. But at Arbroath harbor and at Alne mouth, the heaviest waves are tripped up by the shoal water near the mouths of the harbors, and are not found so dangerous to the works inside as the smaller waves which reach the beach in an unbroken state.

Depth in which waves break.

Mr. Scott Russell states that waves break when they come into water of the same depth as their height. At Wick, however, the height of the waves above the mean level was about two-thirds of their height. In 1870, at Scarborough, it was found that waves of from 5 to 6½ feet broke when the depth was 10 feet 3 inches below their troughs, and 6 feet waves broke in water 13 feet 8 inches deep, which would for waves of this class give $h = \frac{1}{2}d$, where d is depth below mean level, and h the height from hollow to crest.

The late Dr. Macquorn Rankine has shown that, theoretically, the mean water level is not situated half way between the crest and trough of the sea. The following formulæ furnished by him give the mean level of the sea from the height and length of the wave. These formulæ are exact only for water of considerable depth as compared with the length of the wave. For shallower water they are only approximate:—

Let L be the length of a wave, H the height from trough to crest; then, diameter of rolling circle $= \frac{L}{3{\cdot}1416}$, radius of orbit of particle $= \frac{1}{2}H$, and elevation of middle level of wave above still water $= \frac{3{\cdot}1416H^2}{4L} = {\cdot}7854\frac{H^2}{L}$.

Consequently—

$$\text{Crest above still water} = \frac{H}{2} + 7854\frac{H^2}{L};$$

$$\text{Trough below still water} = \frac{H}{2} - {\cdot}7854\frac{H^2}{L}.$$

Deep-Water Harbors.

Harbors of refuge are distinguished from tidal harbors mainly by the superior depth of water which they possess and the larger area which they enclose. The requisites are—shelter during storms, good holding ground, and easy access for shipping at any time of tide and in all states of the weather. A breakwater, though a passive, is yet a real agent, having true work to do. During storms many thousand tons of water are elevated and maintained above the sea-level; and a breakwater has to stop their onward motion within a given space or else to change the direction of their movement. There are two ways in which this work can be performed. One is by means of a plumb wall to alter the direction of the moving water by causing it to ascend vertically, and then to allow it to descend vertically, by which process the waves are reflected and sent back seawards. Another mode is to arrest the undulations by a sloping wall of length sufficient to allow the mass of elevated water to fall down upon the slope. If, however, the slope is not long enough to enable the waves to destroy themselves, they will, though reduced in height, pursue their original direction and pass over the top of the breakwater. In this case the breakwater does not do its full amount of work, and imperfect shelter is obtained.

The principle asserted in favor of the vertical wall is that oceanic waves in deep water are purely oscillatory, and exert no impact against vertical barriers, which are therefore the most eligible, as they have only to encounter the hydrostatic pressure due to the height of the impinging billows which are reflected without breaking.

From the effect of winds and tide-currents already referred to, and perhaps from other causes, the action of which seems to have been overlooked by the advocates of the upright wall, we have good reason for believing that any form of barrier, in whatever depth of water it may be placed, must occasionally be subjected to heavy impact. The possibility of waves of translation being generated in the deepest water is established by the following facts:—*first*, that oceanic waves break, partially at least, long before they reach the shore, because (as admitted by the advocates of the purely oscillatory character of oceanic undulations) the depth of water is too small to admit of their being fully propagated; *secondly*, that waves in strong tideways break in deep water during calm weather—a phenomenon which is apparent to the eye and familiar to all sailors; *thirdly*, and negatively, that to leeward of those races which produce broken water, and which certainly do not reflect the incoming waves, there is comparatively smooth water both at sea and on the adjoining shore until the strength of the tide is exhausted and the race has disappeared, after which violent action is again fully manifested on the shore. Even a vertical wall, if built of ordinary masonry in courses, must during its formation present to the action of the waves at its unfinished end a sloping or at least a stepped face like a talus wall, but which, unfortunately for its stability, possesses none of the advantages of such a finished work. In short, during the most critical period of the history of every built vertical wall, the face work and hearting are exposed, at the outer end, to the force of breaking waves. At Dunbar the force against the unfinished end of a nearly vertical wall was found by the marine dynamometer to be nearly six times greater than on the face of the finished wall, where the waves were at the time purely oscillatory.

Oblique force in vertical plane.

An important advantage of the sloping wall is the small resistance which it offers to the impinging wave, but it should also be borne in mind that the weight resting on the face-stones in a talus wall is decreased in proportion to the sine of the angle of the slope. If we suppose the waves which assail a sloping wall to act in the horizontal plane, the component of their impulsive force at right angles to the surface of the talus will be proportional to the sine of the angle of inclination to the plane, while the effective force estimated in the horizontal plane will be proportional to the square of the sine of the angle of inclination. But if we assume the motion of the impinging particles to be horizontal, the number of them which will be intercepted by the sloping surface will be also reduced in the ratio of the sine of the angle of inclination, or of the inclination of the wall to the vertical. Hence the tendency of the waves to produce horizontal displacement, on the assumption that the direction of the impinging particles is horizontal, will be proportional to the cube of the sine of the angle of elevation of the wall.

If it further happens that, owing to the relative direction of the pier and of the waves, there is an oblique action in azimuth as well as in altitude, there will be another similar reduction in the ratio of the squares or cubes of the angle of incidence, according as the component of the force is reckoned at right angles to the surface of the pier or in the direction of the waves.

Let f = force of the wave on unit of surface of wall for perpendicular incidence;

f' = force on unit of surface at vertical incidence ϕ and azimuthal incidence ψ;

then $$f' \propto f\,(\sin\phi\,\sin\psi)^3.$$

Protective value of a breakwater proportional to the resistance it overcomes.

The amount of shelter which is produced by a breakwater must be measured by the length of the portion of wave which is either destroyed or reflected by it. The amount of work done by it decreases from the maximum, which is at normal incidence, to zero when the waves come upon it

"end on," in which last case it ceases to act as a breakwater at all, unless to the extent due to lateral friction or erosion where there is a wall or a slope on which the end of the waves can break.

A breakwater may increase the waves.

If a breakwater be so situated in relation to the coast line that waves may strike obliquely upon its inner or sheltered side, an extension of its length in the same direction will increase the amount of sea intercepted by it. The lengthening of a breakwater may therefore, during certain winds, increase the sea within the harbor instead of reducing it. In such a case the extension should, if possible, be made in a different direction, or a separate breakwater may be brought from the shore so as to shelter the inner side. If these works cannot be undertaken, then an addition to the sheltered space within must be provided in which the waves can spread, or additional slopes be provided on which they can break.

The table of the principal proportions of some of the most remarkable breakwaters, as given below, may be found useful as a guide in designing works of a similar kind.

Cost of breakwaters.

The following costs of different breakwaters are from the minutes of the Institution of Civil Engineers and other sources:—

Name of Breakwater.	Depth of Water in Fathoms.	Cost per Lin. Foot.	Cost per Lin. Yard.	Remarks.
		£	£	
Jollette, Marseilles.	5 to 6	72	215	
Marseilles (new).....	5 to 6·6	109	328	
Portland.....	8 to 10	116 to 120	348 to 360	Convict labor.
Algiers.....	6 to 9	122	366	No rubble, all large beton blocks.
Holyhead.....	3 to 7	about 163	480	
Alderney.....	3·3	170	510	
Plymouth.....	6·6 to 7·5	200	600	
Dover.....	6·6 to 8·3	360	1080	

Although some of these prices have given rise to lengthened discussions as to the comparative economic advantages of the various designs, the results have not been of much value, on account of the different degrees of exposure and of depth of water at the various places. The economic values may perhaps be arrived at in a more satisfactory manner, although still but only very approximately, thus:—When x = the price per foot of depth, p = the price per lineal foot, and d = the depth in feet at high water, then

$$x = \frac{p}{d}.$$

Table of principal Proportions of remarkable Breakwaters.

Name.	Kind of Work.	General Slope of Outer Face.				Inner Slopes.			Level of top of loose Rubble below Low Water.	Level of foundations of Wall below Low Water.
		From Bottom to near Low Water.	Near Low Water.	Up to High Water.	Above High Water.	Above High Water.	Below Low Water.	Top above High Water.		
								Feet.		
	Sloping Breakwaters.									
Plymouth.....	Pitched slopes above high water, loose rubble below.	1⅔ to 1	4 to 1	5 to 1	5 to 1	2 to 1	2 to 1	3	0	0
Portrush.....	Slopes of loose rubble.	1¾ to 1	6 to 1	3 to 1	1⅓ to 1	1⅓ to 1	1 to 1	16	0	...
Kingstown.....	Pitched slopes of rubble.	1¾ to 1	5 to 1	5 to 1	5 to 1	⅓ to 1	⅓ to 1	15	0	0
Holyhead.....	Slopes of loose rubble.	2 to 1	5 to 1	12 to 1	...	...	1¼ to 1	...	...	...
	Composite Breakwaters.									
Portland.....	Slopes of loose rubble, with plumb wall above high water.	1¼ to 1	5 to 1	4½ to 1	4 to 1, & plumb wall.	plumb wall.	1 to 1	25	0	...
Cherbourg.....	Do. do.	2 to 1	7 to 1	7 to 1	...	7½ to 1, & ⅙ to 1	1 to 1	12½	0	0
Alderney.....	Do. do.	2 to 1	5 to 1	wall	½ to 1, & plumb.	wall	1¼ to 1	25	0	12
Cette.....	Do. do.	1½ to 1 & 6 to 1	3½ to 1	½ to 1 wall	wall	⅓ to 1 ...	1 to 1	12½	...	...
Palteneytown..	Do. do.	1 to 1 & 7 to 1 [This is from bottom to 15 feet below low water.]	wall ⅙ to 1	⅙ to 1	⅙ to 1	⅛ to 1	⅛ to 1	6 & 21	15	18
	Vertical Breakwaters.									
Dover.....	Solid masonry.	¼ to 1	¼ to 1	1¼ to 1	¼ to 1, & cavetto.	¼ to 1	¼ to 1	23	...	45
Aberdeen.....	Concrete blocks below low water, and solid above.	⅛ to 1	⅛ to 1	⅛ to 1	⅛ to 1	⅛ to 1	⅛ to 1	11	...	20

The results calculated in this manner are arranged in order of their costs in the following table, from which the plumb pier at Dover appears to be by far the most costly:—

Name of Harbor.	Depth in Feet at High Water.	$\frac{p}{d}$
Portland.....	62	£1·90
Joliette.....	35	2·06
Algiers.....	42	3·00
Marseilles (new).....	35	3·10
Plymouth.....	58	3·45
Holyhead.....	36	4·40
Alderney.....	37	4·60
Dover.....	38	9·47

Available capacity of harbors of refuge and of anchorages.

Minard allows for large merchant vessels in harbors of refuge one cable-length, which would give about four vessels per acre. Captain Calver allows three vessels per acre for a small sheltered harbor of refuge. At Cardiff Flats there were at one time 224 vessels anchored as close to each other as they could well be, in an open roadstead, and occupying a space of 560 acres, which would give 0·4 vessel per acre.

Tidal Harbors.

We have hitherto been considering outer breakwaters erected in deep water, and which are constantly exposed to the waves; we now turn to piers and sea-walls which are placed within the range of the breaking surf, and which are exposed to its force for a limited period only, being sometimes left nearly or altogether dry by the receding tide.

In dealing with waves which are admitted by all to exert a true percussive force, the question arises as to how this force may be best resisted—whether by opposing to it dead weight, or a comparatively light structure, the stability of which is dependent on strong fixtures connecting it with the bottom. On this subject the late Mr. Alan Stevenson made the following remarks, in relation to lighthouse towers, but his views are equally applicable to piers and breakwaters:—

"A primary inquiry in regard to towers in an exposed situation is the question whether their stability should depend upon their *strength* or their *weight*, or, in other words, on their *cohesion* or their *inertia*? In preferring weight to strength we more closely follow the course pointed out by the analogy of nature, and this must not be regarded as a mere notional advantage, for the more close the analogy between nature and our works the less difficulty we shall experience in passing from nature to art, and the more directly will our observations on natural phenomena bear upon the artificial project. If, for example, we make a series of observations on the force of the sea as exerted on masses of rock, and endeavor to draw from these observations some conclusions as to the amount and direction of that force as exhibited by the masses of rock which resist it successfully, and the form which these masses assume, we shall pass naturally to the determination of the mass and form of a build-

ing which may be capable of opposing similar forces, as we conclude with some reason that the mass and form of the natural rock are exponents of the amount and direction of the forces they have so long continued to resist. It will readily be perceived that we are in a very different and less advantageous position, when we attempt, from such observations of natural phenomena in which weight is solely concerned, to deduce the strength of an artificial fabric. Another very obvious reason why we should prefer mass and weight to strength as a source of stability is that the effect of mere inertia is constant and unchangeable in its nature, while the strength which results even from the most judiciously disposed and well-executed fixtures of a comparatively light fabric is constantly subject to be impaired by the loosening of such fixtures, occasioned by the almost incessant tremor to which structures of this kind must be subject from the beating of the waves. Mass therefore seems to be a source of stability, the effect of which is at once apprehended by the mind as more in harmony with the conservative principles of nature, and unquestionably less liable to be deteriorated, than the strength which depends upon the careful proportion and adjustment of parts."[1]

Effect of configuration of rocks and of bottom of the sea on marine structures.

It is a remarkable fact that during a summer gale 14 blocks, each 2 tons in weight, which had been permanently fixed in the Dhu Heartach lighthouse tower by joggles and cement, at the level of 35½ feet above the sea, were torn out and swept off the rock, while the thin panes of crown glass in the lantern of Winstanley's Eddystone tower, which were only about 5 feet higher, resisted the waves for a whole winter. The impact on marine masonry seems therefore to depend on the relation subsisting between the height of the waves at the place and the height and configuration of the rock itself above and below low water, and perhaps also on the configuration of the bottom of the sea near the rock.[2] While the rock at Dhu Heartach from its height above the sea forms a protection against the smaller waves, it operates as a dangerous conductor to the larger waves, enabling them to exert a powerful action at a much higher level than if the rock had been lower. It is of great importance that these facts should be kept in view, and that the Eddystone should not be regarded as a safe model for imitation at all rocks which are exposed to a heavy sea.

Forces on outside of masonry.

The impact of the waves against the outside of a sea-wall or pier gives rise to four distinct forces, namely—(1) the direct horizontal force, which tends to shake loose, or drive in the blocks of which the masonry consists; (2) the vertical force acting upwards on any projecting stone or protuberance, as well as against the lying beds of the stones; (3) the vertical force acting downwards, which results either from the receding wave striking upon the toe of a talus wall, or from its passing over the parapet and falling upon the pitching behind, so as to plough it up, (4) the "backdraught," which tends by reaction from the wall to remove the soft bottom, and in this way to undermine the lower courses or to suck loose stones out of the work.

It may be concluded from the above that the points which require to be most attended to are—the contour and quality of masonry of the wall itself; the parapet, which if not of proper form, or of insufficient height, leads to damage in the pitching behind it; and lastly, the foundation-courses, in the design and construction of which, if similar precautions be not attended to, underwashing of the bottom may take place, so as to leave the lowest courses without protection.

Forces within the masonry.

Within the masonry, as well as without, the waves exert force in the following different ways:—(1) by the propagation of vibrations produced by the shock of the waves on the outer or sea-wall, through the body of the pier to the inner or quay-wall; (2) by the direct communication of the impulses through the particles of the fluid occupying the interstices of the hearting, so as to act against the back joints of the face stones of the inner quay; (3) by the sudden condensations and expansions of the air in the hearting, so as to loosen, and at last to blow out, the face stones of the quay; combined with (4) the hydrostatic pressure of the water, which is forced through the sea-wall, and, from want of free exit, is retained and acts as a head at the back of the quay, and which, however small in quantity, will, as in a Bramah press, act with equal force upon all surfaces exposed to its pressure, however large those surfaces may be. The last three causes are probably the most efficient agents in the work of destruction.

From a comparison of different piers in the German Ocean where we have most examples, and from careful consideration of the other data, it appears that vertical piers, fully exposed to the ordinary waves of that sea, should be not less than from 35 to 45 feet broad at the level of high water. Of course this remark does not apply to anomalous cases where waves are exceptionally high, but, as already stated, to works exposed to the ordinary waves.

Design of ground plan of of harbor.

The positions in which the piers are to be placed depend on the nature and configuration of the shore and of the bottom. After a correct plan, with soundings, has been obtained, the next step is to lay down contour lines of the different depths which make the limits of the deep and shoal water at once obvious to the eye. The lines of the piers may then be sketched so as, without disregarding other conditions, to keep the works as much as possible on the shoal ground, while they at the same time enclose the greatest possible area of deep water.

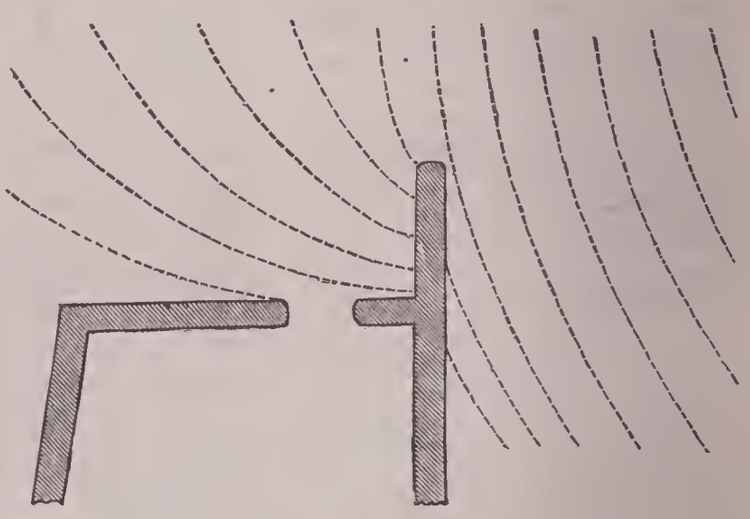


Fig. 7.

Entrance.

The entrance should be fixed seaward of every part of the works; and its direction, unless where the internal area is small and the sea very heavy, should if possible be made to coincide with that of the heaviest waves, so that they may run along with and guide vessels into the harbor. The outer pier should in such a case be extended sufficiently far seaward of the end of the inner pier head to give it a free end, as in fig. 7, thus allowing a ship plenty of sea room to shape an easy course before taking the entrance to the sheltered basin of the harbor.

There should be sufficient distance landward of a harbor mouth to allow a vessel, having full weigh on her, to shorten sail. For this Minard recommends that where vessels of ordinary size require to alter their course in order to reach the inner basin, no circle with a less radius than 200 yards in smooth water should, if possible, be adopted, and it should not be forgotten that a vessel requires a larger radius in turning where the water is shoal than where it is deep.

If the beach consist of travelling detritus, the entrance must be so devised as not to form a trap for the passing shingle. This danger is most to be dreaded on the coasts where heavy waves strike obliquely upon the shore. Finally, there must be a good "loose," so that vessels on leaving the harbor shall be able to shape their course free of rocks or a lee-shore; and Minard very properly remarks that the mouths of harbors should be designed rather to suit the entering, which is far more important, than the exit of vessels.

[1] *Account of the Skerryvore Lighthouse*, by Alan Stevenson, LL.B., F.R.S.E., Edin., 1848, p. 49.

[2] Mr. D. A. Stevenson has lately shown that a funnel-shaped depression in the sea-bottom extends from the ocean in the direction of, and nearly as far as, the Dhu Heartach rock, a geological formation which must certainly admit the heaviest class of waves to come nearer to the rock (*Min. of Proc. of the Inst. of Civil Engineers* vol xlvi.).

Piers of horizontal curvature preferable to long straight piers.

Preference should generally be given to a pier of horizontal convex outline, or a polygonal form, than to one long straight pier. The principal objection to a straight pier does not, however, extend to cases where the heaviest waves strike upon it obliquely, and roll landwards along the sea-wall. Especial care, however, must in all cases be taken that a sea-work nowhere presents to the sea a surface of concave horizontal outline, or, what is still worse, abrupt faces which form a re-entrant angle; for the waves will then act with an almost explosive violence, the breaking of a free wave being a very different thing from the breaking of a wave confined by a barrier of masonry. While the first may be compared to the harmless ignition of a loose heap of gunpowder, the other resembles the dangerous explosion produced by the discharge of a cannon.

It may in some cases be found better, in designing a sea-wall for protecting a sinuous coast, to carry the bulwark straight across ledges of rock which extend landwards, than to follow the line of the high water margin. For although with the straight wall we may have to encounter a greater depth of water and a heavier surf, still with the other we may have to oppose the waves with a wall which has at some places a concave horizontal curvature, by which the force is concentrated and rendered more destructive. Moreover, the straight wall may be considerably shorter than the curved.

Vertical profile of walls.

The general gradient of a fragmentary beach depends upon the size and nature of the particles, and the force of the sea. The dissimilarity between its slopes near the levels of high and low water arises from a decrease in the force of the waves, caused by their being broken before they reach the high water mark. The great object, therefore, is to design the profile of the wall so as to alter as little as possible the symmetry of the beach. For the reasons already stated, it is plain that unless near high water mark a vertical wall is in most cases unsuitable for a sandy beach. Instead of altering the direction of the wave at a distance from its foundation, the whole change is produced at that very point; and, unless the wall be founded at a considerable depth, its destruction is all but certain. A curved profile will prevent to a considerable extent the danger of reaction, by causing the alteration in the direction of the wave to take place at that part where the wall is strongest, and which is also at the greatest possible distance from the toe or curb course. But a very serious objection to all forms of curved walls, unless the radius be large, is the weakness which results from the use of wedge-shaped face-stones. The impact of the sea on materials of that form may be compared to a blow directed upwards against the intrados of a stone arch—the direction of all others in which the voussoirs are most easily dislocated. This action can only be resisted by very careful workmanship in the dressing and setting of the backing. Another objection, applicable to all except tideless seas, such as the Mediterranean, arises from the varying level of the surface of the water; for what may be best at one time of the tide cannot be equally suitable at another.

Reduction of waves by lateral deflection.

When a wave encounters an obstacle such as a breakwater, the portion which strikes it is either entirely destroyed or reflected seawards; while the portion which is not so intercepted passes onwards, and spreading laterally under lee of the barrier suffers a reduction of its height. From a very few observations in the sea under lee of the breakwater at Wick, and from some experiments made in a brewer's cooling vat by Mr. Thomas Stevenson, it appeared that after passing an obstruction the reduction in the height of a wave varies as the square root of the angle of deflection. When x represents the ratio of the reduced to the unreduced wave and α the angle of deflection, the formula, which must however, be regarded as only approximate, is

$$x = 1{\cdot}00 - {\cdot}06\sqrt{\alpha}.$$

The measurements of the distances of high water mark from the centre of divergence, in sandy bays which are under lee of promontories, seem to show that this formula, or one for a logarithmic spiral, represents the effect of lateral divergence very fairly. Providing the materials of the beach are homogeneous and easily moved, the incursions of the waves into the land will be measures of the forces, all of which become *nil* at the high water mark. The following table shows measurements of the finely curved storm and tide marks traced out on the sandy beach under the lee of the promontory at North Berwick, and the results of the formula.

Angles of Deflection.	Distances from centre of Divergence at end of Promontory to High Water Mark.	Ratios of Measurements.	Results of Formula.
0°	1150	1·00	1·00
10°	1000	·87	·87
20°	920	·80	·73
30°	840	·73	·67
40°	735	·64	·62
45°	700	·61	·60
50°	675	·59	·58
60°	600	·52	·53
70°	570	·50	·50
80°	555	·49	·46
90°	530	·46	·43

Reduction of waves after passing into close harbors.

The tranquillity of close harbors with the same exposure depends on the relative widths of the entrance and the interior, the depth of water, and the form and direction of the entrance in relation to the line of maximum exposure. A formula for the reductive power of harbors has been given by Mr. Thomas Stevenson (*Edin. Phil. Journal* for 1853).

Where the piers are high enough to protect the enclosed area from the wind, and the width of entrance not very great in comparison with the breadth of the wave, the quay walls nearly vertical, and the distance from the entrance to place of observation not less than 50 feet, then

$$x = \mathrm{H}\frac{\sqrt{b}}{\sqrt{\mathrm{B}}} - \frac{1}{50}\left(\mathrm{H} + \mathrm{H}\frac{\sqrt{b}}{\sqrt{\mathrm{B}}}\right)\sqrt[4]{\mathrm{D}},$$

where H = height of wave at entrance, b = breadth of entrance, B = breadth of harbor at place of observation, D = distance from mouth of harbor to place of observation, x = height of reduced or residual wave at place of observation,—all in feet. If H be taken as unity, x will be a fraction representing the reductive power of the harbor.

Actual measurements at the harbors of Kingstown, Sunderland, Macduff, Fisherrow, and Buckie gave the mean of observations (which at Buckie alone numbered upwards of 2000) = 2·64 feet, while that of results calculated by the formula gave 2·62 feet.

Size of harbor must be proportionate to magnitude of waves.

The size as well as the ratio of widths of entrance and basin must also bear a proper relation to the height of waves to which the harbor is exposed. The formula for the reductive power assumes that the waves after being reduced by lateral expansion shall have time to sink and be ultimately destroyed. But if instead of this they are again reflected towards the entrance, such recoil will destroy the tranquillity of the basin and prevent vessels from answering their helm when taking the entrance. Also where a spending beach which is only partially effective in destroying the waves is formed very near the entrance, it may do little or no good by causing a back wash or recoil wave which will injuriously affect vessels when entering.

Stilling basins.

As before mentioned, it is essential when the exposure is great that there be either a considerable internal area, or else a separate basin opposite the entrance to the inner basin, for the waves to destroy or spend themselves. Such a basin should, if possible, enclose a portion of the original shore for the waves to break upon, and when circumstances preclude this there should be a flat talus wall of at least 3 or 4 to 1, as recommended by the late Mr. Bremner of Wick. Mr. Scott Russell has found that talus walls of 1 to 1, or steeper, will not allow the waves to break fully, but will reflect them in such a manner as might in some cases make the entrance difficult or even dangerous of access, and the berthage within unsafe.

Places where unprotected quays may be used.

The following cases in which traffic has been successfully carried on at quays unprotected by covering piers, may be found useful as a guide:—

At Scrabster the quay is at right angles to a fetch of 6 miles. At Invergordon there is a fetch of 5 miles; at Burntisland, 6; Kilcreggan, 4; Londonderry, 1½; Greenock, 6½; Albert Quay,

Greenock, 7 miles. The last two are, however, somewhat sheltered by the low-water banks near Greenock.

Five miles is probably not far from the limit that should be observed, which by the ordinary formula, $h = 1{\cdot}5\sqrt{D}$, gives a wave of 3·8 feet; but the formula for distances so short as these would give waves about a foot higher, and in heavy storms perhaps waves not much less than 5 feet may exist, but on such occasions vessels could not safely use the quay.

Booms.

In order to tranquillize harbors of small reductive power, logs of timber called booms, having their ends secured by projecting into grooves cut in the masonry on each side, are placed across the entrance of the inner basin or dock. From 15 to 25 logs are usually dropped into these grooves, or as many more as will ensure close contact of the lowest log with a sill-piece placed in the bottom of the harbor. They are also warped down or fixed with an iron hasp at the coping course, without which precaution the swell is found to enter the harbor from underneath. By this contrivance, which forms a temporary wall, the waves are checked, and completely prevented from spreading into the interior basin.

Twelve-inch booms of pine timber about 33 feet long have been broken at the small fishing village of Mousehole, near Penzance, and elm logs have in consequence been substituted. At Hynish in Argyllshire, booms of the same timber and scantling and 20 feet long have been very frequently broken. The marine dynamometer at this place gave $1\frac{1}{8}$ ton per square foot.

Capacity of harbors for commerce.

The capacity of commercial harbors for trade varies so much with the exposure and size of vessels, that it is difficult to approximate to the truth. At Ramsgate, for instance, there were found to be about 6 vessels to an acre in the outer harbor, while there were about 14 in the inner and better protected basin, where too there was perhaps a greater proportion of small vessels. In the Scotch fishing harbors the number of boats used to be reckoned at from 85 to 115 per acre; but of late their size has been much increased, and probably not more than from 80 to 90 could be accommodated. The Cornish boats at New Lynn, according to the Channel pilot, vary from 60 to 80 per acre.

Timber structures.

The employment of timber in harbor works is of great antiquity. It seems first to have been used in forming boxes which were filled with stones, and at a more recent period in the formation of open framework through which the current could pass freely. Vitruvius mentions moles, consisting of timber filled with stones and cement, as having been used by the harbor-builders in his days.[1] The earliest drawing of timber piers that we have met with is that of the ancient port of Dunkirk in 1699, a cross section of which from Belidor's *Architecture Hydraulique* is given in Plate VIII., fig. 4. This kind of structure is still not uncommon on the coasts of the English Channel.

Destruction by marine insects.

In sheltered bays where a deep-water landing-place is all that is required, and where the bottom is sandy or soft, timber may be employed with great advantage. Even in somewhat exposed situations it can also be used for tidal harbors; but the fatal evil in places where there is no admixture of fresh water is its rapid destruction by marine insects. In the Atlantic Ocean the *Teredo navalis*, and at many places in the German Ocean the *Limnoria terebrans*, which was first discovered by the late Mr. Robert Stevenson at the Bell Rock Lighthouse in 1810, are very destructive of most kinds of timber. Mr. Stevenson found that memel was destroyed by the *Limnoria* at the rate of about 1 inch inwards per annum. He found that greenheart, beefwood, African oak, and bullet tree were scarcely attacked, while teak stood remarkably well and locust tolerably well, though suffering at last. Greenheart timber, though not absolutely impenetrable, as appears from Mr. Stevenson's experiments, is the great specific in seas where the worms are destructive. But subsequent experience has proved that on the coasts of Scotland it is, in some cases, readily attacked, and at these places creosoting is of comparatively little use, as the worm manifests no repugnance to timber which has been even very recently impregnated.

Durability of iron.

In addition to the experiments on timber, twenty-five different kinds and combinations of iron were tried at the Bell Rock, including specimens of galvanized irons. All the ungalvanized irons were found to oxidize with much the same readiness. The galvanized specimens resisted oxidation for three or four years, after which the chemical action went on as quickly as in the others. Although the association of zinc with iron protects, so long as it lasts, the metal with which it is in contact, it must be remembered that this immunity is obtained at the expense of the zinc, the tendency of which to oxidization is proportionally exalted so soon as any part of the iron is exposed.

The important experiments of Mr. Mallet on specimens sunk in the sea showed that the amount of corrosion decreased with the thickness of the casting, and that from $\frac{1}{10}$th to $\frac{4}{10}$th inch in depth, in castings 1 inch thick, and about $\frac{6}{10}$th inch of wrought iron will be destroyed in a century in clear salt water. But there is reason to believe from a cannon ball which was picked up on the shores of the island of Inchkeith that the decay was in that case $\frac{3}{8}$th inch to the century. Cast-iron gratings periodically immersed by the tide at the Bell Rock lost at the rate of 1 inch in a century. Even when the castings were externally sound their strength was reduced one-half in about 50 years.

Materials of construction.

In judging of the qualities of different quarries for harbor purposes the importance of a high specific gravity ought not to be overlooked, as appears from the table given on page 415.

The superiority of granite to greenstone is proved by the following experiments on the times required to abrade $\frac{1}{12}$th inch of each kind of stone, made with the same weights and grinding agents, and with equal cubes of each material:—30 minutes were required for Queensferry (Carlin Nose) greenstone; 40 minutes for greenstone from Barnton near Edinburgh; 60 minutes for Peterhead granite. Mr. Murray of Sunderland also established, many years ago, the superior power of resistance to attrition possessed by granite over greenstone.

Portland cement rubble and concrete.

Portland cement rubble and concrete, a most valuable material now very commonly used in Britain as well as on the Continent, may be said to have to a large extent revolutionized harbor building; for it admits of being employed in many different ways, and can, if due care be taken as to the quality of the cement and purity of the sand and gravel, be used with perfect confidence.

The following specification has been followed extensively at different places:—

> The Portland cement is to be obtained from the best manufacturers. It is to be ground extremely fine, and is to weigh not less than 115 lb per bushel; and each cargo will, on its arrival at the works, be tested in the following manner. The cement is to be made into small blocks 1 inch square and 8 inches long. After being made, these blocks are to be immersed in water for 7 days and then tested by being placed on two supports 6 inches apart, when they must stand the transverse strain produced by a weight of 70 lb placed in the centre. Slabs or cakes are also to be made and placed in water, and after immersion for 24 hours they are not to show any signs of cracking or any softness on the surface.
>
> The cement is to be tested before any of it is used, and if it be found unsatisfactory it must be removed from the works. When a cargo is landed it must be tested from four different bags, and it must also be tested weekly as the works proceed, and the results forwarded to the engineers. The cement must be brought direct from the manufactory and kept at the works in a dry and well-ventilated storehouse with dry wooden floor and side walls, properly roofed in and completely protected from the weather.
>
> The concrete to be used is to consist of one part of Portland cement, two of sand, and five of gravel, to be thoroughly mixed with a proper quantity of pure water; after it is deposited, large angular stones are to be added, care being taken that all the stones are completely surrounded by concrete for a thickness of not less than 4 inches. All stones to be clean and quite free from sea-weed or other vegetable matter likely to prevent the adhesion of the concrete. No concrete to be made during frost. The sand and gravel used must be sharp and clean, being perfectly free from clay or earthy matter.
>
> There are different kinds of machines by which the concrete is thoroughly mixed, and a saving of cost effected. In that of

[1] It was probably to some such work that Horace refers in Ode 1, Book iii.:—

> "Contracta pisces æquora sentiunt,
> Jactis in altum molibus; huc frequens
> Cæmenta demittit redemptor."

A harbor contract dated 1394, in all probability the earliest which has been preserved, appears in the *Registrum Nigrum de Aberbrothoc*—a collection of ancient documents printed by the Bannatyne Club, and edited by the late Professor Cosmo Innes.

Table of Properties of different kinds of Rocks.

Name of Rocks.	S	S × 62·5	$\frac{2240}{S \times 62{\cdot}5} = n$	$\frac{2240}{(S \times 62\frac{1}{4}) - 64{\cdot}75} = n$	$\sqrt[3]{\frac{2240}{(S \times 62{\cdot}5) - 64\frac{1}{4}}}$	$\frac{2240 - 64\frac{1}{4}\,n}{2240}$	Side of a Cube weighing one Ton in Air.	Loss of Weight by immersion in Sea Water.
	Specific Gravity.	Weight of a Cubic Foot in Air.	No. of Feet to a Ton in Air.	No. of Feet to a Ton in Sea Water, Sp. Gr. 1·028.	Side of Cube corresponding to last column.	Weight of a Ton Block in Sea Water Sp. Gr. 1·028.		
		lb.	Cubic feet.	Cubic feet.	Lineal feet	Ton.	Feet.	
Basalt (porphyritic)	2·99	186·87	11·9	18·26	2·63	·658	2·283	·342
Greenstone	2·92	182·50	12·2	19·00	2·66	·650	2·302	·350
Syenite	2·91	181·9	12·3	19·04	2·67	·647	2·308	·353
Clay-slate	2·90	181·25	12·3	19·15	2·67	·647	2·308	·353
Mica-schist	2·89	120·6	12·4	19·24	2·68	·644	2·315	·356
Gneiss	2·82	176·2	12·7	20·00	2·71	·635	2·333	·365
Amygdaloidal greenstone	2·75	171·87	13·0	20·81	2·75	·627	2·351	·373
Chlorite-schist	2·74	171·25	13·0	20·93	2·75	·627	2·351	·373
Graywacke	2·73	170·62	13·1	21·06	2·76	·624	2·357	·376
Clinkstone	2·73	170·62	13·1	21·05	2·76	·624	2·357	·376
Red granite	2·71	169·37	13·2	21·30	2·77	·621	2·362	·379
Slate (Old Red Sandstone formation)	2·71	169·37	13·2	21·30	2·77	·621	2·362	·379
Chalk	2·70	168·75	13·2	21·43	2·77	·621	2·362	·379
White Primary limestone (marble)	2·70	168·75	13·2	21·43	2·77	·621	2·362	·379
Red Primary limestone (marble), with crystals of augite embedded	2·66	166·25	13·4	21·96	2·80	·615	2·375	·385
Chlorite slate	2·64	165·00	13·5	22·23	2·81	·612	2·381	·388
Granular quartz rock	2·63	164·37	13·6	22·37	2·82	·610	2·387	·390
Gray granite	2·61	163·12	13·6	22·65	2·83	·610	2·387	·390
Flinty slate	2·57	160·62	13·9	23·24	2·85	·601	2·405	·399
Red felspar porphyry	2·55	159·37	14·0	23·55	2·86	·598	2·410	·402
Pitchstone	2·53	158.12	14·1	23·86	2·88	·595	2·416	·405
Serpentine	2·46	153·75	14·5	25·02	2·92	·584	2·438	·416
Compact felspar	2·45	153·12	14·6	25·20	2·93	·581	2·444	·419
Sandstone	2·41	150·62	14·8	26·00	2·96	·575	2·455	·425
Roestone (Oolite)	2.36	147·50	15·1	26·88	2·99	·567	2·472	·433
Beton	2·2	137·05	16·3	30·6	3·13	·532	2·535	·468
Magnesian limestone	2·18	136·25	16·4	31·11	3·14	·529	2·541	·471
Oolite	2·05	128·12	17·4	35·07	3·27	·501	2·591	·499
Parrot coal (American)	1·54	96·25	23·3	70·00	4·12	·331	2·856	·669
Bituminous shale	1·50	93·75	23·8	75·93	4·23	·317	2·876	·683
Cannel coal	1·24	77·50	28·9	169·05	5·53	·171	3·069	·829

NOTE.—This table is calculated for sea water of the specific gravity of 1·028 or 64¼ lb to the cubic foot.

Mr. Messent the number of revolutions to mix the concrete thoroughly is twelve.

Continuous building.

The walls of harbors may be constructed of continuous building of concrete and stones, protected by temporary piling and close planking. The best mode of keeping out the water, as adopted by Mr. Balmer at the duke of Richmond's harbor of Port Gordon, is to make a saw-draft in each plank, and to place a thin plate of iron between the planks. An example of this continuous or monolithic building is shown in Plate VIII., fig. 6.

Mr. B. B. Stoney has deposited at Dublin the largest blocks that have as yet been attempted to be moved.

Each block is 27 feet high, 21 feet 4 inches wide at base, and 12 feet long in the direction of wall, contains nearly 5060 cubic feet, and weighs 350 tons; and when laid in place 12 lineal feet of the wall is finished at once up to ordinary low water level. No cofferdam, staging, or pumping is required. The superstructure is built in the ordinary method by tide work, and is faced with granite ashlars for the ships to lie against. The blocks are built on land, and after 10 weeks drying are lifted by floating sheers, the barge or pontoon of which is 130 feet long and 48 feet wide, and of this 130 feet 30 form a tank at the aft end; and, when filled with water, this balances the weight of the block hanging from the sheers at the other end. A block can be raised with the flood tide, and is generally set the following low water.

Depositing pierres perdues.

The late Mr. J. M. Rendel introduced the improved and very valuable method of depositing the *pierres perdues* or rubble, which is now generally used in the construction of large breakwaters. This method he employed first at Millbay pier, near Plymouth, in 1838, in a depth of 38 feet, and afterwards, on a still larger scale, in the construction of the breakwaters at Holyhead and Portland.

The improvement consists in depositing the rough materials from stagings of timber, elevated a considerable height above high water. The stones are brought on this staging in wagons, through the bottoms of which they are discharged into the sea. The principle on which these stagings are designed is that of offering the smallest possible resistance to the sea, the under structure consisting of nothing more than single upright piles for supporting each roadway. At Wick harbor works, as already stated, it was found that the piles of the staging for depositing the rubble required to be of greenheart timber; but even these were broken in large numbers. The piles were invariably broken by the waves at about the level of high water.

Level of conservation of rubble.

A depth of from 12 to 15 feet under low water was pointed out by Mr. Rendel as the level below which the waves did little or no damage to *pierres perdues*. Sir John Rennie indeed considered that there was little or no effect at a fathom and a half. But at Wick, as already stated, the rubble was moved as low as 15 feet, and at Alderney 20 feet.

Evil of fine dressing.

If the beds of the stones in a sea-wall were polished, the power of resistance would be reduced by about one-fourth, or in other words, roughly dressed materials of three-fourths the weight of polished materials will be equally safe. There is also good reason to believe that slopes of large *pierres perdues* are preferable to slopes of dressed masonry. The great object to be attained is the maximum amount and uniform distribution of friction.

Iron piers.

Piers of cast and of malleable iron are now frequently employed. Examples of these may be seen at Scarborough, Southport, Portobello, and at many other parts of the English coast, and have been found to answer even where there is a considerable sea.

The pier at Southport, described[1] by Mr. H. Hooper is of cast iron, and the mode of sinking the piles was peculiar. The piles proper or lowest lengths of the columns are cast in lengths of 8 feet and 10 feet, and are sunk into the sand to the depth of 7 feet and 9 feet respectively. They were provided with circular discs 1 foot 6 inches in diameter, to form a bearing surface; and a small hole being left in the centre, a wrought-iron tube 2 inches in diameter was passed down the inside of

[1] *Min. Inst. Civ. Eng.*, vol. xx.

the pile, and forced about four inches into the sand, a connection being made by means of a flexible hose between the top of the tube and a temporary pipe connected with the Water Company's mains, and extended as the sinking of the piles proceeded. A pressure of water of about 50 lb per inch was thus obtained, and this was found to be sufficient to force the sand from under the disk. Each disk was provided on the lower side with cutters, which, on an alternating motion being given to the pile, loosened the sand. The piles were gradually lowered, and guided by a small ordinary piling engine. When the pressure of water had been removed about 5 minutes, the piles settled down to so firm a bearing that when tested with a load of 12 tons each no signs of settlement could be perceived. The cast-iron columns are 7 inches in external and 5¾ inches in internal diameter. All the piles, to the number of 237, were sunk in six weeks, being at the rate of between 6 and 7 in twenty-four hours.

The Clevedon pier is of malleable iron. Mr. J. W. Grover[1] states that each upright consists of two Barlow rails weighing 80 lb to the yard, riveted back to back, and having a total section for each 100 feet span of 64 inches. They are braced together by diagonal tie-rods from 1¾ to 2⅛ inches in diameter. The lower portions of the piles below low water are of solid wrought iron 5 inches in diameter, shod with cast-iron screws 2 feet in diameter, and were screwed down till a 4½-inch rope passed round 6-feet capstan bars parted with the strain. They penetrated the ground to depths varying from 7 to 17 feet, and though made with a thread of 5 inches in pitch seldom descended more than 2½ inches or 3 inches in a turn. The solid pile-stems are connected with the Barlow rail piles by cast-iron shoes. Where rock occurred holes were jumped, and a 4-inch wrought-iron bar was inserted and secured by a jagged key. A shoe to receive the Barlow rail was fitted and keyed on this, and the remaining space was caulked with iron cement. The length of the longest pile is 76 feet. The level of roadway is 16 feet above extreme high water, and the height above the ground at the pier-head is about 68 feet.

Deposits and Scouring.

Deposits arise from two essentially opposite causes, viz., commotion and stagnation of the water. They are also of different kinds of material:—(1) those lighter matters, such as mud, silt, and fine sand, which are held for a time in mechanical suspension, and which, as the water approaches stagnation, are gradually dropped in the order of their specific gravity and mass; and (2) those grosser matters, such as different kinds of sand and gravel, which are rolled along the bottom or driven forward with the water by the action of waves and currents. The first-named are deposited on the lee side of piers or groins which obstruct the progress of the waves or currents, while the second accumulate on their *weather* sides. But the amount and the positions assumed by the deposits of the second kind depend on the direction and force of the waves or currents in relation to the foreshore and to obstructions. The amount of deposits of the first kind are little dependent on the direction of the stroke of the waves outside of the basin or sheltered place in which they are deposited.

Artificial scouring.

The preservation of the depth of harbors at a level lower than that of the original bottom involves both uncertainty and expense. Where the deposit is confined to the space between high and low water-marks, the scouring by means of salt or fresh water is comparatively easy; but where it forms a bar outside of the entrance, the possibility of maintaining permanently a greater depth becomes very doubtful. The efficacy of the scour, so long as it is not impeded by enlargements of the channel, may be kept up for great distances, but it soon comes to an end after it meets the sea. When the volume of water liberated is great compared with the *alveus* or channel through which it has to pass, the stagnant water which originally occupied the channel does not to the same extent destroy the momentum as where the scouring has to be produced by a sudden finite impulse. In the one case the scouring power depends, *cæteris paribus*, simply on the relation subsisting between the quantity liberated in a given space of time and the sectional area of the channel through which it has to pass; while in the other it depends on the propelling head, and the direction in which the water leaves the sluice. Mr. Rendel's scheme for Birkenhead was on the former principle, which it must be recollected is only applicable where the soil is easily stirred up.

The first example of artificial scouring in England seems to be due to Smeaton, who used it effectively at Ramsgate in 1779. At Bute Docks, Cardiff, designed by the late Sir W. Cubitt, the access to the outer basin is kept open most successfully by means of artificial scouring on a large scale.

Minard holds that when a channel has to be maintained by regular and habitual scouring, the whole effect is generally produced in the course of the first quarter of an hour. This was made the subject of particular investigation at Dunkirk, where sections of the channel were made before and during the scour; and it was found that there was no alteration in the sectional area after the first quarter of an hour.

Causes of Increase of Height of Waves.

The following causes increase the height of waves in a harbor:—(1) the removal of a spending beach either at the entrance channel or within the harbor by building a quay or talus wall across it; (2) deepening the entrance channel or the basin of the harbor itself,—thus the difficulty of keeping vessels to their moorings at the quays of a harbor increases during flood tide, just as the tide rises and the depth is thereby increased; (3) removal of an artificial breakwater or a protecting point of land or spit of gravel outside of the harbor; (4) filling up side creeks or lateral basins in a harbor or its entrance channel; (5) shortening the distance between the sea and the entrance to an inner basin or dock by projecting the basin or dock farther out from the shore-line so as to bring the gates nearer the sea entrance, or projecting the mouth of a harbor farther seawards; (6) removal of a jetty or filling up an artificial side chamber or converting talus into plumb walls; (7) straightening an entrance channel or an outer side breakwater or walls within a harbor; (8) widening the entrance or the entrance channel; (9) reduction of the area of the basin of the harbor; (10) making smoother the surface of a natural sloping beach either within or outside of a harbor by pitching its surface; (11) lowering the top of a protecting outside breakwater over which the sea breaks; (12) converting an open timber quay into a close quay; (13) lengthening a breakwater so as to intercept a greater portion of the waves which come in certain directions.

II. Docks.

Docks are of two kinds, viz., dry or graving docks, and wet or floating docks. The dry or graving dock is a small water-tight chamber, fitted with gates of timber or iron, which are shut against the rising tide after a vessel has entered for the purpose of being repaired. The water below low tide level is pumped out generally by steam power.

Wet docks.

The wet dock or tide basin is a large water-tight inclosure, usually several acres in extent, which is also fitted with gates which are closed, not, however, during the flowing but the ebbing tide, so that the vessels lying at the quays within the basin may remain constantly afloat and nearly at the same level while being loaded and unloaded.

Locks.

In order to extend the time during which vessels can enter or leave a wet dock there are two additional works which are often connected with it. These are the entrance-lock and the outer or half-tide basin. The lock is a narrow chamber of just sufficient length and breadth to admit a ship of the greatest length and breadth of beam that is expected to frequent the port. Such a lock can, in absence of the largest class of ships, accommodate simultaneously three or four vessels of smaller tonnage. Locks are sometimes made with double gates, so that when only one vessel of small size has to enter, she is shut up within a compartment of the lock, by which means some of the water is saved which would have been expended had the whole of the chamber been filled. Shortly after the tide has begun to ebb, and when the gates of the wet dock have been shut, in order to prevent the water from falling too low in the dock, a vessel can still enter or leave by means of the lock. She is first passed into the lock from the sea; and, the lower or sea gates being closed, the sluices in the upper or dock gates are opened, which raises the water in the lock chamber to the same level as the water in the dock, when the upper gates are opened to let the vessel pass in. Ships leaving the dock after the tide has begun to fall are passed into the lock chamber, when the upper gates are closed and the sluices in the lower gates are opened, until the water in the lock has fallen to the same level as the tide outside, when the lower gates are opened and the vessel goes out to sea. This system of locking is continued so

[1] *Min. Inst. Civ. Eng.*, vol. xxxii.

long as the level of the dock is not so much depressed as to affect the loading or unloading of vessels lying at the quays, or until the tide has ebbed so far as to prevent vessels reaching the lock from the sea. At the West Dock, Cardiff, where the level is kept up by fresh water from the river Taff, the gates, in order to suit the rise and fall of the tide, are opened one hour before and about two hours after high water.

Tide basins.

The tide basin may be described as a lock of very large dimensions capable of receiving at the same time a considerable number of vessels, which continue to run into it from the sea after the dock gates have been finally closed for that tide. Such vessels can run in, so long as they have sufficient water over the sill of the sea gates of the basin, or until the basin itself is filled with ships. The sea gates are then closed, and the sluices in the upper gates are opened till the water in the basin is on a level with the water in the dock. The ships are then passed continuously into the dock, in a string, one after the other. By means of this arrangement the traffic can be carried on to a far greater extent than is possible with a narrow lock, which has to be filled and emptied for each vessel that enters or leaves the harbor. The late Mr. Jesse Hartley of Liverpool was the first to propose half-tide outer basins, as adjuncts to wet docks.

Advantages of docks.

The peculiar advantages of docks are the following. Vessels can be accommodated in the smallest possible space, and are enabled to lie constantly afloat; whereas in tidal harbors, where they take the ground, they are apt to be strained or to have their floors broken. But there are other sources of mischief than this in open harbors, for often, when the tide is ebbing, vessels, unless watched, fall against each other. In two instances where the bottom, which was muddy, had a considerable declivity, a ship which had taken the ground on the beach near low water mark was actually run down and damaged by another stranded vessel, the warps of which suddenly snapped and freed her from the moorings at the quay, thus causing a collision between vessels both of which were at the time high and dry. Then there is the chafing of the vessel's sides against the quays in exposed harbors where there is a run of sea, and the breaking of warps during stormy weather, or during land floods, where there is a river. The late Mr. James Walker stated that at Sunderland damage to the extent of £40,000 was occasioned in a single day by large quantities of ice that came down the river Wear. When a vessel is in dock she can be easily and at all times moved from place to place, and the operation of discharging and loading can go regularly on during all times of tide. Her level, too, is never much affected, so that the cargo does not require, when being discharged, to be hoisted so high as would otherwise be necessary. Timber vessels can be unloaded through their ports into the water at all times of tide, while in harbors which are dry at low water the cargo receives injury by falling on the hard bottom.

From the general description which we have given the following conclusions may be drawn as to the best localities for docks:—

Best localities for docks.

(1) Where the rise of tide is considerable, a dock is more required than where the rise is small. In rivers such as the Clyde and the Foyle, for example, where the tide rises only from 9 to 10 feet, the inducement to construct docks is not so great as at the Mersey or the Bristol Channel, where the tide rises from 20 to 50 feet.

(2) Where the nature of the trade requires ships of great length, which are therefore very liable to injury from taking the ground, a dock is more needed than at places where the vessels are of smaller size, and therefore less liable to be strained when not water borne.

(3) Where the bottom is soft and muddy, there is less need for a dock than where the bottom is hard and uneven, unless where strong currents are likely to burrow out the soft soil so as to make the bottom irregular by forming deep ruts.

(4) Where the harbor is open to the entrance of surface waves of considerable height, or of a ground swell, there is more need for a dock than where there is better protection.

(5) Where there is sufficient fresh water, free from mud or silt, for supplying the basin, a dock will be more suitable than where the supply is from the tide, especially if the sea at the place be much loaded with matter in mechanical suspension.

Sea exposure.

In designing a dock the first subject to which the engineer must give his attention is the seaward exposure of his proposed work. Of course no precaution is needed on this head if the place be a land-locked bay, or a narrow river or estuary. But if there be a considerable fetch of open sea, the waves generated during gales may be of such height as to endanger the sea gates or to interfere with their being worked in stormy weather. The formula already given at page 408 for short lengths of fetch will be the most suitable for calculating the exposure of docks, where the fetch ought never to be great.

Having calculated by means of this formula the height of waves that may be expected to reach the dock gates, the engineer must then determine whether such waves are too high for the strength of the gates, or for their being properly worked in stormy weather. Now we have unfortunately but few facts on this subject to guide us, and these not very consistent with each other.

Height of Waves in which Gates can be Worked.

Name.	Width of Entrance in feet.	Height of Waves in which Gates are worked in feet.	Authority.
Ardrossan.....	40	2	Mr. Moffat, C. E.
Seaham.....	36	2	
Sunderland, North...	50	3	Mr. Meik, C. E.
Do. South....	60	2½	Do.
Silloth	60	2	Mr. Boyd, C. E.

It might at first sight be expected that the strain would increase as the squares of the breadth of the gate, but, owing to the manner in which the forces are distributed, this does not seem to be the case.

Where b = the width of opening of the entrance in feet, and h = the height of the waves at the place, the formula $b = \frac{60}{h}$ may perhaps be regarded as safe; or, where h has not been observed, and D is length of fetch in miles,

$$b = \frac{60}{1{\cdot}5\sqrt{D} + (2.5 - \sqrt[4]{D})}.$$

Should the calculation by the formula give higher waves than are compatible with safety or convenience, the proper course will be to provide an outer harbor or covering breakwater, so as to reduce the height of the waves. For this purpose the formula given at page 413 is applicable. In cases where the course now recommended cannot be adopted, from motives of economy or from other causes, recourse may be had to protecting booms such as are described at page 414. If the traffic be considerable and the interruption caused by the shipping and unshipping of the booms be regarded a formidable objection, the gates may in some cases be protected by fastening together the tops of the mitre posts by chains. Another mode of securing gates against the sea was adopted at Ramsgate by Mr. Ramsay, and is stated by Sir John Coode to be perfectly satisfactory. It consisted of the following arrangement:—

"One end of a stout beam or stay of greenheart timber was connected, by means of a massive iron movable joint, to the fore part of each gate, near the middle posts on the inner or basin side, and at about the level of high water of equinoctial spring tides; the opposite end of this beam passed into an opening in the masonry of the side walls of the entrance. The inner end of this beam was supported by a small bogie truck running upon a pair of rails laid in a horizontal plane. On the vertical face of the beam nearest the gate there was a strong toothed rack working into a pinion at the end of a train of gearing, the first motion of which was a screw-and-worm wheel. By means of this gearing the power of the men was communicated to the gate through the beam or stay just described."

Docks should be sheltered from wind.

After the engineer has succeeded in designing a dock which is sufficient in so far as the sea is concerned, it may after all not prove safe and convenient if it be exposed fully to the force of the wind, which, acting on the rigging and hulls of the shipping, causes vessels to break their moorings or produces a grinding action of the vessels against the quays. At Sunderland south dock and at the docks in the Tyne, for example, the gales of October, 1863, occasioned very consider-

able damage, from vessels breaking adrift from their moorings and coming into collision with other vessels.

Capacity of docks and harbors for trade.

The number of vessels that can be accommodated in each acre of a harbor may be termed its "available capacity." This must obviously vary with the sizes of the craft which frequent the port and with the ratio of sheltered to unsheltered acreage; or in other words, with the exposure, depth, and reductive power. It will therefore be highest for a dock with gates, less for a tide-basin into which the waves have access, and least of all for an anchorage breakwater or roadstead. But it also depends on the form of the basin and on its depth.

The following table contains the greatest number of vessels that can be accommodated at one time per acre for several docks:—

Name.	Tonnage of Vessels.	Number of Vessels per Acre.	Authority.
Ardrossan.....	100 to 1000	15	Mr. Moffat, C. E.
Avonmouth.....	2000	0·75	Mr. Brunlees, C. E.
King's Lynn.....	1500 aver.	6	Do.
Silloth	50 to 800	7·50	Mr. Boyd, C. E.

If n represents the number of vessels per acre, and t their average tonnage, and a is a coefficient which may be taken at from 3 to 4 according to the tonnage inversely, the formula $n = \frac{1000}{t} + a$ may perhaps be convenient for showing, though necessarily in a very approximate way, the relative capacity for mixed shipping of proposed docks of symmetrical proportions. But the capacity will very largely depend on whether both large and small vessels frequent the port, or only vessels of one size.

The capacity for *tonnage* per acre is shown in the following table:—

Name.	Depth of Water in feet.	Tonnage per Acre at one time.	Tonnage shipped and unshipped per Acre per annum.	Authority.
Ardrossan....	18½	3400	90,000	Mr. Moffat.
Belfast.....	22	3074	40,307	Mr. Salmond.
King's Lynn.	25	9000	22,650	Mr. Brunlees.
Silloth.....	22	6000	40,718	Mr. Boyd.

Form of dock.

The general form of a dock will in most cases be dependent on local peculiarities. Where the nature of the ground and other circumstances

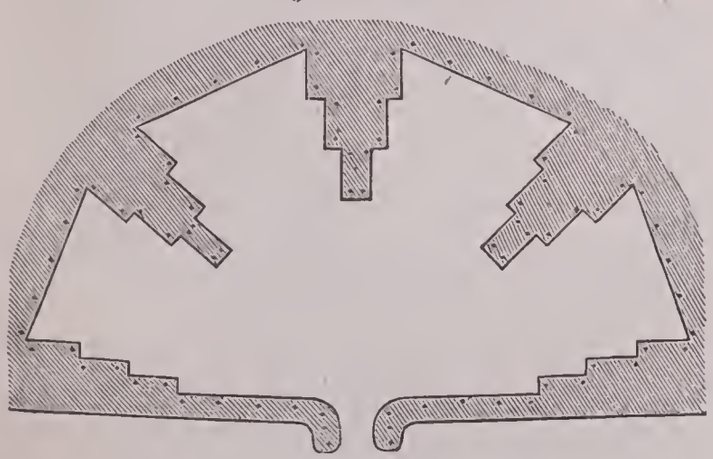


Fig. 8.

admit of it, the width of the basin should, in order to provide for the largest amount of traffic, be greater near the entrance than at a distance from it. The diagram (fig. 8) may perhaps be regarded as an approach to the form of maximum capacity which should be kept in view as a general guide in making a design. But in most situations the form will, as we have said, be mainly if not entirely dependent on the outline of the land and depth of water, on the position of adjoining streets and buildings, and on the geological formation and nature of the subsoil. The serrated outline of the jetties shown in the diagram affords a larger amount of accommodation for shipping than when the quays are continuously straight. Sir John Hawkshaw was, we believe, the first to adopt these indented jetties, which are specially suited for the coal trade; but the radiating form shown in the diagram has not, so far as we know, been adopted. Not only are numerous cross sections of the ground required for fixing on the best site for a dock, but borings of the subsoil are essential, as, upon a careful comparison of these, the position of the entrance must be determined. It is always of the greatest importance to place the foundations of the lock or entrance gates at a place where the bottom is rock, or, where that is not to be found, on the hardest and most impervious part of the subsoil, or, failing that, on a place where the bottom, though soft, is of uniform consistency.

Amount of work per yard of quay.

Mr. Ure, in a report on Glasgow harbor, gives the following table showing the amount of work per yard per annum:—

Port.	Tonnage per Acre of Water.	Tonnage per Lineal Yard of Quay.	Remarks.
Glasgow, including steamers..	30,670	440	Fully worked.
Glasgow, excluding steamers.	20,361	293	
Southampton Tidal Harbor...	20,000	350	Could do more.
Liverpool Docks.....	21,200	185	Fully worked.
Hull Docks.....	19,000	143	During 9 months.
St. Catherine's Docks.....	20,500	142	Fully worked.

Armstrong's hydraulic machinery.

A great increase in the amount of trade, with the same size of dock and length of quay, may be effected by Sir William Armstrong's patent hydraulic machinery. This principle of applying hydraulic pressure for opening gates, bridges, and sluices, or to the capstans for hauling vessels out and into dock and wagons on and off the coal tips, and for turning them on the turntables, the discharging of ballast and loading of coals, and the shipment and discharging of general cargoes, has now been successfully adopted at many harbors. Its use is, however, only warrantable where there is a great amount of traffic, and especially at places where the spring tides remain only a short time at the same level.

At the Victoria Docks, London, the late Mr. Bidder mentions that 41 craft and 17 ships, or 11,711 tons, came in at one tide. In one month the number of craft entering the harbor was 1229; craft leaving, 1288; ships entering, 250; ships leaving, 258; or an aggregate of 2517 craft and 508 ships during the month. The gates, which are 80 feet span, are opened in less than 1½ minutes. At Sunderland the accumulators are equivalent to a head of 600 feet, and the engine is 30 horse-power. A wrought-iron bridge 16 feet wide, and including counterweights equal to nearly 200 tons, is raised vertically 18 inches, and drawn back in about 2½ minutes. At Swansea the accumulators are equivalent to an effective pressure of 750 lb per square inch, and there are three high-pressure engines of 80, 30, and 12 horse-power respectively. The time employed in either opening or closing the gates is about 2½ minutes, which is the shortest period consistent with safety. The wrought-iron swing-bridge can be opened or shut in 1½ minutes. The ballast cranes, which are distributed round the dock, can each discharge from 350 to 400 tons in the day. The quantity of coal that can be shipped is about 1000 tons per day, and the effective quantity of water required for the port is 21,050 cubic feet per week. The large new bridge at Leith, designed by Messrs. Rendel & Robertson, and worked by the Armstrong apparatus, is 120 feet span,—length of girder 214 feet, weight moved 750 tons,—and is opened in 1½ minutes. The saving of time effected by this method is very great, for at Liverpool, according to Mr. A. Giles, gates of 70 feet require 20 minutes, and six men on each side to open them.

Proportion of water to quays and land area.

The proportion of water area to length of quays will obviously depend on the form of the docks. The following table, deduced from information kindly supplied by Mr. Lyster, C. E., gives examples on this head at Liverpool:—

Total Water Area and Quay Space at Liverpool and Birkenhead.

	Water Area.		Lineal Quayage.		Lineal Yards of Quay per Acre.
	Acres.	Yards.	Miles.	Yards.	Yards.
Liverpool Docks.....	252	1601	17	1472	124·4
Liverpool Basins.....	16	4441	1	1088	168·3
Liverpool Docks & Basins.	269	1202	19	800	127·2
Birkenhead Docks.....	159	4535	9	110	99·7
" Docks & Basins.	164	2538	9	779	101·0

In order to utilize the area of a dock to the best advantage, a certain amount of land space dependent on the kind of trade should be provided around it; for without this space, which is needed for giving room for railway sidings, warehouses, and the like, the traffic would be cramped. As an illustration of the large extent of railway which is required in a coal-port, we may refer to Cardiff, where Mr. M'Connochie says, "The extent of sidings provided and maintained by the Bute trustees, in connection with the docks, amounts to 16 miles in length, the whole of which is at times fully occupied."

Proportion of tide basin to dock.

The proportion of the area of outer tide basin to that of the dock to which it forms the access varies necessarily with the requirements of the trade, as is shown in the following table:—

	Dock.	Outer Basin.	Ratio.
	Acres.	Acres.	
Bute Dock (East)	42·33	2·15	19·69 : 1
Bute Dock (West)	16·86	1·40	12·04 : 1
Penarth Dock	17·11	2·68	6·39 : 1
Tyne Dock	50·	9·50	5·27 : 1
Liverpool generally	107·	13·	8·23 : 1

Depth of dock.

The level of the bottom of a dock is always kept lower than that of the sill of the entrance gates, in order to admit of a certain amount of deposit taking place without injuriously affecting the depth of water in which the vessels lie, or interfering with the working of the gates. There should never be less than 1 foot of greater depth over the bottom of the dock than over the entrance sill.

Commercial advantages proportional to cubes of depths.

The commercial advantage of a great depth of water over the sill has been well shown by Mr. George Robertson in his report on the Albert Dock at Leith. By increasing the depth to the extent of 2 feet he found there would be 396 tides in the year giving a depth of 23 feet over the sill, as against only 102 tides in the year when that depth could be had if the sill were only 2 feet high. But besides the advantage of availing ourselves of a greater number of tides, Mr. T. Stevenson found, from an examination of the draughts and tonnage of a large number of sailing vessels, that the commercial advantages in a navigable river, dock, or harbor *are proportional to the cubes of the depths.*

The relation subsisting between the depth of a dock or channel and the tonnage of sailing vessels which can use it is given by the formula $t = \cdot 13d^3$, or $d = \sqrt[3]{7{\cdot}7\,t}$, from which the following table has been calculated:—

Feet.	Tons.	Feet.	Tons.	Feet.	Tons.
5	16	12	225	19	892
6	28	13	286	20	1040
7	44·5	14	357	21	1201
8	66·5	15	439	22	1384
9	95	16	532	23	1581
10	130	17	639	24	1797
11	173	18	758	25	2031

Width of entrance.

In fixing the minimum width that will admit vessels of the size which are expected to trade at the harbor, the engineer must take care to preserve a proper relation between the area of the dock and the width of the entrance; for if this relation be neglected, a current may be generated through the entrance when the tide begins to ebb, which would be incompatible with the safe working of the gates. A very small current is sufficient to act injuriously in this way, especially if the gates be of great width. Whenever the internal area of the proposed basin is considerable, it will be a safe precaution to calculate the velocity of the outgoing current, at different periods of time, after the tide has begun to ebb; and for this purpose observations of the fall of the tide must be carefully made and compared with the proposed transverse sectional area of the passage through the lock chamber. If the velocity thus obtained be thought too great for the safe working of gates of the size required, the only alternative is to provide an additional lock. But a double outlet will at any rate be in all probability needed, or will at least prove a great convenience in all cases where a large internal basin is required.

Lockage.

The late Dr. Rankine in his *Manual of Civil Engineering* gives the following table for the expenditure of water due to the passage of vessels through the lock:—

Let L denote a lockful of water, that is, the volume contained in the lock chamber between the upper and lower water levels, and B the volume displaced by a ship, then the quantities of water discharged from the dock are shown in the table. The sign — prefixed to a quantity of water denotes that it is displaced from the lock into the dock.

Single Lock.	Lock Found.	Water Discharged.	Lock Left.
A descending ship	Empty.	L − B	Empty.
Do. do.	Full.	− B	Empty.
An ascending ship	Empty or full.	L + B	Full.
$2n$ ships descending and ascending alternately	Descending full, ascending empty.	n L and $(n+1)$L	Descending empty, ascending full.
Train of n ships descending	Empty.	n L − n B	Empty.
Do. do.	Full.	$(n-1)$L − n B	Empty.
Train of n ships ascending	Empty or full.	n L + n B	Full.
Two trains of n ships—the 1st descending, the 2d ascending	Full.	$(2n-1)$L	Full.

From these calculations it appears that ships ascending and descending alternately cause less expenditure of water than equal numbers of ships in train.

Depression of dock-land.

The level of the surface of the water in a dock will of course sink in proportion to the number of times the lock has to be filled during each tide, and may also be affected to a small extent by leakage. In order to provide for this depression of level, the old dock of Grimsby, and also the Bute Docks, Cardiff, are supplied by land streams, while at Penarth Sir John Hawkshaw was unable to get a supply of pure water, and the dock at that port is supplied from the tide water of the Bristol Channel, which holds in suspension a large amount of alluvial matter. In the old London docks the level is kept up by pumping.

If the masonry of the walls has been properly constructed, and if the gates and lock are kept in proper repair, and especially if the basin be of large area, the depression of the water level due to leakage, will, as appears from the following table, be comparatively trifling:—

Name of Dock.	Area in Acres.	Leakage.	Authority.
Ardrossan	4	18 in. per tide.	Mr. Moffat, C. E.
Belfast	3¼	At first 1 to 2 in., now 6 in. springs, and 4 in. neaps.	Mr. Salmond, C. E.
Whitehaven	4½	3 in.	Mr. Brunlees, C. E.
Avonmouth	16	⅛ in. in 24 hours.	Do.
King's Lynn	6½	1½ in.	
Silloth	4	12 in. per tide.	Mr. Boyd, C. E.

Works of construction.

The principal works required in the construction of docks are—*first*, cofferdams for excluding the tide, and pumps for keeping the basin dry while the works are going on; *second*, excavation of the basin and lock pit; *third*, piling for the foundations of quay walls and lock, where the bottom is soft; *fourth*, the building of the quay walls, lock, and outer tide basin; *fifth*, entrance gates, gangway, and dolphins in the channel outside of the dock for facilitating the entry and departure of vessels.

As to the *first* of these works, namely, the cofferdam and pumping apparatus, reference is made to the articles on these subjects in this work; and as to the *second* and *third*, there is nothing requiring special notice, as no peculiarity attaches to the mode of carrying on excavation or piling for docks more than for any other engineering undertaking where these are needed. It is only necessary to point out that when the bottom is soft a large amount of piling is required, more especially at the lock pit, where rows of sheeting piles should be driven across the lock, at least at the entrance, and in the lines of the clap or pointing sills against which the gates shut.

Proportions of quay walls.

The *fourth* class of works, namely, quays and lock, are in all cases most important features in a dock. Different rules have been given by engineers for the proportions of quay walls. Mr. A. Giles recommends that they should be made strong enough to resist the pressure of a head of water equal to their own height; and Minard recommends their thickness at bottom to be $\frac{4}{10}$ths of their height.

Quay walls of concrete.

The recent use of Portland cement concrete in the construction of harbors has led to its introduction at dock works. In the small dock erected in 1875 at Berwick-on-Tweed, Messrs. Stevenson had the dock walls and gate chamber constructed entirely of Portland cement concrete, excepting a small portion at and above the high water level, against which the vessels might rub; and Mr. Rendel at the new Victoria Docks, London, which are the longest in the world, is making the whole masonry of cement concrete.

Graving docks.

Graving docks are basins sometimes 600 feet long and 60 or 70 feet wide, fitted with gates, from which the tide-water which floats the vessel into the dock is pumped out, so as to let the carpenters get access to the ship's bottom. The sides of graving docks consist of a series of steps of masonry, called "altars," against which small timber props, generally of Gulf of Bothnia timber, are placed, for supporting the vessel's sides as she ceases to be water-borne. Her keel is supported on blocks, generally of hard wood, but of late years they have in some places been made of cast iron. The sides, in order to save pumping, are in some places made of a curved form, so as to suit the shape of the vessel's sides. The advantages are, however, more than counterbalanced by the undue contraction of the space allotted for the carpenters, who are unable to move about easily on the sloping surface of the masonry.

Of all the different kinds of masonry which enter into the construction of marine works, there is none which requires greater accuracy of workmanship, or more careful circumspection, than the graving dock. Leakage in a wet dock, provided it does not originate at a place where it is liable to increase through time, and is of no greater extent than to depress the surface of the water a few inches, cannot be regarded as a serious evil. But in a graving dock, where the requirements are different, there should be no leakage. A very little water, accumulating on the platform of a dry dock, interferes to a serious extent with the comfort and convenience of the carpenters. Although it may occasion considerable additional expense, there ought to be in all cases, especially where the soil is full of springs, an ample underground storage provided by a system of drains for receiving the leakage, which can then be pumped out periodically, as required, without ever allowing the water to rise above the platform.

Mr. G. B. Rennie's floating dock.

Mr. G. B. Rennie's docks are stated to be the first of the kind that have been made of iron. They consist of floating caissons for holding the vessel to be repaired. They are sunk by allowing them to fill with water, and are raised by pumping. The caissons are made with water-tight compartments, and they are carried up as high as the vessel's bulwarks, excepting that through which the vessel enters and leaves. Among several advantages that have been claimed for this kind of dock may be mentioned—its independence of the rise and fall of the tide, the power of applying breast shores as in an ordinary graving dock, and the stiffness produced by the side walls. As the upper parts of the side walls or altars are always full of air, this dock may be used in deep water, and is therefore independent of the nature of the bottom.

Mr. E. Clark's hydraulic lift.

Mr. Edwin Clark's hydraulic lift, at the Victoria Docks, London, consists of a pontoon which is filled with water and sunk between two rows of iron columns. After a vessel has been floated and steadied upon the pontoon, the whole is raised by twelve hydraulic force-pumps of 2 feet diameter, acting on the pontoon by means of chains. After the pontoon has been brought about the tide-level, the water is allowed to escape, when there is sufficient floating power to admit of the whole being removed to any place where the repairs can be conveniently made. The pontoons, which can accommodate vessels of a length of 350 feet, are about 320 feet long and 59½ feet broad. "The power of the hydraulic lift is 6400 tons. The largest pontoon will carry a dead load of 3200 tons in addition to its own weight."

Slips.

Slips are the contrivance of the late Mr. Thomas Morton of Leith, and consist of a carriage or cradle working on an inclined railway, falling generally at the rate of about 1 in 17, and extending above high water to a sufficient distance for the class of vessels which are expected to use them to several feet below the level of low water, and a truck or carriage which moves on it. When the carriage is let down under the water, the vessel is floated above the place, and the carriage is drawn up till the vessel catches it forwards. When the ship is placed truly above the line of the carriage, a powerful crab-purchase at the top of the slip, which is generally worked by steam, is set in motion, and raises the truck and ship out of the water.

Gridiron.

The gridiron is a simple framework of timber placed at a level sufficient to admit of vessels being floated above it during the flood-tide, and grounded upon it during the ebb, and when thus left high and dry the vessel's bottom can be examined to ascertain if it be necessary to take her into the graving dock, and trifling repairs can also be made. The gridirons at Liverpool vary from 25 feet to 36 feet 3 inches in breadth, and from 228 feet 3 inches to 313½ feet in length.[1]

Hydraulic and screw docks.

The hydraulic and screw docks used in America are chambers into which vessels are floated during the flood-tide, above a cradle which is drawn up above the high water level, either by means of Bramah's press worked by a steam-engine, or by a powerful apparatus of screws.

Relative advantages of slips and graving docks.

The patent slip possesses the following advantages over the graving dock. (1) The cost of its construction is less. (2) When the fall of tide is languid, a vessel can generally be more quickly laid dry. (3) When so laid dry she can be more easily examined, and, from the duration of the daylight being greater than in a deep graving dock, the time in which work can be done is considerably extended during winter. (4) There is more perfect ventilation, by which the vessel's sides are sooner dried, which is of some moment with an iron ship. (5) A vessel can be hauled up long before high water, and the repairs can be begun at once; whereas with a dock the pumping occasions considerable delay. (6) While the upper part of the slip is occupied, an additional vessel may be taken up for a shorter time than its predecessor, without interrupting the workmen.

The advantages afforded by a graving dock, on the other hand, are these. (1) Although its construction is more costly, it is nevertheless, if properly built, unquestionably a more durable structure—the rails, rollers, carriages, and chains connected with the slip being liable to derangement, which entails occasional repair. (2) The management of the graving dock is simple, and involves comparatively little superintendence; whereas that of a slip is intricate, and requires more than mere nautical skill. (3) The working of a graving dock is equally simple for large or small vessels, while it is undeniable that the raising of a large vessel on a slip is a delicate operation, and should be attempted only under the direction of persons thoroughly versed in such matters, and having ample mechanical resources at command. (4) The graving dock possesses the advantage, which is sometimes important, of affording the means of more easily filling a vessel with water, so as to detect leaks which may not be discoverable by other means. For this purpose a nozzle to receive a flexible tube should be fixed into the dock-gates. (5) Where double gates are provided the water contained in the dock affords a certain limited power of scouring the forebay and entrance, an advantage which is of course not possessed by a slip. (6) In any rapid land current, or strong tideway, it is a much easier process to dock a vessel than to land her safely on the cradle of a slip—an operation which, when incautiously gone about, has been in some cases attended with serious consequences even in sheltered situations. (7) The graving dock need not interfere with the set of the currents, whereas a slip which projects a long way seaward of low water may deflect them and produce shoals in the channel. (8) Mr. Mallet has remarked that the strains on a ship's timbers are more direct than when she is on a slip, especially when she is leaving the cradle. The late Mr. J. M. Balfour suggested, in order to meet this objection, that the cradle for a slip might be made of a wedge shape, so that its upper surface shall be parallel with the horizon, or that the back end should even be tilted slightly, so as to give a bite on the vessel and prevent her from slipping.

The relative advantages of the other contrivances for the repair of ships already described may be judged of by comparing them with each other in a similar manner.

[1] "Historical and Descriptive Sketch of the Mersey Docks and Harbor," by J. J. Rinckel, in the *Artizan* for 1864.

Dock-gates. Mr. P. W. Barlow has given the following formulæ for the strength of dock-gates:—

Formula for Straight Gates.

If ϕ = horizontal angle (or "sally") between pointing sill and line joining heel-posts of the two leaves; W = pressure on the length of the gate with any head and for a given depth of the gate; and S = whole transverse strain at angle ϕ; then

$$S = \tfrac{1}{2} W \sec \phi + \tfrac{1}{20} \cos \phi.$$

From this Mr. Barlow has deduced that the salient angle, where the strain is the minimum, is 24° 54′, but as the length of the gate increases with the secant, the strength will not at this angle be the greatest with a given section of timber. The "sally" or angle which gives the greatest strength, with a given section of timber, is stated by him as 19° 25′.

Formula for Curved Gates.

When θ is the salient angle, or camber of the beam, formed by a chord line drawn from the heel to the mitre post, with the tangent to the curve of the gate—

$$S = \tfrac{1}{2} W \left\{ 1 - \frac{\sin \theta}{\sin (2\phi - \theta)} \right\}.$$

There is great difference of opinion among engineers as to the strain to which dock gates are subjected, and the reader is referred for further information to the 18th and 31st volumes of the *Minutes of Proceedings of the Institution of Civil Engineers*. In these discussions Mr. Brown pointed out an error in Mr. P. W. Barlow's paper, which stated that the line of pressure at the mitre-posts would always be a tangent to the curve of the separate gates, whereas that line must always be at right angles to the centre line of the lock, and could only be a tangent to the curve when the two gates formed a segment of a circle, or, as Mr. Bramwell says, at all events when their junction at the mitre-posts formed at that point part of a continuous curve. Mr. Brown gives elaborate formulæ suited to meet a yielding or deflection of the structure, which he alleges must always take place. Mr. Bramwell states, and we think justly, that, when the gates form when closed a segment of a circle, they cannot be subject to transverse strain, and that the whole of the gates would be subjected simply to compression. Mr. R. P. Brereton very properly suggests that when the gates are of malleable iron the boiler-plate should never be less than ¼ inch thick, whatever the formula may indicate.

Where l represents the length of one-half of a straight or cambered malleable iron gate, w the distributed pressure over the length of the leaf taken on a given element of the gate, bounded by two horizontal planes 1 foot apart, t the thickness of framework of gate or distance between the two skins, s the transverse strain in middle of gate, θ half of the mitring angle—*i. e.*, the angle formed by meeting of gates—all the dimensions being in feet and weight in tons,—then

$$S = \frac{\frac{1}{2} w l}{4t};$$

$\frac{1}{5} s$ = sectional area of metal on compressed side in inches;
$\frac{1}{5} s$ do. do. on extended side do. ;
$\frac{1}{2} w \tan \theta$ = compressive strain produced by other leaf of gate.

Mr. Kingsbury adds half of this compressive strain to the strain representing the compression due to the transverse pressure, and deducts it from the same amount for the extension; and these results being divided as before by 4 and 5 respectively, being the allowances per square inch of metal for compression and extension, give the areas for each. He, however, expresses a doubt whether the whole of the compressive strain from the other gate may not perhaps come upon the compressed section. The sections close to the posts he takes as requiring to resist the compression due to transmitted pressure only, or

$$= \frac{\frac{1}{2} w \tan \theta}{4}.$$

For cylindrical gates Mr. Kingsbury gives the formula,—when p = pressure per unit of surface, and r = radius of curvature,—

$$\frac{pr}{4} = \text{sectional area of metal in square inches.}$$

It must be remembered in designing gates which are exposed to the waves that they should be made stronger than these formulæ require. And the gates for graving or dry docks sustain a greater pressure with the same rise of tides than those of wet docks, and should therefore be made correspondingly stronger.

Caissons. Caissons are sometimes employed instead of gates, and are the invention of the late General Bentham. They are constructed of malleable iron plates and are sometimes made in the form of a ship's hull, and sometimes have vertical sides. The caisson fits into checks made for its reception in the side walls of the entrance to the dock. They require to be very carefully ballasted, and to be most accurately fitted to the masonry on the sides and bottom, and even when they are faced with timber which has been finely dressed and fitted, coal cinders are often needed to make the joints water tight. At high water they are floated into the grooves, and are then scuttled by admitting the water into the interior chamber. When a vessel has to leave the dock, the water is again pumped out, and the caisson is then floated out of its place and taken into the river or harbor, so as to be out of the way of the vessel which is leaving. General Bentham says caissons are cheaper than gates, occupy less room, and are more easily repaired, and the same caisson may be used for different places at different times, while they answer for roadways, and require less labor for opening.

The caisson at Keysham was designed by Mr. Scamp, deputy-director of the Admiralty works, and is 80 feet wide and 43 feet deep, with an air-chamber at the bottom. When raised a few inches above the bottom, the caisson is drawn back into a recess or chamber in the side walls. The total weight is 290 tons, and the deflection was ⅞ inch near the bottom, when the pressure of the whole surface was 2000 tons. The time for opening and closing the entrance at Keysham is 10 minutes and 8 minutes respectively. The cost was about £10,000.

Mr. M'Connochie says that the iron caisson at Cardiff is 60 feet long, 26 feet greatest width, and 30½ feet deep, with a total weight of 152 tons.

Outer gangway and direction of entrance. The outer gangway at entrance to docks is generally a structure of open timber work, erected in the line which will best suit the entrance of vessels when under the influence of currents. This gangway is sometimes useful for a vessel discharging her passengers or completing her cargo while the gates are shut. Mr. Redman remarks that "the practice in the port of London is to dock a ship upon the flood just before the high water, and to undock her at about the same period of tide. . . . The directions as apparently the most desirable are an angle of about 45° pointing up the streams for graving docks, an angle of about 60° in a similar direction for wet docks, and a right angle for building slips."

Coal staiths. It is of importance in discharging coal into ships that the fall should be as small as possible.

At Bramley Moor Dock, Liverpool, the Wigan coal is discharged by railway 18 feet above the quay. At Sunderland Mr. Meik finds that 20 feet above the quays, as at the south dock, is too small for the shoots, and prefers 36 feet. At Penarth the height is 22, and they are able to lift 180 tons per hour. At Greenock, where steam cranes are used, they load about 500 tons a day. At Middlesboro' they can discharge 150 tons per hour, but 106 tons are as much as can be trimmed on board. At Cardiff, where there is no hydraulic machinery, they load 100 tons an hour. The distance between the staiths is 180 feet. At the Tyne Docks, Mr. Harrison states that on one occasion, when a vessel had very long hatchways admitting of several wagons being simultaneously discharged, 420 tons of coal have been shipped in 55 minutes, a feat which shows the admirable mechanism employed.

Ballast cranes. At Swansea, with hydraulic machinery, they can discharge from 350 to 400 tons a day, and those at Penarth load at the rate of 60 tons an hour.

The Law of Harbors and Ports.

The power of appointing suitable places to be ports or havens in England is one of the ancient prerogatives of the crown, founded, as Blackstone thinks, partly upon the rights of the king as conservator of the kingdom, partly upon his interest in the marine revenues. "In England it hath always been holden that the sovereign is lord of the whole shore, and particularly is guardian of the ports and havens which are the inlets and gates of the realm, and therefore, so early as the reign of King John, we find ships seized by the king's officers for putting in at a place that was not a legal port." The right of the king to make a harbor, and to grant the dues arising from the use thereof, in any suitable place, although the ownership of the soil may be in another, is subject to any vested rights of harbor already existing; and in the recent case of Foreman *v.* the Free Fishers of Whitstable, it was said that the right of the public freely to navigate the high seas is a paramount right to which the right of the crown in the soil is necessarily subservient, and therefore, as the right of navigation must include the right of anchorage,

the crown or its grantee could not impose a toll on this use of its soil. To justify such a toll some facts must be shown proving that the soil was originally within the precincts of a port or harbor, or that some service or aid to navigation was rendered, in respect of which the alleged right of toll was granted. The crown having once granted a harbor could not afterwards narrow its limits, but by 16 and 17 Vict. c. 107 the crown is enabled to ascertain the limits of all ports, and to assign quays thereon for the enclosure, loading, and landing of merchandise, so that frauds on the revenue may be prevented.

The Act 10 and 11 Vict. c. 27 consolidates the clauses usually inserted in private acts authorizing the construction of harbors; 24 and 25 Vict. c. 45 facilitates the formation and improvement of piers and harbors in Great Britain and Ireland; and 25 and 26 Vict. c. 69 and 28 and 29 Vict. c. 100 transfer from the Admiralty to the Board of Trade certain powers and duties relative to harbors. Besides these general Acts, there are many special Acts relating to particular harbors.

Reference may be made to *Brit. Assoc. Reports*, 1848 (J. S. Russell), and 1850 (Scoresby); Smeaton's *Reports;* J. S. Russell, "Researches on Hydrodynamics," *Trans. Roy. Soc. Edin.*, vol. xiv., 1837; Thomas Stevenson, "Account of Experiments on Force of Waves of Atlantic and German Oceans," *Trans. Roy. Soc. Edin.*, vol. xvi., 1845; T. Stevenson, "On Reduction of Height of Waves after passing into Harbors," *Edin. New Phil. Journ.*, 1852; J. Bremner, *Treatise on Planning and Constructing Harbors*, Wick, 1845; Sir J. Rennie, *Theory, Formation, and Construction of British and Foreign Harbors*, Lond., 1854; Belidor's *Architecture Hydraulique*, Paris; Capt. Washington, *Royal Tidal Harbor Com. Reps.*, Lond., 1845–46; the article on "Tides and Waves," in the *Encyclopædia Metropolitana*, by G. B. Airy, Astronomer Royal; *Minutes of Proceedings of Institution of Civil Engineers;* A. Cialdi's writings on Waves and Harbors; *Report of the Committees on Harbors of Refuge*, 1857–58; *Report of the Royal Commission on Harbors of Refuge*, 1858–59; C. J. Minard, *Cours de construction des ouvrages hydrauliques des ports de mer*, Liége, 1852; Thomas Stevenson, *Design and Construction of Harbors* (2d ed.), Edin., 1874; Professor Mitchell's American *Reports*.

The gates figured in Plate XI. are those at Great Grimsby and Victoria Dock, London; and the caisson, Plate XII., is that in use at Cardiff Docks. (T. ST.)

HARBURG, a seaport town of Hanover, Prussia, at the head of a circle in the district of Lüneburg, is situated on the left bank of the southern branch of the Elbe opposite Hamburg, which stands on the right bank of the northern branch of that river. The distance between the two towns is about 4½ miles, and there is railway communication between them by means of a bridge over both rivers, completed in 1871. The town is also connected with Hanover by railway. It is the seat of a local court, a superintendent-general, a head custom-house, and a chamber of commerce; and it possesses an old castle, which from 1524–1642 was the residence of the Hamburg line of the house of Lüneburg, a real-school of the first order, a commercial school, and a trade school. The industries include shipbuilding and the manufacture of india rubber and gutta percha wares, oil, soda, starch, alum, cigars, yarn, cast-iron, machines, and leather. There are also horse and cattle markets, and some shipping trade, which, however, has considerably declined since better communication was opened up with Hamburg. In 1878 there entered 469 sea-going vessels with a burthen of 38,110 tons, and 7677 iron vessels with a burthen of 175,643; while the corresponding averages during the previous twelve years (1866–1877) were 633 sea-going vessels and 7669 of iron craft, with burthens respectively of 43,036 and 168,082 tons. Harburg belonged originally to the bishopric of Bremen, and received town rights in 1297. In 1376 it was united to the principality of Lüneburg, along with which it fell in 1705 to Hanover, and in 1806 to Prussia. In 1813 and 1814 it suffered considerably from the French, who then held Hamburg, and who built a bridge between the two towns, which remained standing till 1816. The population in 1905 was 56,238.

HARDENBERG, Friedrich von (1772–1801), German poet and philosopher, best known as Novalis, was born on his father's estate in the county of Mansfeld, in Prussian Saxony, May 2, 1772. He was of a shy, retiring, and thoughtful disposition, and was deeply influenced by his parents, who were strict members of the sect of Moravian Brethren. After attending the gymnasium of Eisleben he went as a youth of eighteen to the university of Jena, where he studied philosophy, mathematics, and the natural sciences. There he was treated with great kindness by Schiller, of whom he was a warm admirer. He studied law in Leipsic and Wittenberg, and in 1794 settled for a time in Tennstädt in order to perfect himself in the practical work of the legal profession. During his residence in Tennstädt he formed a passionate attachment to Sophie von Kühn, a beautiful but delicate girl of thirteen, and with her consent obtained a promise from her parents that when she reached womanhood she should become his wife. In 1795 he was made auditor at the salt-works of Weissenfels, where his father was director. Two years afterwards his betrothed died, and for some time he seemed to be broken-hearted and to have lost all interest in life. In a few months, however, he went to the academy of mines at Freiberg, where he studied with a view to a higher appointment in connection with the salt-works; and in the midst of his studies he became engaged for a second time, and was again able to look forward to a happy and useful career. He returned to Weissenfels in 1799, and was associated as assessor with the directorate of the salt-works. As he was preparing for his marriage in the autumn of 1800 he was alarmed by the sudden appearance of blood from the lungs. The wedding was postponed, and although he believed to the end that his recovery was certain, the disease made rapid progress, and he died on the 25th of March, 1801. He was of a tall, slight, and graceful figure, with light brown hair and hazel eyes, and a face expressive of a calm, gentle, and meditative spirit. After his death his writings were issued in two volumes by his friends Ludwig Tieck and Friedrich Schlegel, and were rapidly recognized as important contributions to German literature. They are for the most part composed of fragments, of which the chief is *Heinrich von Ofterdingen*, an unfinished romance. Hardenberg is often spoken of as "the prophet of the Romantic school;" and the phrase sufficiently marks his leading peculiarities. He took no part in the literary warfare carried on by his friends, but he shared to the full their strongest sympathies. Like them he intensely disliked those "enlightened" writers of the 18th century who had claimed to say the last word about human life through mere logic; he was penetrated by the conviction that there are elements in the world which cannot be grasped by the understanding, and which must be felt rather than reasoned about. Although he was fond of science and history, he moved most freely in the borderland between religion, philosophy, and poetry; and his prose writings are full of sayings which, although not easily intelligible, are impressive and stimulating. His diction is often simple and unostentatious, but it is rendered difficult both by the abstruseness of his themes and the remoteness of his allusions. As a poet he lacked definiteness of conception; his lyrics, however, especially those of a religious nature, have a certain tender beauty which gives them high rank in the serious literature of Germany. They are marked by deep feeling and by sweetness and grace of expression. He himself regarded a series of *Hymns to Night* as his best achievement, but it is in *Heinrich von Ofterdingen* that the majority of his admirers find the fullest utterance of his mystic aspirations, his passion for spiritual beauty, and his idealist philosophy.

See his *Schriften* (5th ed., Berlin, 1837; vol. iii., 1846), and R. Haym, *Die Romantische Schule* (1870), and *Friedrich von Hardenberg* (1873).

HARDENBERG, Karl August (1750–1822), Prussian statesman, was born at Esselroda in Hanover, May 31, 1750. Having studied at Leipsic and Göttingen, he entered the Hanoverian civil service as chamber councillor (Kammerrath) in 1770, and afterwards spent some time in Wetzlar, Ratisbon, Vienna, and Berlin, and travelled in France, Holland, and England. He was made privy chamber councillor (Geheim-Kammerrath) and raised to the rank of count in 1778; but a private quarrel with the prince of Wales compelled him four years afterwards to give up his appointments in Hanover and seek a new career. In 1787 he received the office of president of the board of domains (Kammercollegium) in Brunswick; and he was entrusted with the duty of delivering to Frederick William II. of Prussia the will of Frederick the Great, who had deposited it with the duke of Brunswick. Frederick William II. was

so impressed by Hardenberg's appearance and character that in 1790 he recommended him as a minister to the margrave of Anspach and Baireuth. These principalities being united to Prussia in 1791, Hardenberg was appointed a Prussian cabinet minister, but continued to perform his duties as chief administrator of the new province. In the war with the French republic he acted as minister of war, and in 1795 signed on behalf of Prussia the treaty of peace concluded at Basel. When Frederick William III. mounted the throne in 1797, Hardenberg was transferred from Anspach-Baireuth to Berlin, where he received high offices in the cabinet, being also soon afterwards nominated chief of the departments for Magdeburg and Halberstadt, for Westphalia, and for Neuchâtel. At this time the foreign policy of Prussia was determined by Haugwitz who was on all occasions subservient to Napoleon. When in 1803 Prussian interests seemed to be threatened by the French occupation of Hanover, Haugwitz fell into disrepute, and in the following year his place at the head of the cabinet was taken by Hardenberg. The latter was anxious to maintain peace, but when in 1805 Napoleon's troops marched through Anspach he strongly protested, and entered into a convention with Russia. The victory of the French at Austerlitz, however, made it difficult for Prussia to proceed to hostilities; and on the 15th December, 1805, Haugwitz signed a convention with Napoleon, whereby in return for Hanover Prussia conceded Anspach, Cleves, and Neuchâtel to the French. Hardenberg then retired, and Haugwitz returned to power. The policy of Haugwitz was exceedingly unpopular, and led to the war in which his country was prostrated at the feet of Napoleon. After the battle of Jena Hardenberg undertook the office of foreign minister; but when the treaty of Tilsit was signed he withdrew and watched from a distance the vigorous and enlightened efforts of Stein to restore new life to the fallen and humiliated state. Stein being compelled to retire in 1810, Hardenberg was recognized as the only possible successor of the great minister; and he amply justified the confidence with which he was honored. The circumstances of the time did not admit of his pursuing an independent foreign policy; but he steadily prepared for the inevitable struggle with France by carrying out Stein's far-reaching schemes of social and political reorganization. The military system was completely reformed, serfdom was abolished, municipal institutions were fostered, the civil service was thrown open to all classes, and great attention was devoted to the educational needs of every section of the community. In the war of liberation Hardenberg was one of those who did most to stimulate the patriotic enthusiasm not only of the Prussians but of all Germans; and so important were his services that on the 3d June, 1814, after he had signed the first treaty of Paris, he was raised to the rank of a Fürst or Prince. He accompanied the allied sovereigns to London, was one of the chief plenipotentiaries at the congress of Vienna, and took a leading part in the negotiations which led to the second treaty of Paris. After the restoration of peace he retained his place at the head of the Prussian cabinet, but his conduct of affairs was no longer marked by energy and foresight. He was accused of being too submissive to the papacy, and, although a man of liberal sentiments, he had not the courage to resist his royal master's dislike of constitutional government. He died at Genoa, November 26, 1822.

Hardenberg wrote memoirs of the time between 1801 and the conclusion of the treaty of Tilsit, and entrusted them before his death to his friend Schöll, a councillor of state. They were sealed by Frederick William III. and placed in the state archives, with directions that they should not be published until after the lapse of fifty years. At the end of this time they were entrusted by Prince Bismarck to Leopold von Ranke, who issued them accompanied by a biography of the author (*Denkwürdigkeiten des Staatskanzlers Fürsten von Hardenberg*, 4 vols., 1877). See also Klose, *Leben Karl August's, Fürsten von Hardenberg*, 1851; and Seeley, *Life and Times of Stein*, 1879.

HARDERWIJK, a town of the Netherlands, in the province of Guelderland, on the coast of the Zuyder Zee, about 28 miles N.E. of Utrecht. Its principal buildings are the town-house, the Reformed church rebuilt in the 15th century, the Nassau-Veluwe gymnasium, the colonial dockyard depôt, formerly the mint, and the municipal orphanage. Agriculture, fishing, and a few trifling domestic industries form the sole employment of the inhabitants, who in 1900 numbered 7,410.

Formerly the town was much more important. Having been surrounded with walls by Count Otto II. in 1229, and gifted with municipal privileges in 1231, Harderwijk rapidly extended its commerce till it dealt directly not only with Holstein and Hamburg but with England, Denmark, and Sweden. In 1522 the town was captured by Charles V.; in 1572 it became subject to the United Netherlands; and in 1672–73 it was besieged for seventeen months by the bishop of Münster and his French allies.

HARDICANUTE, HARTHACNUT, or HARDIKNUT (c. 1018–1042), the last of the Danish sovereigns of England, son of Canute king of England, and his wife Alfgiva Emma, the sister of Richard duke of Normandy, and widow of King Ethelred, was born most probably in 1018 or 1019. When Canute died in 1035 Hardicanute was ruler of Denmark, and Swend, the elder reputed son of Canute by Alfgiva of Northampton, one of his concubines, was ruler of Norway. It is said to have been the wish of his father that Hardicanute should be ruler of both England and Denmark, but his connection with Denmark seems to have been prejudicial to his English interests; and though his claims were supported by Godwine and the West Saxons, the witenagemot which met at Oxford decided that his government should not extend further north than the Thames, and that Harold, Canute's younger son by Alfgiva of Northampton, should reign over the northern provinces, being also in all probability overlord of the whole kingdom. Hardicanute refused, however, to come to England on such conditions, and in 1039 the witan of Wessex deposed him, and chose Harold also for their king. On the death of Harold in 1040, Hardicanute, who was about to invade England, had his hostile intentions disarmed by the message which reached him at Bruges, making him an offer of the crown for which he was preparing to do battle. The witan's choice of him seems to have been spontaneous, and not at all due to the threatening attitude he had assumed; but apparently he had not forgotten the former slight he had received, and his short reign was marked by great oppression and cruelty. He caused the dead body of Harold to be dug up from its place of sepulture at Westminster, and thrown into a marsh or, according to another account, into the Thames; he exacted so heavy a *danegeld* for the support of his foreign fleet that great discontent was created throughout the kingdom, and in Worcestershire a general uprising took place against the earls sent to collect the tax, upon which he burned the city of Worcester to the ground and devastated the surrounding country; in 1041 he permitted Eadwulf, earl of Northumbria, to be treacherously murdered after having granted him his full friendship. It would appear that Hardicanute was greatly given to excess in eating and drinking; and while carousing at the marriage feast of one of his thegns he was suddenly seized with an epileptic fit, from which he died a few days afterwards, June 8, 1042. He had no children, and though the line of Danish sovereigns might have been continued by Swend, the choice of the kingdom was unanimous for Edward Atheling, son of Ethelred.

See Freeman's *Norman Conquest*, vol. i.; Palgrave's *History of the Anglo-Saxons*; and Green's *History of the English People*, vol. i.

HARDING, JAMES DUFFIELD (1798–1863), a landscape painter, was the son of an artist, and took to the same vocation at an early age, although he had originally been destined for the law. He was in the main a water-color painter, but he produced various oil-paintings both at the beginning and towards the end of his career. He frequently contributed to the exhibitions of the Water-Color Society, of which he became an associate in 1818, and a full member in 1822. He was also very largely engaged in teaching, and published several books developing his views of art,—amongst others, *The Tourist in Italy*, 1831; *The Tourist in France*, 1834; *The Park and the Forest*, 1841; *The Principles and the Practice of Art*, 1845; *Elementary Art*, 1846; *Scotland Delineated in a Series of Views*, 1847; *Lessons on Art*, 1849. He died at Barnes on 4th December, 1863. Harding was noted for facility, sureness of hand, nicety of touch, and the various qualities which go to make up an elegant, highly trained, and accomplished sketcher from nature, and composer of picturesque landscape material; he was particularly skilful in the treatment of foliage, and had for many years a leading position among those landscapists who carry on the miscellaneous work of the art to the satisfaction of their own generation, without

establishing an ultimate claim to the higher kind of posthumous renown.

HARDING, JOHN. See HARDYNG.

HARDINGE, HENRY HARDINGE, VISCOUNT (1785–1856), field-marshal and governor-general of India, was born at Wrotham in Kent, March 30, 1785. After passing a short time at Eton College, he entered the army in 1798 as an ensign in the Queen's Rangers, with whom he served in Canada. In the Peninsular War he served for a time on Wellington's staff, and received an appointment as deputy-quartermaster-general in the Portuguese army from Marshal Beresford, whose approval and subsequent influence he had won by his gallantry at Corunna in 1809. Hardinge was present at nearly all the battles of the campaign; he was wounded at Vimiera and Vittoria. At Albuera he saved the day for the British by taking the responsibility at a critical moment of ordering General Cole's division to advance. When peace was again broken in 1815 by Napoleon's escape from Elba, Hardinge hastened into active service, and was appointed to the important post of commissioner at the Prussian headquarters. In this capacity he was present at the battle of Ligny, June 16, 1815, where he lost his left hand by a shot, and thus was not present at Waterloo fought two days later. For the loss of his hand he received a pension of £300; and in the same year was made a K.C.B. In 1820 and 1826 Sir Henry Hardinge was returned to parliament as member for Durham; and in 1828 he accepted the office of secretary at war in Wellington's ministry, a post which he also filled in Peel's cabinet in 1841–43. In 1830 and 1834 he was chief secretary for Ireland. In 1844 he succeeded Lord Ellenborough as governor-general of India, a position which he retained till January, 1848. During his term of office the Sikh War broke out; and the governor-general after the battle of Mudki magnanimously offered to serve as second in command under Lord Gough. He manifested all his old courage and skill, and at the peace, for his services in the campaign, he was created Viscount Hardinge of Lahore, and of King's Newton in Derbyshire, with a Government pension of £3000 for three lives; while the East India Company voted him an annuity of £5000. He returned to England in 1848, and in 1852 succeeded the duke of Wellington as commander-in-chief of the British army. While in this position he had the home management of the Crimean War, which he endeavored to conduct on Wellington's principles—a system not altogether suited to the changed mode of warfare. In 1855 he was promoted to the rank of field-marshal. Viscount Hardinge resigned his office of commander-in-chief in July, 1856, owing to failing health, and died on September 24th of the same year at his house near Tunbridge Wells.

HARDOI, a British district of Oudh, India, under the jurisdiction of the lieutenant-governor of the North-Western provinces, lying between 26° 53′ and 27° 47′ N. lat., and between 79° 44′ and 80° 52′ E. long. with an area in 1878 of 2285·64 square miles. The district is an irregular parallelogram between the Gumti and Ganges; its greatest length from north-west to south-east is 78 miles; and the average breadth is 46 miles. It is bounded on the N. by Sháhjahánpur and Kheri; E. by Sítápur, the Gumti forming the boundary-line; S. by Lucknow and Unáo; and W. by Farrukhábád, the Ganges marking the boundary. It is a level district watered by the Ganges, Rámgangá, Garra, Sukhetá, Sái, Baita, and Gumti,—the three rivers first named being navigable by boats of 500 *maunds*, or about 17 tons burden. Towards the Ganges, the land is uneven, and often rises into hillocks of sand cultivated at the base, and their slopes covered with lofty *munj* grass. The soil of Hardoi is lighter than that of perhaps any other district of Oudh, 27 per cent. being sand, 56 per cent. loam, and 17 per cent. clay. Several large *jhíls* or lakes are scattered throughout the district, the largest being that of Sándi, which is 3 miles long by from 1 to 2 miles broad. These *jhíls* are largely used for irrigation, 126,000 acres being watered from them. Large tracts of forest jungle still exist. Leopards, black buck, spotted deer, and *nilgái* are common; the mallard, teal, gray duck, common goose, and all kinds of waterfowl abound.

The inhabitants of Hardoi district in 1869 numbered 931,517, of whom 500,994 were males and 430,523 females (Hindus, 845,293; Mahometans, 85,824; Christians, 48; "others," 352). The nine largest towns are,—Sháhábád, 18,254 inhabitants; Sandíla, 15,511; Bílgrám, 11,534; Mallánwán, 11,670; Sándi, 11,123; Pihání, 7582; Hardoi (the administrative headquarters of the district), 7156; Gopámau, 5949; and Páli, 5122. The principal religious fairs are the following:—At Bílgrám, in September, on the occasion of the *Rám Lílá* festival, lasting ten days and attended by about 40,000 persons; at Hattia Haran, during the whole month of Bhádra (August and September), attended by 100,000 persons; at Barsuya, in April and November, the *Pramhanska Samádh* festival, lasting for only a single day on each occasion, and attended by from 15,000 to 20,000 persons. These, together with several other smaller fairs, are held for religious purposes, and have no commercial importance. Rice, wheat, and other food-grains form the great staples of agriculture. The area under crops is 844,560 acres or 1319 square miles, being more than one-half the entire area. The Oudh and Rohilkhand Railway from Lucknow to Sháhjahánpur runs through Hardoi for a distance of 62 miles. There are also 329 miles of raised and bridged roads, and 73 miles of minor roads, intersecting the district. The principal imports are cotton, salt, country cloth, and European piece-goods; the chief exports,—food-grains, sugar, tobacco, horned cattle, and hides. The value of the imports in 1875 was £102,952; of the exports, £62,977. The gross revenue of the district in 1875 amounted to £170,952, the expenditure to £18,478. The regular police (1873) consisted of 436 officers and men, costing £6610. The number of schools in 1875 was 142, with 5877 pupils. The average rainfall for the ten years ending 1872 was 32 inches. Malaria fevers, epidemic cholera, and smallpox prevail.

History.—The first authentic records of Hardoi are connected with the Mussulman colonization. Báwan was occupied by Sayyid Sálár Masáúd in 1028, but the permanent Moslem occupation did not commence till 1217. Owing to the situation of the district, Hardoi formed the scene of many sanguinary battles between the rival Afghán and Mughal empires. Between Bílgrám and Sándi was fought the great battle between Humáyun and Sher Sháh, in which the former was utterly defeated. Hardoi, along with the rest of Oudh, became British territory under Lord Dalhousie's proclamation of February, 1856.

HARDOUIN, JEAN, was a classical scholar of the 17th century, at once singularly learned and learnedly singular. He was born at Quimper in Brittany in 1646, and died at Paris in 1727. Having acquired a taste for literature in his father's book-shop, he sought and obtained about his sixteenth year admission into the learned society of the Jesuits. In Paris, where he went to study theology, he ultimately became librarian of the Collége Louis le Grand. The life of laborious authorship inaugurated by his edition of Themistius (Paris, 1684), which included no less than thirteen new orations, was continued with wonderful perseverance and success. At the advice of Garnier he undertook to edit the *Natural History* of Pliny for the Delphin series, and five years saw the completion of a task which, in the opinion of Huet, would have taken any ordinary scholar fifty years. His attention having been turned to numismatics as auxiliary to his great editorial labors, he published several learned works in that department, marred, however, as almost everything he did was marred, by a determination to be at all hazards different from other interpreters. It is sufficient to mention his *Nummi antiqui populorum et urbium illustrati* (Paris, 1684), *Antirrheticus de nummis antiquis coloniarum et municipiorum* (Paris, 1689), and *Chronologia Vet. Test. ad vulgatam versionem exacta et nummis illustrata* (Paris, 1696). By the ecclesiastical authorities Hardouin was appointed to supervise the *Conciliorum collectio regia maxima* (Greek and Latin, Paris, 1715, 12 vols.); but he was accused of suppressing important documents and foisting in apocryphal matter, and by order of the parliament of Paris the publication of the work was delayed till some of its deficiencies were remedied. It is, however, as the originator of a variety of paradoxical theories that the learned father is now best remembered. The most remarkable, contained in his *Chronologie expliquée par les médailles* (Paris, 1696), was to the effect that, with the exception of the works of Homer, Herodotus, and Cicero, the *Natural History* of Pliny, the *Georgics* of Virgil, and the *Satires* and *Epistles* of Horace, all the ancient classics of Greece and Rome were spurious, having been manufactured by monks of the 13th century.

In 1709 Jean Louis de Lorme published at Amsterdam an edition of Hardouin's *Opera Selecta*, and though he made many corrections at the author's suggestion, he refused to adn it the wholesale cancelling of the passages condemned by the Jesuits. Details in regard to Hardouin's labors, controversies, and whimsies may be found in Bayle and Moreri; in Lacombe, *Dict. des portraits historiques*; Lambert. *Hist. litt. du règne de*

Louis XIV.; Dupin, *Bibliothèque des auteurs ecclesiastiques*; Levot, *Biographie bretonne* (Vannes, 1852–57); and, more particularly, Augustin and Alois de Backer, *Bibliothèque des Écrivains de la Comp. de Jésus* (Liége, 1853).

HARDT, Hermann von der (1660–1746), Orientalist, descended from an old Dutch family, was born at Melle, in Westphalia, on the 15th November, 1660. His father, who was treasurer of the county of Tecklenburg, appreciating his son's abilities, gave him a good education at Osnabrück, and sent him afterwards to Jena and Leipsic. Young Hardt, gifted with a quick disposition and a powerful memory, soon gained renown for his fluency in carrying on learned discussions in Latin; but the study of the Oriental languages diverted him from all other pursuits, and in no long time he made himself master of Hebrew, Syriac, and Chaldee. The duke of Brunswick, hearing of Hardt's fame, appointed him his librarian shortly after the Orientalist had founded at Leipsic a philobiblical society, with the object of determining the sacred text. In 1690 Hardt was called to the chair of Oriental languages at Helmstädt; and his late master was prevailed upon to present to that university his valuable library, of which Hardt was again appointed to take charge in 1702. Seven years later he was named rector of the gymnasium of Marienburg, a post which he held till his death on the 28th of February, 1746.

Among his numerous writings, the following deserve mention:—*Autographa Lutheri aliorumque celebrium Virorum, ab anno 1517 ad annum 1546. Reformationis Ætatem et Historiam egregie illustrantia*, 1690–91; *Magnum Œcumenicum Constantiense Concilium*, 1697; *Hebrææ linguæ Fundamenta*, 1694; *Syriacæ linguæ Fundamenta*, 1694; *Elementa Chaldaica*, 1693; *Historia litteraria Reformationis*, 1717; *Enigmata prisci orbis*, 1723. The last is a collection of pieces previously published separately, all of which had been condemned by the church. This republication was ordered to be suppressed. Hardt left a *History of the Reformation* in manuscript, which is preserved in the Helmstädt Juleum.

HARDWÁR, or Hurdwar, an ancient town of India and place of pilgrimage, in Saháranpur district, North-Western Provinces, situated on the right bank of the Ganges at the foot of the Siwálik Hills, in 29° 57′ 30″ N. lat., 78° 12′ 52″ E. long. Population (1872), 4800. The town is of great antiquity, and has borne many names. It was originally known as Kapila from the sage Kapila. Hwen Thsang, the Chinese Buddhist pilgrim, in the 7th century A. D. visited a city which he calls Mo-yu-lo, the remains of which still exist at Máyapur, a little to the south of the modern town. Among the ruins are a fort and three temples, decorated with broken stone sculptures. The great object of attraction at present is the Hari-ke-charan, or bathing *ghát*, with the adjoining temple of Gangadwára. The *charan*, or foot-mark of Vishnu, is imprinted on a stone let into the upper wall of the *ghát*, and forms an object of special reverence. A great assemblage of people takes place annually, and every twelfth year a feast of peculiar sanctity occurs, known as a *Kumbh-mela*. The ordinary number of pilgrims at the annual fair amounts to 100,000, and at the *Kumbh-mela* to 300,000. The Hardwár meeting also possesses considerable mercantile importance, being one of the principal horse-fairs in Upper India. Commodities of all kinds, Indian and European, find a ready sale, and the trade in grain and food-stuffs forms a lucrative traffic. The Ganges canal draws its supply of water from a branch channel close to the town. Hardwár is a police station, with post and telegraph offices.

HARDY, Alexandre (1560–1631), the most fertile of all dramatic authors, next to Lope de Vega and Calderon, merits a place in dramatic literature on that account alone. He is said to have written upwards of six hundred plays, of which forty-one were printed in his own edition of 1624–28, and may still be read. It cannot be charged upon modern writers that they are slow to see merit in early French authors, but it has been found impossible by any to admire the hasty works of a man who wrote a tragedy in eight days, and did not scruple to borrow situations from any quarter where he could find them. He at first followed a strolling company as its author, and ended by becoming the dramatist of the Théâtre du Marais. He knew how to make the most of his situations; he, evidently by constant practice, became a master of stage business and stage effects; he knew the kind of dialogue—coarse and rough—which would please his audience; his art, compared with that of Molière, his successor, is the art of a carpenter compared with that of a sculptor. To the student of the drama Hardy will always be an interesting figure, appearing as he does between the degraded morality and the modern comedy, an imitator alike of Italian pastoral and Spanish tragedy. He had no sympathy with the classical pretensions of Jodelle; he gave little heed to art; he thought entirely of what would succeed for the moment. One piece alone of Hardy's has succeeded in arresting the attention of critics, the tragedy of *Mariamne*. Hardy lived long enough to witness the first successes of Corneille.

HARDYNG, or Harding, John, an English rhyming chronicler of the 15th century, was born in 1378. Having been admitted at the age of twelve to the household of Henry Hotspur, son of the earl of Northumberland, he was afterwards present with his patron at the battles of Homildon (1402) and Cokelawe, and saw him fall in the fatal field of Shrewsbury (1402). He next entered the service of Sir Robert Umfraville, and held for some time the post of constable of the castle of Warkworth. In the beginning of the reign of King Henry V. he was commissioned to recover as many as possible of the deeds connected with the homage of the Scottish kings to the English crown; and we find him some time after presenting the results of his search to Henry at Bois de Vincennes. In recognition of his exertions he was promised the manor of Gedyngton in Northamptonshire (worth in the money of the time from £32 to £36), but the king dying before he obtained possession he was left, as he tells us, "without reward or lyfelode any wise." Beyond a stray notice in the Lansdowne MS. of his chronicle, to the effect that Hardyng was in 1424 at Rome consulting and transcribing the chronicle of Trogus Pompeius, there is little trace of his proceedings till 1434, when he received a safe conduct from James of Scotland, that he might bring with him "the thynges which we spake to you at Coldingham of, for which we binde us by this letters to pay you a thousand marks of English nobles." A contract preserved in the Exchequer bears that in 1457 he delivered to the earl of Shrewsbury the letters in which David and Robert of Scotland recognized the English supremacy, and a number of less important documents of similar tendency; and in the same year letters patent were issued granting him a pension of £20 per annum for life. The leisure of his old age appears to have been occupied with a revision of his chronicle, which he presented to Edward IV. It could not have been finished before 1465, but it only comes down to the flight of Henry VI. to Scotland. The purpose of the writer being "that Englishe men might have understanding of all affairs touching their own countree Even to his dayes from all antiquitee," he starts his narrative with Brutus the Trojan, and details the history of all the mythical kings. When he comes down to his own time a considerable part of the material is derived from his own experience. The Scottish portions are animated by strong national hostility: "unto the Scots he could never be friend."

The most important MSS. of Hardyng's Chronicle are the Lansdowne (20) and the Harleian (661) in the British Museum, the Bodleian (*Archiv. Seld.*, B. 10), and the Ashmolean. Richard Grafton printed two editions in January, 1543, which differ in almost every page from each other. Grafton's abridgment was printed by Tottel in 1562, and again in 1564. Mr. Ellis in 1812 edited the work from the Lansdowne MS., and prefixed a life of the author.

HARE, the common name of all the species, excepting the rabbit, of *Leporidæ*, a family of rodent mammals, distinguished from the rest of that order by the possession of four incisor teeth in the upper jaw, two in front, which are well developed and longitudinally grooved, and two exceedingly small ones behind. The molars are formed for the mastication of vegetable food, an uneven surface being produced by the presence of transverse enamel plates which are worn down more slowly than the intermediate dentine. The teeth are without permanent roots, and thus the constant waste at the surface is compensated for by continuous growth at the opposite extremity. Hares all possess long ears, and in most species the hind legs are much longer than those in front. They are without exception timid, defenceless animals, although during the breeding season two males have been known to fight together for possession of the female until one was killed; while all the species are protectively colored. They form a single genus (*Lepus*), containing from thirty-five to forty species according as

certain forms are regarded as independent species, or merely as geographical varieties. They occur in all the great zoological regions of the world, but are especially characteristic of the northern and temperate areas of both hemispheres.

The common hare (*Lepus timidus*, fig. 1), is a typical example of the family. The ears in this species are longer than the head, and its hind legs are so long in comparison with those in front, that it is only by descending a hill diagonally that it can avoid overbalancing itself. It is found in all parts of Europe except the north of Russia, the Scandi-

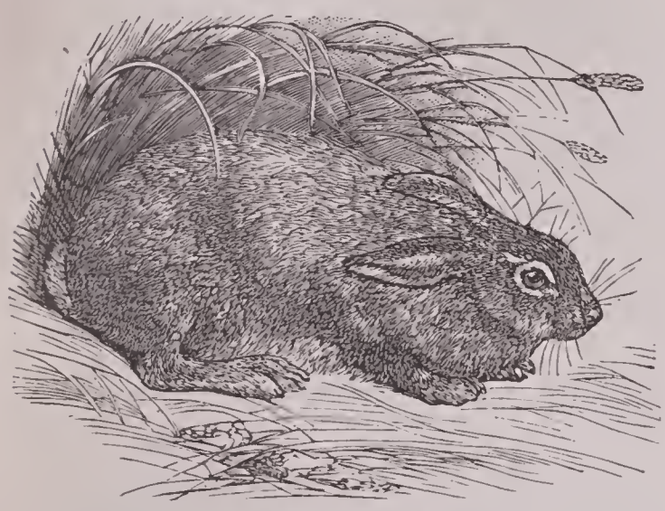


Fig. 1.—Common Hare.

navian peninsula, and Ireland, and is specially abundant in those countries in which it enjoys the protection of game laws. Its fur is usually of a tawny gray color above and white beneath, with the upper surface of the short tail and the tips of the ears black. The color of the fur, however, differs considerably in different latitudes and at different seasons of the year, showing, for example, a tendency to become white during winter in northern countries, while assuming a reddish-yellow hue in the more genial climate of southern Europe. On the strength mainly of such outward differences various species have been described, but these have been found to be so linked together by intermediate forms as to satisfy most naturalists that they are merely climatal varieties of one species. The hare is a night-feeding animal, remaining during the day on its "form," as the slight depression is called which it makes in the open field, usually among grass. This it leaves at nightfall to seek the fields of young wheat and other cereals whose tender herbage forms its favorite food. It is also fond of gnawing the bark of young trees, and thus often does great damage to plantations. In the morning it returns to its form, where it finds considerable protection in the close approach which the color of its fur makes to that of its surroundings; should it thus fail, however, to elude observation it depends for safety on its extraordinary fleetness. On the first alarm of danger it is said to sit erect and to reconnoitre, when it either seeks concealment by clapping close to the ground or takes to instant flight. In the latter case its great speed, and the cunning endeavors it makes to outwit its canine pursuers, form the chief attractions of coursing. The hare takes readily to the water, where it swims well; and Yarrell records an instance in which one was observed crossing an arm of the sea about a mile in width. Hares are remarkably prolific. They pair when scarcely a year old, and the female brings forth several broods in the year, each consisting of from two to five leverets (from the French *lièvre*), as the young are called. These have their sight at birth, and after being suckled for a month they are able to look after themselves. In Europe this species has never been known to breed in confinement. The hare was well known to the ancient Greeks and Romans.

In those parts where the common hare does not occur, its place is taken by the varying or mountain hare (*Lepus variabilis*, fig. 2). It is found throughout the entire northern portion of the great Palæarctic region, from Ireland eastward to Japan, while it also occurs on the Pyrenees, the Alps, the highlands of Bavaria and the Caucasus, although altogether absent in the less elevated regions which connect those mountain ranges. Its presence in such isolated situations in company with many truly arctic plants is regarded as one of the many proofs of a former glacial epoch, during which boreal plants and animals were spread all over southern and central Europe. On the advent, however, of milder climatic conditions, this northern flora and fauna retired towards the Arctic Circle, leaving a few species, such as the varying hare, behind on the various mountain ranges, where by ascending to a sufficient altitude the necessary boreal conditions could be obtained. The mountain hare differs from the preceding species in its ears being shorter than its head, and in its fur becoming in most cases white in winter,—a change of color which renders it almost invisible in the snow. Along the southern limit of its range, or in districts where the temperature is from any cause exceptionally mild, this change of color either does not take place at all, as in Ireland, or is only partial, as in many parts of Scotland. In this respect it resembles the ermine, which it further resembles in having a part of its fur always remaining black; in the hare, however, it is the tips of the ears, and not the point of the tail, which thus remain unaltered. In Scotland, where it is known as the "blue hare," it occurs plentifully throughout the hilly regions north of the Forth, where it descends to the low grounds in winter; while in Ireland it is the only hare found. Owing to the mildness of the climate, however, in the "Green Isle," the color of the fur undergoes little or no alteration in winter, and on this account it was until recently regarded by many as a distinct species (*Lepus hibernicus*). Throughout the Arctic regions of North America a closely allied species, the polar hare (*Lepus glacialis*), occurs. Naturalists have hitherto had considerable difficulty in distinguishing this from the preceding species, the chief difference being in the color of the fur, which in the Polar hare is white all the year round, with the exception of the tips of the ears. Considerable light has, however, been thrown on this point by the observations of the naturalists attached to the late Arctic Expedition under Sir George Nares, who found this species inhabiting the shores of Grinnell Land, and obtained evidence in footprints on the snow of its existence in latitude 83° 10′, about 20 miles north of the nearest land. Unlike all other hares, and resembling in this respect the rabbit, the polar hare would seem to occupy a burrow—"a hole," says Captain Feilden, "4 feet in length, scraped horizontally into a snow drift." "I have no doubt," he continues, "the same burrow is regularly occupied, as this one was discolored by the feet of the animal, and a quantity of

Fig. 2.—Mountain Hare.

hair was sticking to the sides." Another point of importance in establishing the specific distinctness of this species from the former lies in the difference in the number of young composing a brood in each of these species. The number of young found in gravid females by the naturalists already referred to varied from seven to eight, while in the varying hare of Europe the number does not exceed five. According to Captain Lyon, the polar hare is by no means a shy animal, as during his cruise in the Arctic seas hares were in the habit of coming out on the ice to his ships to feed on the tea leaves which were thrown overboard. This species has thus been found inhabiting the highest northern lands yet visited by man, where it also attains its normal weight of from 8 to 10 lb, subsisting on the stoneworts and other hardy plants which form the scanty vegetation of circumpolar valleys. The American varying hare (*Lepus*

americanus) is one of the most widely distributed species of this family, extending, in one or other of its four geographical varieties, from the borders of the Arctic barren grounds southwards to New Mexico. It differs from the mountain hare of Europe in its smaller size and relatively smaller ears, but resembles it in the change of color in the fur, especially of the northern varieties, during winter. It is exceedingly abundant on the banks of the Mackenzie River, where it is killed in great numbers by the Hare Indians. A favorite device among the Indians for catching it, according to Darwin, is to walk spirally round and round it, when on its form, especially at midday when the shadow of the hunter is shortest. It has still more implacable enemies, however, in the wolves, gluttons, and lynxes of those regions, of the last of which it is said to form the principal food. The fur of this species is imported into Great Britain, but it is of little value. In the swampy district of the south-eastern portion of the United States, the swamp hare (*Lepus aquaticus*) and the marsh hare (*Lepus palustris*) occur. These take readily to the water, and are said to dive for some distance, their legs being less thickly clothed with hair than are those of the less amphibious species. They feed chiefly on aquatic plants. Only one species of hare (*Lepus brasiliensis*) occurs in South America. It is found throughout Brazil, and on various parts of the Andes in Bolivia and Peru. Fossil remains of several species of *Leporidæ* have been found in the Post-Glacial deposits and the bone-caves of Europe, while the remains of many extinct species have been lately discovered in the Miocene deposits of Dakota and Colorado. (J. GI.)

HARE, JULIUS CHARLES (1795–1855), theological writer, was born at Valdagno, near Vicenza, in Italy, on the 13th of September, 1795. He came to England with his parents in 1798, but in 1804–5 spent a winter with them at Weimar, where he met Goethe and Schiller, and received a bias to German literature which influenced his style and sentiments throughout his whole career. On the death of his mother in 1806, Julius was sent home to the Charterhouse in London, where he remained till 1812, when he entered Trinity College, Cambridge. There he became fellow in 1818, and after some time spent abroad he began to read law in London in the following year. In 1822 he was appointed assistant-tutor at Trinity College, which position he retained for ten years. Turning his attention from law to divinity, Hare took priest's orders in 1826; and on the death of his uncle in 1832, he succeeded to the rich family living of Hurstmonceaux in Sussex, where he accumulated a library of some 12,000 volumes, especially rich in German literature. Before taking up residence on his parish he once more went abroad, and made in Rome the acquaintance of the Chevalier Bunsen, who afterwards dedicated to him part of his work, *Hippolytus and his Age*. In 1840 Hare was appointed archdeacon of Lewes, and in the same year preached a course of sermons at Cambridge (*The Victory of Faith*) followed in 1846 by a second, *The Mission of the Comforter*. Neither series when published attained any great popularity. Archdeacon Hare married in 1844. In 1851 he was collated to a prebend in Chichester; and in 1853 he became one of the queen's chaplains. He died January 23, 1855.

Julius Hare belonged to what has been called the "Broad Church party," though some of his opinions approach very closely to those of the Evangelical Arminian school, while others again seem vague and undecided. He was one of the first of his countrymen to recognize and come under the influence of German thought and speculation, and, amidst an exaggerated alarm of German heresy, did much to vindicate the authority of the sounder German critics. His writings, which are chiefly theological and controversial, are largely formed of charges to his clergy, and sermons on different topics; but, though valuable and full of thought, they lose some of their force by the cumbrous German structure of the sentences, and by certain orthographical peculiarities in which the author indulged. In 1827 *Guesses at Truth by Two Brothers*[1] appeared. Hare assisted Thirlwall, afterwards bishop of St. David's, in the translation of the 1st and 2d volumes of Niebuhr's *History of Rome* (1828 and 1832), and published a *Vindication of Niebuhr's History* in 1829. He wrote many similar works, among which is a *Vindication of Luther against his recent English Assailants*, 1854. In 1848 he edited the *Remains of John Sterling*, who had formerly been his curate. Carlyle's *Life of John Sterling* was written through dissatisfaction with the "Life" prefixed to Archdeacon Hare's book. *Memorials of a Quiet Life*, published in 1872, contain accounts of the Hare family.

HAREBELL, or, as the name is often written, HAIRBELL, known also as the Blue-bell of Scotland, and Witches' Thimbles, a well-known perennial wild flower, *Campanula rotundifolia*, L., a member of the natural order *Campanulaceæ*. The harebell has a very slender slightly creeping root-stock, and a wiry, erect stem. The radical leaves, to which the specific name refers, have long stalks, and are roundish or cordate, crenate or serrate; the lower stem leaves are ovate or lanceolate, and the upper ones linear, subsessile, acute and entire, rarely pubescent. The flowers are slightly drooping, arranged in a panicle, or in small specimens single, having the calyx-tube glabrous, with subulate and erect segments, the corolla campanulate, with slightly recurved segments, and the capsule nodding, and opening by pores at the base of the calyx-tube. There are two varieties:—(*a*) *genuina*, with slender stem-leaves, and (*b*) *montana*, in which the lower stem-leaves are elliptical-oblanceolate. The plant is found on heaths and pastures throughout Great Britain and North America, and flowers in late summer and autumn. The harebell has ever been a great favorite with poets, and on account of its delicate blue color has been considered as an emblem of purity.

Harebell (*Campanula rotundifolia*).

HAREM, or less frequently HARAM, the recognized European title for that portion of a polygamist's house which is devoted to the exclusive occupancy of his wives and their attendants, or, by a simple metonymy, for the female portion of his household. The word *harem* is Arabic for anything forbidden or not to be touched. It is generally applied in Moslem law to such things as games of chance, draughts, chess, witchcraft, and portrait-taking, which are inconsistent with the religious code, and under the form of harem it is well-known even to Europeans as designating the sacred enclosure of the principal mosque at Cairo and at Jerusalem (*Haram esch-Scherig*). The word seraglio, which is not unfrequently employed as equivalent to harem, is an Italian modification (usually spelled *serraglio* from assimilation to serrare, to shut in) of the Persian term *serai*, which simply means a palace or large building, as in the familiar compound caravanserai. Wherever polygamy is maintained in the midst of a developed social life, the harem appears to be an almost inevitable institution. We consequently find it after a more or less rigid type among the Jews, the Babylonians, the Siamese, the ancient Persians, the Peruvians, etc. But it is among the modern Mahometan peoples that it has attained its most perfect development; and the harems of the sultan of Turkey and the shah of Persia may be taken as the most elaborate and best-known specimens of the type.

According to the Koran, the Mussulman is required to satisfy himself with four wives, but the sultan may possess as many as seven. Each of these has her own suite of apartments, her own garden and bath-room, and her own body of servants, male and female. They are not called by their names, but distinguished as *Kadin* (or Lady) Number One, Kadin Number Two, and so on. The title of sultana is bestowed only on the mother, the sister, or the daughter of a sultan; and consequently it is the kadin who first gives birth to an heir to the empire who alone can have this distinction. She further obtains the title of *hasseky* or *kasseki*, but this is lost if the child dies. All the female slaves, or

[1] Julius Hare's co-worker in this book was his brother Augustus William Hare (1792–1834), who, after a distinguished career at Oxford, was appointed rector of Alton Barnes, Wiltshire. He died prematurely at Rome in 1834. He was the author of *Sermons to a Country Congregation*, published in 1837

as they are called odalisks (a European corruption of the word odalik, from *oda* a chamber, and *lik* belonging to), are at the absolute disposal of the sultan, and if, in spite of the natural endeavors of the kadins to prevent such a contingency, one of them becomes the mother of her lord and master's first-born, she is advanced to the rank of sultana hasseky. It is contrary to etiquette for the sultan to select his own favorites among the odalisks; he is expected to accept the choice made for him by his mother, who bears the title of validé, and exercises great influence not only in the affairs of the harem but even in political matters. Every odalisk who has been promoted to the royal couch is henceforth considered sacred from all meaner patronage, and receives apartments and attendants of her own; but she has no further claim to the sultan's attention, and may have to console a life-long widowhood with the memory of the honor which was once bestowed on her. The ranks of the odalisks are ever and anon recruited by slaves presented to the sultan by his female relatives or the state officials. The latter, for example, are accustomed to make acknowledgment of their allegiance in this way every year on the evening before the 15th of Ramazan. An old and devoted favorite of the sultan occupies the post of *kehaya chatun*, or lady-superintendent of the harem. A large body of eunuchs, both black and white, are employed as guards and gate-keepers. The white eunuchs have charge of the outer gates of the seraglio, but they are not allowed to approach the women's apartments, and obtain no posts of distinction. Their chief, however, the *kapou aghassi*, or master of the gates, has part control over the ecclesiastical possessions, and even the vizier cannot enter the royal apartments without his permission. The black eunuchs have the right of entering the gardens and chambers of the harem. Their chief, usually called the *kizlaer aghassi*, or master of the maidens, though his true title is *darus scadet aga*, or chief of the abode of felicity, is an official of high importance. His appointment is for life. If he is deprived of his post he receives his freedom; and if he resigns of his own accord he is generally sent to Egypt with a pension of 100 francs a day. His secretary keeps count of the revenues of the mosques built by the sultans. He is usually succeeded by the second eunuch, who bears the title of treasurer or khazuahdar, and has charge of the jewels, etc., of the women. The number of eunuchs is always a large one. The sultana validé and the sultana hasseky have each fifty at their service, and others are assigned to the kadins and the favorite odalisks.

Further details on the Sultan's harem will be found in an anonymous paper in the *Revue d'Orient* (London, 1861), in the elaborate article by Hoffmann in Ersch and Gruber's *Encyclopädie*, and the *Serraglio del gransignore descritto* (Venice, 1865) by Ottaviano Bon, Venetian ambassador in 1608. An account of a visit to the harem of the Persian prince Melek Kasim Mirza was given by M. Flandin in the *Revue des Deux Mondes* (1852), and at the time created a great sensation in Persia. Sketches of harem interiors are common in our popular literature from Lady Mary Wortley Montagu's *Letters* and Lempriere's *Tour to Morocco* (1793) down to Mrs. S. Harvey's *Turkish Harems and Circassian Homes* (Lond., 1871). The Count de Beauvoir gives a picture of the harems of the sultan of Java and the Siamese mandarins in his *Voyage round the World* (Lond., 1870). Much interesting information on harem life in general is supplied by Dr. Häntzsche (who as a physician was *mehrem* or admissible to the harem) in *Zeitschrift für allgemeine Erdkunde* (Berlin, 1864).

HARFLEUR, the Harflew of our older historians, a maritime town of France in the department of Seine Inférieure and arrondissement of Havre, about 6 miles E. of Havre on the railway between that city and Rouen. It lies in the fertile valley of the Lézarde, at the foot of wooded hills not far from the northern bank of the Seine; and the steeple of St. Martin's, 289 feet high, forms an excellent landmark for the pilots of the river. Its old ramparts are now replaced by bleach-works, chemical factories, and other industrial establishments, and the fosses are transformed into vegetable gardens. St. Martin's is the most remarkable building in the town, and ranks as an "historical monument." It dates from the 15th and 16th centuries, but the great portal is the work of the 17th, and the whole has undergone the process of modern restoration. Of the old castle there are but insignificant ruins, and the present castle, situated in a fine park to the northward, is a building of the 18th century. The hôtel de ville belongs to the 16th. In 1901 the population was only 2,686, and though for its size Harfleur is still a busy place with its fishers and traders, it has greatly fallen from its ancient importance.

In the Midde Ages, when its name, Herosfloth, Harofluet, or Hareflot, was still sufficiently uncorrupted to indicate its Norman origin, it was the principal seaport of north-western France. In 1415 it was captured by Henry V. of England, but when in 1435 the people of the district of Caux rose against the English, 104 of the inhabitants opened the gates of the town to the insurgents, and thus got rid of the foreign yoke. The memory of the deed was long perpetuated by the bells of St. Martin's tolling 104 strokes. Between 1445 and 1449 the English were again in possession; but the town was recovered for the French by Dunois. In 1562 the Huguenots put Harfleur to pillage, and its registers and charters perished in the confusion; but its privileges were restored by Charles IX. in 1568, and it was not till 1710 that it was subjected to the "taille." By common consent Harfleur is now identified with the Caracotinum of the *Itinerary* of Antoninus,—M. Fallue's explorations since 1839 having proved conclusively that the neighborhood is rich in Roman remains.

See De La Motte, *Antiquitez de la ville de Harfleur*, Havre de Grâce, 1677; Letellier, *Recherches historiques sur Harfleur*, 1841; M. Fallue's papers in *Archives du Havre*, 1840, *Mém. de la Soc. des Antiquaires de la Normandie*, and *Revue Archéologique*, 1856–57; Abbé de Cochet, *La Seine Inférieure*, Paris, 1864; E. Dumont and A. Léger, *Hist. de la ville de Harfleur*, 1868.

HARGREAVES, JAMES. See COTTON, vol. vi. p. 434.

HARIÁNÁ, or HURREEANAH, a tract of country in the Punjab, India, consisting of a level upland plain, interspersed with patches of sandy soil, and largely overgrown with brushwood. The Western Jumna Canal now fertilizes the grounds of a large number of its villages. Since the 14th century Hissár has been the local capital. During the troublous period which followed on the decline of the Mughal empire, Hariáná formed the battlefield where the Marhattás, Bhattís, and Síkhs met to settle their territorial quarrels. The whole surrounding country was devastated by the famine of 1783. Since the conquest of the Punjab, Hariáná has been broken up into the districts of Hissár, Rohtak, and Sírsa.

HÄRING, WILHELM (1797–1871), German novelist, known as Wilibald Alexis, was born at Breslau, June 23, 1797. He attended the Werder gymnasium in Berlin, and served as a volunteer in the campaign of 1815. On his return he studied law for some time at the universities of Berlin and Breslau, but he soon gave up the legal profession and devoted himself to literature. He made some attempt to add to his income by practical undertakings, but they were rarely successful. He was fond of travel, and happened to be in Italy with his wife during the Revolution of 1848, the progress of which he had an opportunity of watching in Rome, Florence, and Naples. In 1852 he transferred his residence from Berlin to Arnstadt in Thuringia. Here he was laid low by paralysis of the brain, and after many years of suffering died on the 16th September, 1871. Häring began his literary career in 1823 with a historical romance, *Walladmor*, which was given out as the work of Sir Walter Scott.[1] It rapidly became popular, and was translated into several languages, including English. He next published *Schloss Avalon*, which he attributed to the same author. Soon afterwards he issued a number of very successful short stories and several books of travel, and for a time he indicated a preference for the polemical tendencies of the school of Young Germany. In *Cabanis*, however, which appeared in 1832, he entered the special field of historical romance in which he was destined to achieve his highest fame. From 1840 onwards he published at short intervals a series of romances, each of which deals with some particular epoch in the history of Brandenburg. Among them may be named *Der Roland von Berlin* (1840), *Der falsche Waldemar* (1842), *Der Werwolf* (1848), *Ruhe ist die erste Bürgerpflicht* (1852), *Isegrimm* (1854), and *Dorothe* (1856). These tales are not only full of patriotic feeling, but in all of them the interest is well sustained and the characters are drawn with a bold and firm hand. His *Gesammelte Werke* have been issued in Berlin in 20 volumes.

HARINGTON, SIR JOHN (1561–1612), was the son of Mr. John Harington, of Kelston, near Bath, who had been imprisoned in the Tower by Queen Mary for forwarding a letter to Elizabeth. Harington, born in 1561, was Eliza-

[1] One of the interlocutors in the jocular "Introduction" to Scott's *Betrothed* (1825) supposes *Walladmor* "to have been the work of Douterswivel, by the help of the steam-engine."

beth's godson. He studied at Eton and at Christ's College, Cambridge, where he took the degree of M. A., his tutor being Bishop Still, the famous author of *Gammer Gurton's Needle*. He came up to London about 1583 and studied law, but Queen Elizabeth seems to have removed him to a place at court. Tradition relates that it was at her command that he undertook the translation of Ariosto's *Orlando Furioso*, a work that saw the light in 1591 and was reprinted in 1607 and 1634. Soon after this first date Harington retired to the family mansion at Kelston. In 1596 he published in succession *The Metamorphosis of Ajax*, *An Apology*, and *Ulysses upon Ajax*, the three forming collectively a very absurd and indecorous work of a Pantagruelistic kind. In 1599 he served in Ireland under Essex, and was knighted on the field, to the annoyance, it is said, of Elizabeth. He married a lady of title, who bore him eight children, and who survived until 1634. In 1608 he wrote a personal satire against the bishops, which he read to James I., but which was first published, by a Presbyterian printer, as late as 1653, under the title of *A Brief View of the State of the Church*. This is a somewhat scandalous production. In the spring of 1612, Harington was suffering heavily from the dropsy, and in December of that year he died. In 1613 his *Epigrams*, which had circulated widely in MS., were printed in a collection of the verse of various writers entitled *Alcilia*, and separately in 1615. They became very popular, and were often reprinted. The miscellaneous writings of Harington existing in MS. in his family were first collected by the Rev. Henry Harington in 1779, in 2 volumes, under the title of *Nugæ Antiquæ*. The *Nugæ* include some very elegant pieces of the poet's father.

The translation of the *Orlando Furioso* was a very important labor, and it was carried out with skill and perseverance. Harington, however, was neither a very exact scholar nor a very poetical translator, and he cannot be named in the same breath with Fairfax. The *Orlando Furioso* was a sumptuous book, illustrated in the best taste of the day, and to it were appended a prose critique of the poem, and a life of Ariosto compiled by Harington from various Italian sources. Harington's Rabelaisian pamphlets show that he was almost equally endowed with wit and indelicacy, while of his epigrams little can be said but that they are sometimes smart and always easy.

HARÍRÍ. Abu Mohammed al Kasim ibn 'Alí Ibn Mohammed ibn 'Othman, surnamed EL HARÍRÍ, was born at Bussorah 1054–55 A. D. and died in 1121 or 1123, being therefore contemporary with the first crusade. His native city was renowned for its school of grammar, a most important science amongst a people whose every rule of religion and of life depended upon the accurate interpretation of some word or passage of the Koran, or some saying of the prophet. The rival school of Kufa was the only one that approached it in fame or glory, and in all the numerous disputes that took place between the two academies Bussorah is generally allowed to have had the advantage. His name Harírí signifies silk-merchant, and was probably derived from his father's occupation, as, in spite of the assertion of his biographers to that effect, he appears not to have ever engaged in trade, but to have devoted himself exclusively to literary pursuits. His great object was to investigate the niceties of the Arabic language, and he composed several treatises on the subject, amongst which the best known are *Molhat el 'Irab* (Beauties of Desinential Syntax) and *Durrat el Ghawwás* (The Divers' Pearl), in which he criticises certain common faults of language in vogue amongst the educated. Portions of both these works have been published by De Sacy in his *Chrestomathie*, and the *Durrat el Ghawwás* has been edited by H. Thorbecke (Leipsic, 1871). But his great work is the *Makámát*, or "Assemblies," in which a series of anecdotes of a very slight character in the career of an imaginary learned vagabond afford the opportunity for the display of vast philological and literary learning. The plan was not original, having been already invented and used by Badí' az Zamán el Hamadáni, who died about 1008. The composition of Harírí's own *Makámát* is attributed to the following circumstance. Being one day in the mosque of the Beni Haram, in the quarter of Bussorah in which he resided, he noticed an old man enter, shabby and worn with travel, who in answer to the questions of the persons present gave his name as Abu Zeid, and said that he came from Serúj, a city near Edessa, which had recently been devastated by the crusaders. The old man related the incidents of the destruction of his native city and his own domestic losses and exile in so eloquent a strain as to excite general admiration and compassion. On reaching his home Harírí wrote out the incident in the form of a makámeh or assembly, in the style of El Hamadáni's work, and it now forms the 48th of his book. When subsequently elaborating the idea he modelled the successive chapters on the same theme; a simple-minded Arab gentleman, El Harith ibn el Hammám, on his travels constantly meets with a vagabond old improvisatore, Abu Zeid, who, under different characters and disguises, always succeeds in eliciting the sympathy and alms of his audience and the approbation of El Harith himself. Abu Zeid is always poor, ill-dressed, and crafty, but eloquent in the extreme, and his fraudulently-obtained gains are always spent in some forbidden enjoyment; yet there is ever a good side to his character, and he is not without an exhibition of true feeling, especially when he alludes to the circumstances of his expulsion from his home, and the loss of his daughter, who had been made captive by the marauding Franks. The improvised speeches of Abu Zeid are masterpieces of Arabic learning, every sentence being made to introduce some allusion to Arab history, poetry, or tradition, or the discussion and elucidation of some difficult point of rhetoric or grammar. It is this that gives the value to the book and makes it with its commentary a complete encyclopædia of classical Arabic literature and philology. It is written in rhymed and rhythmical prose, such as is used in the Koran itself, interspersed with verses of poetry of which the merit is more often in the language than the thought.

The *Makámát* have been edited by Silvestre de Sacy, with a select Arabic commentary (Paris, 1822), and a new edition of this edition, with numerous French notes, was issued by MM. Reinaud and Derenbourg (Paris, 1853). An English translation of some select "Assemblies" was made by Theodore Preston for the Oriental Translation Fund (London, 1850), and an admirable translation of the first twenty-six assemblies by T. Chenery[1] (London, 1867), containing an introduction and notes, and a resumé of all the literature of the subject. Of the numerous imitations of the *Makámát* of Harírí, the best known are the *Machberoth Ithiel*, a Hebrew work by Yebudah ben Sbelomoh al Kharizi, edited by T. Chenery (London, 1872), and the *Majma 'al Bahrain* (Confluence of the Two Seas), by Nasyf el Yaziji (Beyrout, 1853), an excellent work in Arabic, displaying an immense acquaintance with the ancient literature of the language. (E. H. P.)

HARLEQUIN. See PANTOMIME.

HARLEY. See OXFORD, EARL OF.

HARLINGEN, or HAARLINGEN, in Frisian *Harns*, an important trading town and seaport in the province of Friesland in the Netherlands, is situated 17 miles W. of Leeuwarden with which it has been connected by rail since 1863. Besides its dilapidated fortifications, and the townhouse, which was erected between 1730 and 1733 and is adorned with a statue of the historian Simon Stijl, the only noteworthy buildings are the Great or New church, the West church, which was formerly part of the castle, the Roman Catholic church, and the Jewish synagogue. The school of navigation and school of design may also be mentioned. Harlingen is the seat of the Frisian Navigation Company, and it has regular steam communication, not only with Amsterdam and Nieuwe Diep, but also with London and Hull. Besides an inner harbor protected from the high tides by powerful sluices, it has an outer harbor of modern construction for the accommodation of large vessels. One of the chief departments of its trade is the export to England of Frisian produce—corn, cattle, butter, cheese, and flax. Wharves, saw-mills, anchor forges, rope-yards, and a canvas factory represent the auxiliary industries of the place. In the middle of the last century, Harlingen had 7000 inhabitants, which increased in the course of the next hundred years to about 8000. In 1860, before the new harbor works, they numbered 9800, and in 1900 they were 10,800.

Originally Harlingen was only a part of the village of Almenum, and lay at some distance inland, but the Zuyder Zee, which had already in 1134 destroyed an intervening town, made another inroad in 1566 and attained its present limits. The Spanish lieutenant Caspar Robles de Belly, whose monument, the "Man of Stone," now stands on the sea-dyke, took care to protect the site of the town by further embankments. In 1579 it was surrounded by walls and fosses; a new castle had been built in 1502. During the civil broils of 1787 Harlingen was blockaded by the patriots of Franeker. In Novem-

[1] Thomas Ch. (1826–84), born in Barbadoes, Crimean War correspondent, Arabic professor in Oxford, editor of the *London Times*, and an Oriental scholar.—AM. ED.

ber, 1776, and February, 1825, it suffered from severe inundations.

HARMODIUS, a beautiful Athenian of the tribe Gephyræi, was the intimate friend of Aristogiton, a citizen of the middle rank. Hipparchus, younger brother of the tyrant Hippias, was also a lover of Harmodius. He tried to attract Harmodius to himself, and failing in the attempt, revenged himself by putting a public affront on his sister at a solemn festival. Thereupon the two friends conspired with a few others to murder both the tyrants during the armed procession at the Panathenaic festival (514 B. C.). But in a sudden alarm they prematurely attacked and slew Hipparchus alone. Harmodius was cut down on the spot by the guards, and Aristogiton was soon captured and tortured to death. When Hippias was expelled (510 B. C.), Harmodius and Aristogiton became the most popular of Athenian heroes; their statues were set up in the agora, their descendants were exempted from public burdens, and their names were celebrated in popular songs and scolia as the deliverers of fair Athens. Thucydides (vi. 54) alludes to the falseness of the popular belief about them, and gives the story in detail.

HARMONIA, wife of Cadmus. The Theban legends (see CADMUS) have been so modified and systematized by poets and logographers that we must look to Samothrace with its old religious rites for an explanation of the myth. There Harmonia is said to have been the daughter of Zeus and Electra, while her brother Iasion was the founder of the mystic rites which were celebrated annually on the island. When Cadmus came to Samothrace, and was initiated, he received Harmonia as his wife. The gods honored the wedding with their presence, Athene presented the bride with a peplus and necklace, Electra gave the mystic rites of the mother of the gods. According to the scholiast on Euripides (*Phœn.*, i.) Cadmus with the aid of Athene carried off Harmonia; and in the mysteries the lost Harmonia is regularly sought for. We have here an exact parallel to the Eleusinian legends. Electra and Harmonia are mere varieties of Demeter and Core. Cadmus like Pluto carries off the bright daughter of the goddess to the world below to spend there the dreary winter. Hence in the Theban tale Cadmus and Harmonia leave Thebes to go away among the Encheleis, the snake people, are themselves changed into serpents, and are finally translated to the Elysian fields. We then understand, too, why (according to Pausanias, ix. 16, 5) Cadmus dwelt at Thebes in the temple of Demeter Thesmophoros. The necklace, wrought by Hephæstus, which Harmonia received as a marriage gift, may be compared with the cestus of Aphrodite; for it is impossible to draw a fast line between Harmonia or Core and Aphrodite. Then it is seen to be the mythic representative of some phenomenon like the halo of dawn or the rainbow. Like the works of the German dwarfs, this necklace carried with it ill-luck, and the legends give it a history of woe. With it Polynices bribed Eriphyle to betray her husband Amphiaraus. It brought death at last to her son Alcmæon. Dedicated in the temple of Athene Pronoia at Delphi, it was given by the tyrant Phayllus (352 B. C.) to his mistress; her son going mad set fire to the house, and she perished in the conflagration.

HARMONICA is the technical name for the "musical glasses" with the learned conversation about which the pseudo-ladies from town astonish the simple-minded vicar of Wakefield. An instrument for producing musical sounds by means of drinking glasses touched with the moistened fingers was, however, known 100 years before Goldsmith's novel. What its exact nature may have been cannot now be ascertained, but its mode of playing must have been far from perfect; for as late as the middle of the 18th century the musical glasses played by Mr. Puckeridge were placed on a table and their pitch was fixed by the quantity of water they contained, naturally a very uncertain mode of determination. It was to this instrument that the great Benjamin Franklin applied his improvements described in his letter to Father Beccaria of Turin. Instead of fixing the glasses he made them rotate round a spindle set in motion by the player's foot by means of a treadle. The edge of the glasses by the same means passed through a basin of water, the pitch henceforth being determined by the size of the glasses alone. The player touched the brims of the revolving glasses with his finger, his task being further facilitated by the scale of color which Franklin adopted in accordance with the musical gamut. Thus C was red, D orange, E yellow, F green, G blue, A indigo, and B violet. The black keys of the piano were represented by white glasses. The instrument thus improved became very fashionable in England, and a Miss Davis, a relation of Franklin's, became a celebrated harmonica player, who performed at numerous concerts with great applause. It is interesting to know that the great composer Gluck was a virtuoso on the musical glasses in their earlier form, which he played, according to a contemporary advertisement, at the Haymarket Theatre, April 23, 1746. He even seems to have claimed the instrument as his own invention, and promises to "perform upon it whatever may be done on a violin or harpsichord." Nowadays the idea of a composer of repute—for such Gluck was at the time—playing on the musical glasses would appear grotesque. But the notions of artistic dignity were different in the 18th century. Many attempts have been made to increase the power and flexibility of the harmonica, and also to avoid the nervous irritability said to be caused by the friction of the vibrating glasses. Thus harmonicas played with the bow or by means of a keyboard, like that of the pianoforte, have been invented. But none of these has met with permanent success, and in all essential points the modern harmonica is such as Franklin left it.

HARMONIC ANALYSIS is the name given by Sir William Thomson and Professor Tait in their treatise on *Natural Philosophy* to a general method of investigating physical questions, the earliest applications of which seem to have been suggested by the study of the vibrations of strings and the analysis of these vibrations into their fundamental tone and its harmonics or overtones.

The motion of a uniform stretched string fixed at both ends is a periodic motion; that is to say, after a certain interval of time, called the fundamental period of the motion, the form of the string and the velocity of every part of it are the same as before, provided that the energy of the motion has not been sensibly dissipated during the period.

There are two distinct methods of investigating the motion of a uniform stretched string. One of these may be called the wave method, and the other the harmonic method. The wave method is founded on the theorem that in a stretched string of infinite length a wave of any form may be propagated in either direction with a certain velocity, V, which we may define as the "velocity of propagation." If a wave of any form travelling in the positive direction meets another travelling in the opposite direction, the form of which is such that the lines joining corresponding points of the two waves are all bisected in a fixed point in the line of the string, then the point of the string corresponding to this point will remain fixed, while the two waves pass it in opposite directions. If we now suppose that the form of the waves travelling in the positive direction is periodic, that is to say, that after the wave has travelled forward a distance l, the position of every particle of the string is the same as it was at first, then l is called the wave-length, and the time of travelling a wave-length is called the periodic time, which we shall denote by T, so that

$$l = \mathrm{V}\mathrm{T}.$$

If we now suppose a set of waves similar to these, but reversed in position, to be travelling in the opposite direction, there will be a series of points, distant $\frac{1}{2}l$ from each other, at which there will be no motion of the string; it will therefore make no difference to the motion of the string if we suppose the string fastened to fixed supports at any two of these points, and we may then suppose the parts of the string beyond these points to be removed, as it cannot affect the motion of the part which is between them. We have thus arrived at the case of a uniform string stretched between two fixed supports, and we conclude that the motion of the string may be completely represented as the resultant of two sets of periodic waves travelling in opposite directions, their wave-lengths being either twice the distance between the fixed points or a submultiple of this wave-length, and the form of these waves, subject to this condition, being perfectly arbitrary.

To make the problem a definite one, we may suppose the initial displacement and velocity of every particle of the string given in terms of its distance from one end of the string, and from these data it is easy to calculate the form which is common to all the travelling waves. The form of

the string at any subsequent time may then be deduced by calculating the positions of the two sets of waves at that time, and compounding their displacements.

Thus in the wave method the actual motion of the string is considered as the resultant of two wave motions, neither of which is of itself, and without the other, consistent with the condition that the ends of the string are fixed. Each of the wave motions is periodic with a wave-length equal to twice the distance between the fixed points, and the one set of waves is the reverse of the other in respect of displacement and velocity and direction of propagation; but, subject to these conditions, the form of the wave is perfectly arbitrary. The motion of a particle of the string, being determined by the two waves which pass over it in opposite directions, is of an equally arbitrary type.

In the harmonic method, on the other hand, the motion of the string is regarded as compounded of a series of vibratory motions which may be infinite in number, but each of which is perfectly definite in type, and is in fact a particular solution of the problem of the motion of a string with its ends fixed.

A simple harmonic motion is thus defined by Thomson and Tait (§ 53):—When a point Q moves uniformly in a circle, the perpendicular QP, drawn from its position at any instant to a fixed diameter AA′ of the circle, intersects the diameter in a point P whose position changes by a *simple harmonic motion.*

The amplitude of a simple harmonic motion is the range on one side or the other of the middle point of the course.

The period of a simple harmonic motion is the time which elapses from any instant until the moving-point again moves in the same direction through the same position.

The phase of a simple harmonic motion at any instant is the fraction of the whole period which has elapsed since the moving point last passed through its middle position in the positive direction.

In the case of the stretched string, it is only in certain particular cases that the motion of a particle of the string is a simple harmonic motion. In these particular cases the form of the string at any instant is that of a curve of sines having the line joining the fixed points for its axis, and passing through these two points, and therefore having for its wave-length either twice the length of the string or some submultiple of this wave-length. The amplitude of the curve of sines is a simple harmonic function of the time, the period being either the fundamental period or some submultiple of the fundamental period. Every one of these modes of vibration is dynamically possible by itself, and any number of them may coexist independently of each other.

By a proper adjustment of the initial amplitude and phase of each of these modes of vibration, so that their resultant shall represent the initial state of the string, we obtain a new representation of the whole motion of the string, in which it is seen to be the resultant of a series of simple harmonic vibrations whose periods are the fundamental period and its submultiples. The determination of the amplitudes and phases of the several simple harmonic vibrations so as to satisfy the initial conditions is an example of harmonic analysis.

We have thus two methods of solving the partial differential equation of the motion of a string. The first, which we have called the wave method, exhibits the solution in the form containing an arbitrary function, the nature of which must be determined from the initial conditions. The second, or harmonic method, leads to a series of terms involving sines, and cosines, the co-efficients of which have to be determined. The harmonic method may be defined in a more general manner as a method by which the solution of any actual problem may be obtained as the sum or resultant of a number of terms, each of which is a solution of a particular case of the problem. The nature of these particular cases is defined by the condition that any one of them must be conjugate to any other.

The mathematical test of conjugacy is that the energy of the system arising from two of the harmonics existing together is equal to the sum of the energy arising from the two harmonics taken separately. In other words, no part of the energy depends on the product of the amplitudes of two different harmonics. When two modes of motion of the same system are conjugate to each other, the existence of one of them does not affect the other.

The simplest case of harmonic analysis, that of which the treatment of the vibrating string is an example, is completely investigated in what is known as Fourier's theorem.

Fourier's theorem asserts that any periodic function of a single variable period p, which does not become infinite at any phase, can be expanded in the form of a series consisting of a constant term, together with a double series of terms, one set involving cosines and the other sines of multiples of the phase.

Thus if $\phi(\xi)$ is a periodic function of the variable ξ having a period p, then it may be expanded as follows:

$$\phi(\xi) = A_0 + \sum_1^\infty A_i \cos\frac{2i\pi\xi}{p} + \sum_1^\infty B_i \sin\frac{2i\pi\xi}{p}. \quad . \quad (1).$$

The part of the theorem which is most frequently required, and which also is the easiest to investigate, is the determination of the values of the co-efficients A_0, A_i, B_i. These are

$$A_0 = \frac{1}{p}\int_0^p \phi(\xi)\,d\xi;$$

$$A_i = \frac{2}{p}\int_0^p \phi(\xi)\cos\frac{2i\pi\xi}{p}\,d\xi;$$

$$B_i = \frac{2}{p}\int_0^p \phi(\xi)\sin\frac{2i\pi\xi}{p}\,d\xi.$$

This part of the theorem may be verified at once by multiplying both sides of (1) by $d\xi$, by $\cos\frac{2i\pi\xi}{p}\,d\xi$, or by $\sin\frac{2i\pi\xi}{p}\,d\xi$, and in each case integrating from 0 to p.

The series is evidently single-valued for any given value of ξ. It cannot therefore represent a function of ξ which has more than one value, or which becomes imaginary for any value of ξ. It is convergent, approaching to the true value of $\phi(\xi)$ for all values of ξ such that if ξ varies infinitesimally the function also varies infinitesimally.

Sir W. Thomson, availing himself of the disc, globe, and cylinder integrating machine invented by his brother, Professor James Thomson, has constructed a machine by which eight of the integrals required for the expression of Fourier's series can be obtained simultaneously from the recorded trace of any periodically variable quantity, such as the height of the tide, the temperature or pressure of the atmosphere, or the intensity of the different components of terrestrial magnetism. If it were not on account of the waste of time, instead of having a curve drawn by the action of the tide, and the curve afterwards acted on by the machine, the time axis of the machine itself might be driven by a clock, and the tide itself might work the second variable of the machine, but this would involve the constant presence of an expensive machine at every tidal station.

It would not be devoid of interest, had we opportunity for it, to trace the analogy between these mathematical and mechanical methods of harmonic analysis and the dynamical processes which go on when a compound ray of light is analyzed into its simple vibrations by a prism, when a particular overtone is selected from a complex tone by a resonator, and when the enormously complicated sound-wave of an orchestra, or even the discordant clamors of a crowd, are interpreted into intelligible music or language by the attentive listener, armed with the harp of three thousand strings, the resonance of which, as it hangs in the gateway of his ear, discriminates the multifold components of the waves of the aerial ocean. (J. C. M.)

HARMONIUM. Perhaps no musical instrument ever became in a few years so widely known and used as the harmonium. The reasons for this may at once be found in the facilities it offers for playing easy music, and, when simply constructed, its comparatively low price, which renders the purchase of a tolerable harmonium possible when the cheapest pianoforte fairly playable would be unattainable, and the real organ, although of chamber size, quite out of the question. Besides being a convenient makeshift for an organ, the harmonium can also be used in domestic concerted music, to play all or any of the wind band parts of the orchestra; it may even be employed as a substitute for the violin, and in such vicarious uses it is past all question one of the handiest of deputies.

It is true the tone of the harmonium is not in itself beautiful; the prominence in sounds from reeds of certain overtones is irreconcilable with pleasure to the ear unless by convention of habit, and the necessity of tuning according to equal temperament all major thirds too sharp leads through this harmonic peculiarity in the chords to an

abnormally disagreeable quality, from which those whose nerves are very sensitive or weak are not unfrequently painfully affected. The American organ, a kind of harmonium of late years much in vogue, owes its popularity to its being less pronounced and reedy in timbre (its softer tone being nearer to that we are familiar with in the church organ), and to its being easier to play for simple domestic use. Yet the real harmonium has more independent character as an instrument, and is capable of higher treatment in performance than the American organ.

Both are known as "free-reed" instruments, the musical tones being produced by tongues of brass, technically "vibrators," set in oblong frames; the sides of these they do not quite touch, but pass, when in movement, freely downwards,—the "beating reeds" used in church organs covering the entire orifice. A reed or vibrator, set in periodic motion by impact of a current of air, produces a corresponding succession of air puffs, the rapidity of which determines the pitch of the musical note. There is an essential difference between the harmonium and the American organ in the direction of this current; in the former the wind apparatus forces the current upwards, and in the latter sucks it downwards, whence it becomes desirable to separate in description these varieties of free-reed instruments.

The *Harmonium* has a keyboard of five octaves compass when complete, from C to C, and a simple action controlling the valves, etc. The necessary pressure of wind is generated by bellows worked by the feet of the performer upon footboards or treadles. The air is thus forced up the wind-trunks into an air-chamber called the wind-chest, the pressure of it being equalized by a reservoir, which receives the excess of wind through an aperture, and permits escape, when above a certain pressure, by a discharge valve or pallet. The aperture admitting air to the reservoir may be closed by a drawstop named "expression." The character of the instrument is then entirely changed from a mechanical response to the player's touch to an expressive one, rendering what emotion may be communicated from the player by increase or diminution of sound through the greater or less pressure of wind the reeds may be submitted to. The drawstops bearing the names of the different registers in imitation of the organ, admit, when drawn, the wind from the wind-chest to the corresponding reed compartments, shutting them off when closed. These compartments are of about two octaves and a half each, there being a division in the middle of the keyboard scale dividing the stops into bass and treble. A stop being drawn and a key pressed down wind is admitted by a corresponding valve to a reed or vibrator. Above each reed in the so-called sound-board or pan is a channel, a small air-chamber or cavity, the shape and capacity of which have greatly to do with the color of tone of the note it reinforces. The air in this resonator is highly compressed at an even or a varying pressure as the expression-stop may not be or may be drawn. The wind finally escapes by a small pallet-hole opened by pressing down the corresponding key. In Mustel and other good harmoniums, the reed compartments that form the scheme of the instrument are eight in number, four bass and four treble, of three different pitches of octave and double octave distance. The front bass and treble rows are the "diapason" of the pitch known as 8 feet, and the bourdon (double diapason), 16 feet. These may be regarded as the foundation stops, and are technically the front organ. The back organ has solo and combination stops, the principal of 4 feet (octave higher than diapason), and bassoon (bass) and oboe (treble), 8 feet. These may be mechanically combined by a stop called full organ. M. Mustel, the French maker, whose pre-eminence is universally acknowledged, has added other registers for much admired effects of tone, viz.,—"harpe éolienne," two bass rows of 2 feet pitch, the one tuned a beat too sharp, the other a beat too flat, to produce a waving tremulous tone that has a certain charm; "musette" and "voix celeste," 16 feet; and "baryton," a treble stop 32 feet, or two octaves lower than the normal note of the key. The "back organ" is usually covered by a swell box, containing louvres or shutters similar to a Venetian blind, and divided into fortes corresponding with the bass and treble division of the registers. The fortes are governed by knee pedals which act by pneumatic pressure. Tuning the reeds is effected by scraping them at the point to sharpen them, or near the shoulder or heel to flatten them in pitch. Air pressure affects the pitch but slightly, noticeable only in the larger reeds, and harmoniums long retain their tuning, a decided advantage over the organ and the pianoforte. Mechanical contrivances in the harmonium, of frequent or occasional employment, besides those already referred to, are the "percussion," a small pianoforte action of hammer and escapement which, acting upon the reeds of the diapason rows at the moment air is admitted to them, gives prompter response to the depression of the key, or quicker speech; the "double expression," a pneumatic balance in the wind reservoir of great delicacy, exactly maintaining by gradation equal pressure of the wind; and the "double touch," by which the back organ registers speak sooner than those of the front that are called upon by deeper pressure of the key, thus allow prominence or accentuation of certain parts by an expert performer. "Prolongement" permits selected notes to be sustained after the fingers have quitted their keys. Dawes's "melody attachment" is to give prominence to an air or treble part by shutting off in certain registers all notes below it. This notion has been adapted by inversion to a "pedal substitute" to strengthen the lowest bass notes. The "tremolo" affects the wind in the vicinity of the reeds by small bellows which increases the pulsation in rapidity according to pressure; and the "sourdine" diminishes the supply of wind by controlling its admission to the reeds.

The *American Organ*, as already said, acts by wind exhaustion. A vacuum is practically created in the air-chamber by the exhausting power of the footboards, and a current of air thus drawn downwards passes through any reeds that are left open, setting them in vibration. This instrument has therefore exhaust instead of force bellows. Valves in the board above the air-chamber give communication to reeds, made more slender than those of the harmonium and more or less bent, while the frames in which they are fixed are also differently shaped, being hollowed rather in spoon fashion. The channels, the resonators above the reeds, are not varied in size or shape as in the harmonium; they exactly correspond with the reeds, and are collectively known as the "tube-board." The swell "fortes" are in front of the openings of these tubes, rails that open or close by the action of the knees upon what may be called knee pedals. The tone of the American organ is softer than that of the harmonium; this is sometimes aided by the use of extra resonators, as, for instance, in Clough and Warren's latest instruments (of Detroit, Michigan, U. S.), which they call pipes or qualifying tubes. The blowing being also easier, ladies find it much less fatiguing. To these differences we may attribute its increasing popularity. The expression stop can have little power in the American organ, and is generally absent; the "automatic swell" in the instruments of Mason and Hamlin (of Boston, U. S.) is a contrivance that comes the nearest to it, though far inferior. By it a swell shutter or rail is kept in constant movement, proportioned to the force of the air-current. Another very clever improvement introduced by these makers, who are the originators of the instrument itself, is the "vox humana," a smaller rail or fan, made to revolve rapidly by wind pressure; its rotation, disturbing the air near the reeds, causes interferences of vibration that produce a tremulous effect, not unlike the beatings heard from combined voices, whence the name. This vibrato stop has found general adoption. The arrangement of reed compartments in American organs does not essentially differ from that of harmoniums; but there are often two keyboards, and then the solo and combination stops are found on the upper manual. The diapason treble register is known as "melodia"—different makers occasionally vary the use of fancy names for other stops. The "subbass," however, an octave of 16 feet pitch and always apart from the other reeds, is used with great advantage for pedal effects on the manual, the compass of American organs being usually down to F (FF, 5 octaves). In large instruments there are sometimes foot pedals as in an organ, with their own reed boxes of 8 and 16 feet, the lowest note being then CC. Blowing for pedal instruments has to be done by hand, a lever being attached for that purpose. The "celeste" stop is managed as in the harmonium, by rows of reeds tuned not quite in unison, or by a shade valve that alters the air-current and flattens one row of reeds thereby.

Harmoniums and American organs are the results of many experiments to play upon free reeds by a key-board, initiated by the "orgue expressif" of Grenié, a Frenchman. During nearly the first half of this century various tentative efforts in France and Germany, and subsequently in England, came to nothing more valuable than the Viennese "physharmonica" of Häckel, the Parisian "melophone," and our own "seraphine." The inventor of the harmonium was indubitably Alexandre Debain, who took out a patent for it in Paris in 1840. He produced varied timbre registers by modifying reed channels, and brought these registers on to one keyboard. Unfortunately he patented too much, for he secured even the name harmonium, obliging contemporary and future experimenters to shelter their improvements under other names, and the venerable name of organ becoming impressed into connection with an inferior instrument, we have now to distinguish between reed and pipe organs. The compromise of reed organ for the harmonium class of instruments must therefore be accepted. Debain's harmonium was at first quite mechanical; it gained expression by the expression-stop already described. The

Alexandres, well-known French makers, by the ingenuity of one of their workmen, Martin, added the percussion and the prolongement. The melody attachment was the invention of an English engineer; the introduction of the double touch now used in the harmoniums of Mustel, Bauer, and others—also in American organs—is due to Mr. Tamplin, an English professor. Reference has already been made to the improvements of M. Mustel, a maker imbued with true artistic devotion.

The principle of the American organ originated with the Alexandres, whose earliest experiments are said to have been made with the view of constructing an instrument to exhaust air. The realization of the idea proving to be more in consonance with the genius of the American people, to whom what we may call the devotional tone of the instrument appealed, the introduction of it by Messrs. Mason and Hamlin in 1861 was followed by remarkable success. They made it generally known in Europe by exhibiting it at Paris in 1867, and from that time instruments have been exported in large numbers by different makers. Harmoniums are not entirely, although chiefly, of French make. Mr. Bauer, one of the best English makers, learned the trade in Paris, and employs chiefly French workmen. As keyed instruments, reed organs of either principle cannot be expected to compete musically with the older organ and pianoforte, yet the harmonium, studied for itself with something like the devotion that is given to the other keyed instruments, might be made more important than it is at present. Excepting from a few isolated students who may be told upon the fingers, it has received no true cultivation. Whether it will ever get this is a question that remains to be answered. Commercially the harmonium and American organ have taken a much more important place, although of course one not equal to that of the pianoforte. For some years the Alexandres were sending annually 7000 harmoniums to England. This afterwards, from various causes, diminished; the number, however, of their instruments made up to 1879 has reached 110,000. A general estimate of harmoniums made annually in France, Germany, and England is not forthcoming; but the yearly production of American organs in the United States has been stated at the large total of 40,000. (A. J. H.)

HARMONY. See Acoustics and Music.

HARO, said to be the ancient *Castrum Bilium*, a town of Spain, is situated in the province of Logroño, and the bishopric of Calahorra, 12 miles S. E. of Miranda, and 58 miles N. of Madrid. It occupies a beautiful site near the Ebro, in a fertile plain, bounded by a range of mountains. The town contains a fine parish church, a theatre built in 1841, a hospital, and other public buildings. Various unimportant manufactures are carried on by the inhabitants; but the chief source of wealth is the red wine produced in great abundance from the vines of the surrounding plain. There are some copper-mines in the neighborhood. Haro was the birthplace of Diego de Leyva, the celebrated painter, about 1580. The population was estimated for 1900 at 7,900.

HAROLD I., surnamed Fairhaired (Harald Haarfager), the founder of the old royal dynasty of Norway, succeeded his father, Halfdan the Black, as jarl about the year 863. His ambition to become king is said to have been awakened by the refusal of Gyda, daughter of Eric of Hadaland, to marry him until he had made himself ruler of all Norway, as Gorm had of Denmark, and Eric of Sweden; and he vowed that he would never clip nor comb his hair until he had fully achieved his task. After he had subdued all the jarls, he sent for Gyda and made her one of his wives, and had his hair cut at a feast in Möre by Jarl Rögnwald, who then gave him the name of *Haarfager*. During the wars of Harold with the jarls many of the Norsemen left their country and settled in Iceland, the Faroe Islands, the Orkney and Shetland Islands, and even in the Hebrides of Scotland, from whence they returned and committed many sea robberies in Norway. Harold therefore fitted out a great expedition, conquered and slew the vikings, and made himself ruler over all these Norse settlements. During his absence on another expedition against Jarl Einar of Orkney his sons made war on one another, and also committed many acts of violence against his jarls. Accordingly on his return, finding it difficult to keep them in check, Harold resolved to give them separate provinces to govern, and about the year 893 called together a great "thing," at which he conferred on each the title of king, with a seat higher than that of the jarls, he himself retaining the sovereignty of the whole country. He also made Eric Bloodyaxe his heir, and took him to live with him; and about his eightieth year, when he found himself no longer able to discharge his kingly duties, he transferred the whole government to Eric and gave him the royal seat. Harold died three years afterwards about the year 933.

HAROLD II., surnamed Grayskin (Harald Graafel), son of Eric Bloodyaxe, succeeded Haco the Good in the government of Norway about the year 960, having bribed his other brothers to be satisfied with reigning as under kings in the other provinces. It would appear that Harold himself was disposed to govern peacefully and well, but his brothers now resolved to take vengeance on the friends of the late King Haco, and murdered among others Jarl Sigurd. They, however, failed of their purpose on Haco, his son, who after for some time resisting their attacks fled to Denmark, where he obtained the assistance of King Harold Bluetooth, with whose help he defeated and slew Harold Grayskin, upon which, under Harold Bluetooth, he became ruler of Norway with the title of jarl, according to some in the year 965, to others in 969, and to others in 975.

HAROLD III., surnamed Stern in Council (Harald Haardraade or Hardrada), son of Jarl Sigurd, half-brother of King Olaf the Holy, and descended by his father from Harold I., was one of the most distinguished warriors among the old Norse kings. About his fifteenth year he made his escape wounded from the battle of Stiklestad (1030), where his half-brother Olaf was killed; and after staying till he was cured of his wounds with a "bonde" in a forest, he made his way to Sweden, whence after the winter was over he went to Russia, where he was kindly received by King Yaroslaf of Novgorod. He remained in Russia for several years, but, being refused the hand of a Russian princess, he betook himself with several companions to Constantinople, and became chief commander of the famous Byzantine life-guards known as Varangians, and consisting almost wholly of Norsemen. At the head of these warriors he gained many victories over the Saracens in Sicily and Italy. It is even said that in a crusade against the infidels he penetrated as far as Jerusalem, but most probably if he entered that city it was in the peaceful character of a pilgrim. Returning after his exploits to Constantinople, he was refused the hand of a niece of the empress Zoe, because, according to the legend, the empress herself was enamored of him; and offended at the refusal he one night made his escape with two galleys, carrying with him all his treasures, and also it is said the princess whose hand had been denied him, whom, however, he put on shore after he had passed the Bosphorus, with a message to the empress that, if he had so willed, her power would have been vain against his strategy and skill. He now set sail for Russia, where he was warmly welcomed by King Yaroslaf; and as he was now a man of great fame and wealth Yaroslaf gave him in marriage his daughter Ellisof or Elizabeth, whose hand he had formerly asked in vain. Soon after his marriage he resolved to return home and if possible to win the crown of Norway from his nephew Magnus the Good. With that purpose he about the year 1045 came to an agreement with his relative Swend of Denmark, who had been driven by Magnus into exile in Sweden; but Magnus, having obtained news of the intended joint expedition against him, entered into communication with Harold, and agreed to share with him the government of Norway, each ruling over a separate division. They now turned their united forces against Swend, drove him from Denmark, and completely prostrated his power; but just when he had resolved finally in despair to give up the contest, Magnus about the year 1047 took suddenly ill and died, bequeathing on his death-bed the whole of Norway to Harold and Denmark to Swend. Such a bequest did not however coincide with the desires of Harold, and between him and Swend a constant warfare raged for several years, until in 1064 they agreed to a peace by which each retained his dominions according to the old established boundaries. The chief motive of Harold in consenting to this arrangement was probably that he might be free to embark on a purpose of wider ambition, namely, to revive in his own person the old Scandinavian sovereignty of England which had ended with the death of Hardicanute. The story goes that he was instigated to the enterprise by a visit from Tostig, the exiled earl of Northumbria; but whether that be so or not, he in 1066

set sail for England with an immense fleet, which carried his wife Ellisof, his son Olaf, his treasures, and more than half of all his fighting men. After touching at Orkney, where he left his wife, he proceeded southwards to the Tyne, and was there joined by Tostig and by a contingent of troops from Malcolm of Scotland. From the Tyne they sailed southwards along the cost of Yorkshire, stopping at intervals to ravage the country for provisions, and after proceeding up the Humber cast anchor on the left bank of the Ouse near the village of Riccall. Leaving a detachment under his son Olaf to guard the fleet, Harold along with Tostig marched with a great force towards York, and, defeating the Northumbrians with heavy loss at Fulford on September 20th, received the surrender of the city on September 24th. Meanwhile Harold of England, having heard of the Norse invasion, was marching northwards from London day and night with an immense army; and passing through York on the day after its surrender, he appeared suddenly on the afternoon before the Norsemen encamped at Stamfordbridge. Taken by surprise, the Norsemen fought nevertheless with stubborn courage and fierce energy, but though the battle was for some time doubtful it ended at nightfall in their total overthrow, with a slaughter so enormous that the great majority of them lay dead upon the field. Tostig was slain and also Harold Hardrada himself, who, towering head and shoulders above all his warriors, was inflicting death on all who dared to meet him, till struck by an arrow in the windpipe he received the wound which laid him low. According to some writers his body ultimately found burial in Norway.

HAROLD IV., king of Norway, surnamed Gille,—said to be the short form of Gylle Kirst, that is, Servant of Christ,—came about the year 1127 to Norway with his mother, an Irishwoman, and claimed to be recognized as the son of King Magnus Barefoot and half-brother of the reigning Sigurd. Sigurd consented to acknowledge the relationship on condition that Harold did not claim any share in the government during his lifetime or that of his son Magnus. This agreement Harold honorably kept during the lifetime of Sigurd, but after his death in 1130 he got himself chosen king of the half of the country, and after several battles took Magnus prisoner, put out his eyes, and confined him in a convent. Harold now reigned as sole king till 1136, when he was murdered in his sleep by Slembi-diakn, another bastard son of Magnus Barefoot.

For the Norwegian Harolds, see the *Heimskringla* of Snorro Sturleson, translated into English by Samuel Laing, London, 1844; *Sturlunga Saga*, 2 vols., Oxford, 1878; Carlyle's *Early Kings of Norway*, London, 1875; and also, for Harold Hardrada, Freeman's *Norman Conquest*, vols. ii. and iii.

HAROLD I., surnamed Harefoot, king of England, illegitimate son of Canute and Alfgiva[1] of Northampton, was on the death of Canute in 1035 chosen by the witan overlord of England and king of the provinces north of the Thames; and in 1037 he became king of England, when the people of Wessex offered him their crown on Hardicanute refusing to come to England to accept it. In the beginning of Harold's reign Alfred, son of Ethelred, landed in Wessex, with the purpose it is said of asserting his claims to its sovereignty; but, either without the knowledge of Earl Godwine, or with his connivance, he was seized by the agents of Harold and put to death with cruel tortures. Harold also banished Queen Emma from the kingdom. The only other events of importance in his reign are inroads of the Welsh and Scots, which were, however, without effectual results, and in the case of the Scots who laid siege to Durham ended in defeat with heavy loss. Harold died at Oxford, March 10, 1040. It is affirmed by some that Harold made no pretensions to a Christian belief, but this seems an exaggeration, for, whatever may have been his own private opinions, he appears to have conformed generally to the recognized religious customs, and there is one instance at least in which he redressed a wrong done by others to the church.

HAROLD II., king of the English, was the second son of Earl Godwine and his Danish wife Gytha, the sister of Earl Ulf. The year of his birth is not accurately fixed, but it must have been about 1022. The choice of his name, like that of some others of his brothers and sisters (see GODWINE), witnesses to the influence of his Danish mother. Both he and his elder brother Swegen were appointed to earldoms while still very young, seemingly about 1045. Harold's earldom was that of the East-Angles. In 1046 Swegen, having carried off Eadgifu, abbess of Leominster, and not being allowed to marry her, threw up his earldom in disgust, and his possessions were divided between his brother Harold and his cousin Earl Beorn, the nephew of Gytha. In 1049 Swegen came back and sought the recovery of his lands, which was refused by Harold and Beorn. Harold now appears for the first time in command, holding a ship in the fleet commanded by his father. For some unknown cause his ship was transferred to Beorn, which most likely saved Harold's life; for Swegen presently came and entrapped and slew Beorn, who was buried by Harold. We next hear of Harold in 1051 as accompanying Godwine when he appeared in arms in Gloucestershire. He shared his father's outlawry and banishment in that year, but he chose a different place of shelter, going with his brother Leofwine to Ireland, while Godwine went to Flanders. In 1052 Harold and Leofwine came back. They were opposed by the men of Somerset and Devonshire, whom they defeated at Porlock, and plundered the country. Then they joined their father, and were with him at the assembly which decreed the restoration of the whole family. Harold was now restored to his earldom of the East-Angles, and, on his father's death in 1053, he succeeded him in the greater earldom of the West-Saxons.

Harold was now the chief man in the kingdom, and when the older earls Leofric and Siward died, his power increased yet more, and the latter part of Eadward's reign was virtually the reign of Harold. But he was the minister of the king rather than his personal favorite. This last place rather belonged to his younger brother Tostig, who on the death of Siward in 1055 received the earldom of the Northumbrians. Two other of Godwine's younger sons, Gyrth and Leofwine, also received earldoms in 1057. This last date would seem to have been about the time when the prospect of the crown began to open to Harold. The Ætheling Eadward, the son of Eadmund Ironside, who had been brought home from Hungary as the intended successor, died that year. So did Eadward's nephew Ralph, who, though not really of the kingly house, might possibly have been looked to for lack of a nearer candidate. There was now no one of the old stock but Eadgar son of Eadward and his sisters. If then the king should die while Eadgar was still a child, there would be no qualified candidate in the royal house. It would seem as if, from this time, men began to look to Earl Harold as a possible successor to the crown. He is spoken of in a way, and his name is joined with that of the king in a way, which is unusual in the case of an ordinary earl.

The chief events in which Harold appears personally during this time are the wars with the Welsh under their king Gruffydd ap Llywelyn. In 1055, in alliance with the banished Earl Ælfgar of Mercia, Gruffydd defeated Earl Ralph and burned Hereford. Harold now drove back the Welsh and restored Hereford, but allowed the restoration of Ælfgar to his earldom. In 1058 he made the pilgrimage to Rome; in 1060 he completed the building of his church, at Waltham, and completed the foundation of the college in 1062. In 1063 came the great Welsh war, in which Harold, with the help of his brother Tostig, crushed the power of Gruffydd, who was killed by his own people. Harold now gave Wales to two vassal kings, Bleddyn and Rhiwallon. Both of his wars were accompanied by an extension of the English frontier towards Wales. In 1065 the Northumbrians revolted against their earl Tostig, and chose in his place Morkere, the son of Ælfgar. Harold now acted as mediator between the king and the insurgents, and at last, as the Northumbrians were fully prepared not to receive Tostig again, he agreed to their choice of Morkere and to the banishment of his brother.

Besides these there is one very important event in Harold's life the date of which can only be guessed at. At some time or other between William's visit to England in 1051 and Eadward's death at the beginning of 1066, Harold was the guest of Duke William in Normandy, and took some kind of oath to him. This oath the Normans represented as an act of homage, with a further oath to procure William's succession to the English crown. The tale is told only by the Norman writers, and it is told by them with such contradictions of every kind that no reliance can be placed on any detail. But that there is some truth in the story is proved by the strongest negative evidence. While the contemporary English writers take care, directly or indirectly,

[1] [She was, *more Danico*, a lawful wife, a Cnut, and the question was not of legitimacy, but of marriage compact with Emma.—AM. ED.]

to deny all those Norman charges against Harold which were sheer invention, they say not a word as to his alleged oath to William. It seems on the whole most likely that Harold was wrecked on the shore of Ponthieu, imprisoned by its Count Guy, and released by the interference of William. He then helped William in a war with the Bretons, and promised to marry one of his daughters. This was most likely accompanied by an act of homage, such as was often made to any superior or benefactor. Such an oath might, in the ideas of the times, be made to mean a great deal or very little, according to circumstances. The most likely date is 1064. But there is a remarkable statement that Harold took a journey in Gaul with a political object, seemingly that of making alliances with some of the princes of the country, most likely William's enemies in France, Anjou, and Aquitaine. This was in the year of his Roman pilgrimage. And, as there is no direct evidence for the date of the oath, it is open to any one to put the two things together.

At the beginning of 1066 Eadward died. His last act was to recommend Harold for election to the crown. He was accordingly chosen on the day of Eadward's death, January 5th, and crowned the next day by Ealdred, archbishop of York. But, though he was crowned by the Northumbrian primate, the men of Northumberland at first refused to acknowledge him. They were won over by the new king, who went to York accompanied by Saint Wulfstan, bishop of Worcester. To secure Eadwine and Morkere, he married their sister Ealdgyth, the widow of the Welsh king Gruffydd. He thus put it out of his power to comply with that part of his engagement to William which is best attested, namely, to marry one of William's daughters. The rest of Harold's reign was taken up with preparations against the attacks of two enemies at once. William challenged the crown, alleging both a bequest of Eadward in his favor and the personal engagement which Harold had contracted towards him. This was of course a mere matter of form, and William began to make ready for the invasion of England. Meanwhile the banished Tostig was trying all means to bring about his own restoration. He first, seemingly in concert with William, came in May, and attacked first the Isle of Wight and then Lindesey, but was driven to take shelter in Scotland. From May to September the king kept the coasts with a great force by sea and land; but at last provisions failed, and the land army was dispersed. Harold then went to London, ready to meet whichever enemy came first. By this time Tostig had engaged Harold Hardrada of Norway to invade England. He accordingly sailed up the Humber, defeated Eadwine and Morkere (September 20th), and received the submission of York (September 24th). Harold of England was now on his march northward; on September 25th he came on the Northmen at Stamfordbridge beyond York, and won a complete victory, in which Tostig and Harold Hardrada were slain. But two days later (September 27th) William of Normandy landed at Pevensey and (September 29th) occupied Hastings, and laid waste the land. Harold had then to march southward as fast as possible. He gathered his army in London from all southern and eastern England, but Eadwine and Morkere kept back the forces of the north. The king then marched into Sussex, occupied the hill of Senlac, now Battle, and awaited the Norman attack. After a vain exchange of messages, the decisive battle was fought on October 14th. As the English were wholly infantry, while the Normans were strongest in cavalry and archers, Harold's object was simply to hold the hill against all attack. As long as he was obeyed, his tactics were completely successful. But a part of his troops, disobeying his orders, left the hill to pursue, and the English array was broken. The Normans could now get up the hill, and, after a fight which lasted from morning till evening, they had the victory. The king and his brothers Gyrth and Leofwine were killed. As Harold was condemned by the pope, William at first refused him Christian burial, and caused him to be buried on the rocks at Hastings. But it seems most likely that he afterwards allowed the body to be removed to Harold's own church at Waltham. The tale which represents Harold as escaping from the battle, living a life of penitence, and at last dying at Chester, is a mere romance.

Harold left several children, but there is a good deal of uncertainty as to his marriage or marriages. He had two sons by Ealdgyth, Harold and Wulf; but they must have been twins born after their father's death. He had also three sons, Godwine, Eadmund, and Magnus, and two daughters, Gytha and Gunhild. It will be seen how strong the Scandinavian element is in these names. These five were not children of Ealdgyth, and the sons were grown up, or nearly so, when their father died. They may have been the children of an unrecorded first wife. But the local history of Waltham represented Harold's body as being found after the battle by a former mistress of his, Eadgyth Swanneshals (Swansneck). Some have thought that this Eadgyth is the "Eddeva pulcra" of Domesday, who appears as the former holder of great estates in the east of England. This, though not unlikely, is quite uncertain; but there seems evidence enough to show that Eadgyth Swanneshals is a real person, and to connect her with Harold's East-Anglian earldom. It seems most likely that she was the mother of Harold's earlier children, and that the connection between them was that intermediate state between marriage and concubinage called the Danish marriage, of which we not uncommonly hear in those days.

The character of Harold is blackened with many, but mostly very vague, charges by the Norman writers. The English, on the other hand, paint him as the perfect model of a ruler. With regard to his accession to the crown, the common charge of usurpation springs from ignorance of the English law of the time. Harold was beyond all doubt regularly nominated by Eadward, regularly chosen by the witan, and regularly crowned by Ealdred. This last point is of importance in those days, when the rite of coronation was deemed of such moment. The Normans try to represent the ceremony as invalid, by saying that Harold was crowned by Stigand, archbishop of Canterbury, whose canonical position was doubtful. That Harold crowned himself, instead of receiving the ecclesiastical consecration, is a mere fable, arising from a misunderstanding of some of the rhetorical invectives of the Norman writers. It should be noticed that those contemporary writers who speak of Harold as an usurper do so wholly on the ground of the alleged right of William, and of Harold's oath to William. That Harold's accession was a wrong done to young Eadgar is an idea which we first hear of in the next century, when the doctrine of hereditary right had taken firmer root. In Domesday the reign of Harold is passed by; he is regularly spoken of as earl; the doctrine of the Norman lawyers was that William, though of course not full king till his coronation, had the sole right to the crown from the moment of Eadward's death.

The military skill of Harold is plain, both from the Welsh war, when he overcame the mountaineers by making his English soldiers adopt the Welsh tactics, and from his conduct both at Stamfordbridge and at Senlac. He clearly understood the difference between his two enemies, when it was wise to attack and when it was wise to await the attack. At Stamfordbridge his strategy was perfectly successful; it failed at Senlac only because of the disobedience of part of his army. The best witness to his civil government is the general peace and good order of England during that part of the reign of Eadward which was virtually his reign. When the peace is broken, it is always by the act of others, and Harold is always called on to make the settlement. He appears throughout as singularly mild and conciliating, never pressing hard upon any enemy. The later Norman writers indeed have an elaborate tale which represents Harold and Tostig as enemies from their childhood. But this is mere romance, with no ground in any contemporary writer.

The relations of Harold to the church, always an important feature in the character of a prince of that age, suggest several questions. He is charged in Domesday with several encroachments on ecclesiastical property, chiefly in Herefordshire, and the like charge is brought against him in a deed of Leofric, bishop of Exeter. But it must be remembered that this kind of charge is brought against every leading man of the time, and that we very seldom hear more than one side. The most distinct and detailed charge, that which represents Harold as a wholesale spoiler of the church of Wells, can be refuted, not by hearing the other side, but by going back to the charge as brought by the original complainant, Bishop Gisa. We here find that Harold took nothing from the church, but simply hindered the bishopric from receiving a bequest to which there is some reason for thinking that he may have had a right as earl. On the other hand, Harold appears as the

friend and protector of several ecclesiastical bodies, and above all as the founder of Waltham. Here we may remark that, when monks were all the fashion, he preferred the secular clergy. He was the firm friend of the best prelate of his time, Bishop Wulfstan, and he appeared on good terms with most of the leading churchmen.

The contemporary authorities are the English Chronicles, the Latin biographer of Eadward in Dr. Luard's collection (he gives a splendid panegyric on Harold), and Florence of Worcester, on the English side. On the Norman side are the Bayeux Tapestry, William of Poitiers, William of Jumiéges, Guy of Amiens (*Carmen de Bello Hastingensi*). In the next century the book *De Inventione Sanctæ Crucis Walthamensis* gives Harold's picture as drawn in his own foundation. The book called *Vita Haroldi* is a mere romance, but contains one or two scraps of authentic tradition; Orderic, Eadmer, William of Malmesbury, and the writers of the 12th century generally, often prove particular facts, and especially show how the estimate of the events of the 11th century gradually changed. The French life of Eadward in the 13th is very bitter against Harold. Of the Scandinavian writers, Saxo Grammaticus is violent against him, while the biographer of Olaf Tryggvesson counts him for a saint. All the statements are brought together and examined in Freeman's *History of the Norman Conquest*, vols. ii. and iii. The opposite pictures of the earlier writers, Thierry and Palgrave, are also worth comparing. (E. A. F.)

HAROUN AL RASCHID, more properly Harún er Rashíd, "Aaron the Orthodox," was the fifth of the Abbaside caliphs of Bagdad. His full name was Harún 'bn Mohammed ibn Abdallah ibn Mohammed ibn Ali 'bn 'Abdallah ibn Abbás. He was born at Ray the last day of Dhi 'l Heggah, 145 A.H. (20th March, 763 A.D.), according to some accounts, and according to others 1st Moharrem 149 A.H. (15th Feb., 766 A.D.). Haroun al Raschid was twenty-two years old when he ascended the throne. His biographers unanimously speak of him as "the most accomplished, eloquent, and generous of the caliphs;" but, though his name is a household word, and few figures stand out more grandly prominent in the history of their times, little is really popularly known about his private life and personal history.

Raschid owed his own succession to the throne entirely to the prudence and sagacity of Yahya 'bn Khálid ibn Barmek, his secretary,[1] whom, on his accession, he appointed his lieutenant and grand vizier. Yahya, upon whom the whole responsibility of the government really devolved, performed his duties with the most consummate ability and judgment. He fortified the frontiers, and repaired all the deficiencies in the administration of the empire. He filled the treasury, made the provinces flourishing and prosperous by encouraging trade and securing the public safety, and in a word brought the caliphate up to the highest pitch of prosperity and glory. He personally superintended and organized the whole system of government. As a minister he was eloquent, wise, accomplished and prudent, and he was moreover an able administrator, ruling with a firm hand and proving himself able to cope with any emergency that might arise. His generosity was munificent in the extreme and gained for him universal encomiums. With a most affable demeanor and great moderation he combined an imposing dignity that commanded universal respect.

In 182 A.H. (798 A.D.) Al Raschid proclaimed his son 'Abdallah as his heir apparent after El Amín, his eldest son, whom he had appointed his successor when only five years old, and gave him the post of viceroy of Khorassan. It was on this occasion that he gave 'Abdallah the name of El Mamún and confided him to the care of Jaafer son of Yahya. The historians speak of this act of Raschid's with natural surprise, for he had seen the results of similar policy on the part of his father and of his grandfather, as well as what his brother Hádi had done in his own case.

Yahya, the prime minister, and Jaafer, his son, enjoyed so fully the confidence of Haroun al Raschid that they rapidly rose to wealth and power. The great popularity and influence of the Barmek or Barmecide family, however, at length aroused the caliph's jealousy, and to make matters worse he heard that Jaafer had secretly married his sister. No sooner had he been made acquainted with the facts than he caused his sister to be put to death, ordered Mesrúr, his slave and executioner, to bring him Jaafer's head, and next murdered his two inoffending young nephews.

After the fall of the Barmek family the office of prime minister was exercised by Fadhl ibn Rabi' who had been chamberlain to Haroun himself, and to his predecessors Mensúr, Mehdí, and Hádi. He held the office of vizier until the death of Haroun al Raschid himself, which occurred at Tus, the birthplace of the celebrated Persian epic poet Firdousi. Al Raschid had set out for Khorassan to put down the insurrection of Rafí' ibn Leith ibn Nasr ibn Sayyar, who had revolted against his authority, made himself master of Samarcand, and killed the governor of that province. The rising had assumed such alarming proportions that Al Raschid determined to march in person against the rebels. He had not, however, got further than Tus when he was surprised by death in 193 A.H. (808–9 A.D.).

The reign of Al Raschid was one of the most brilliant in the annals of the caliphate, and the limits of the empire were then more widely extended than at any other period. The greater part of the Eastern world submitted to his laws, and paid tribute into his treasury; Egypt itself was only a province under his sway, and its ruler an officer appointed by himself. No caliph ever gathered round him so great a number of learned men, poets, jurists, grammarians, cadis, and scribes, to say nothing of the wits and musicians who enjoyed his patronage. Haroun himself was an accomplished scholar and an excellent poet. He was well versed in history, tradition, and poetry, which he could always quote on appropriate occasions. He possessed exquisite taste and unerring discernment, and his dignified demeanor made him an object of profound respect to high and low.

Haroun al Raschid is best known to Western readers as the hero of many of the stories in the *Arabian Nights*; and in Arabic literature he is the central figure of numberless anecdotes and humorous stories. Of his incognito walks through Baghdad, however, the authentic histories say nothing; and the account of his relations with Charlemagne, of which European historians speak, does not rest on a trustworthy basis. His reign is chiefly remarkable for the fact that a family belonging to the pure Persian aristocracy held for so long the reins of power under a caliph whose boast was that he was the only one who came of unmixed Hashimi blood, that of the family from which the prophet of El Islam sprung.

The principal authorities for the history of this period are—the Arabic histories of Ibn El Athir, Ibn Khaldún, and the Tarikh El Khamis; while the best European works to consult on the subject are Gibbon's *Decline and Fall of the Roman Empire*; Osborn's *Islam under the Caliphs of Bagdad*; and Weil's *Geschichte der Chalifen*. (E. H. P.)

HARP, a musical instrument of the string kind, approximating to triangular form from the strings diminishing in length as they ascend in pitch. While the instrument is of great antiquity, it is yet from northern Europe that the modern harp and its name are derived. The Greeks and Romans preferred to it the lyre in its different varieties, and a Latin writer, Fortunatus (vii. 8), describes it in the seventh century of our era as an instrument of the barbarians—"Romanusque lyra, plaudat tibi barbarus harpa."

[1] According to the Mahometan law of succession the eldest brother or male relative of the reigning monarch is the heir apparent to the throne, and almost all Muslim princes have endeavored to set aside the claims of their relatives in favor of their own children. El Hádi, Haroun's brother, was no exception to the rule, and conceived the idea of stripping Haroun of his rights and proclaiming his own son Jaafer as his successor. Yahya was then Haroun's secretary, and expected to exercise the important office of vizier if ever his master should mount the throne. Hádi saw that his first step must be to conciliate Yahya; he therefore took him apart, and having given him a present of 20,000 dinars began to broach the subject nearest his heart. Yahya, however, brought a very strong argument to bear upon the point: "If you do so, Prince of the Faithful," said he, "you will set your subjects an example of breaking an oath and disregarding a contract, and other people will be bold enough to do the same. But if you leave your brother Haroun in possession of his title of heir apparent and appoint your son Jaafer as next in succession to him, it will be much more likely to secure his ultimate accession to the throne." Hádi allowed the matter to rest for some time, but at length paternal affection got the better of him, and he again summoned Yahya into his presence and consulted him, and Yahya urged that if the caliph should die while Jaafer was yet a child the chiefs of the imperial family would never recognize the validity of his succession. Hádi having acknowledged the truth of this, Yahya continued, "Renounce then this project, in order the better to arrive at the consummation of your wishes. Even if your father El Mehdi had not appointed Haroun to succeed you it would be policy on your part to do so, inasmuch as that is the only way to ensure the continuance of the caliphate in the family of the Beni Hashem." Raschid ever afterwards acknowledged this as the greatest obligation which he owed to Yahya.

This is believed to be the earliest mention of the name, which is clearly Teutonic,—the Old High German "harapha," the Anglo-Saxon "hearpe," the Old Norse "harpa." The modern French "harpe" retains the aspirate; in the Spanish and Italian "arpa" it is dropped.

For the origin of the instrument we have to look to Egypt, and the earliest delineations of it there give no indication that it had not existed long before. There are, indeed, representations in Egyptian paintings of stringed instruments of a bow-form that support the idea of the invention of the harp from the tense string of the warrior's or hunter's bow. This primitive-looking instrument was played horizontally, being borne upon the performer's shoulder. Between it and the grand vertical harps in the frescos of the time of Rameses III., more than 3000 years old, paintings discovered by the traveller Bruce (fig. 1), there are varieties that permit us to bind the whole, from the simplest bow-form to the almost triangular harp, into one family (see fig. 2).

The Egyptian harp had no front pillar, and, it being strung with catgut, the tension and pitch must necessarily have been low. The harps above-mentioned depicted in the tomb at Thebes, assumed from the players to be more

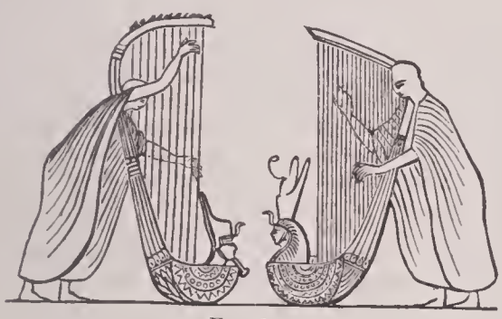


Fig. 1.

than 6 feet high, have not many strings, the one, according to Wilkinson, having ten, the other thirteen. What the accordance was of these strings it would be to no satisfaction to follow Burney and others in trying to recover. We must be content with the knowledge that the old Egyptians possessed harps in principle like our own, the largest having pedestals upon which they bestowed a wealth of decoration, as if to show how much they prized them.

The ancient Assyrians had harps like those of Egypt in being without a front pillar, but differing from them in having the sound-body uppermost, in which we find the early use of soundholes; while the lower portion was a bar to which the strings were tied and by means of which the tuning was apparently effected. What the Hebrew harp

Fig. 2.

was, whether it followed the Egyptian or the Assyrian, we do not know. That King David played upon the harp as commonly depicted is rather a modern idea. Mediæval artists frequently gave King David the psaltery, a horizontal stringed instrument from which has gradually developed the modern piano. The Hebrew "kinnor" may have been a kind of trigonon, a triangular stringed instrument between a small harp and a psaltery, probably sounded by a plectrum, or, as advocated by Dr. Stainer in his essay on the music of the Bible, a kind of lyre.

The earliest records that we possess of the Celtic race, whether Gaelic or Cymric, give the harp a prominent place and harpists peculiar veneration and distinction. The names for the harp are, however, quite different from the Teutonic. The Irish "clairseach," the Highland Scotch "clarsach," the Welsh, Cornish, Breton, "telyn," "telein," "télen," show no etymological kinship to the other European names. The first syllable in clairseach or clarsach is derived from the Gaelic "clar," a board or table (sound-board), while the first syllable of telyn is distinctly Old Welsh, and has a tensile meaning; thus resonance supplies the one idea, tension the other.

The literature of these Celtic harps may be most directly found in Bunting's *Ancient Music of Ireland*, Dublin, 1840; Gunn's *Historical Enquiry respecting the Performance on the Harp in the Highlands of Scotland*, Edinburgh, 1807; and E. Jones's *Musical and Poetical Memoirs of the Welsh Bards*, London, 1784. The treatises of Walker, Dalyell, and others may also be consulted; but in all these authorities due care must be taken of the bias of patriotism, and the delusive aim to reconstruct much that we must be content to receive as only vaguely indicated in records and old monuments. There is, however, one early Irish monument about which there can be no mistake, the harp upon a cross belonging to the ancient church of Ullard near Kilkenny, the date of which cannot be later than 830; the sculpture is rude, but the instrument is clearly shown by the drawing in Bunting's work to have no front pillar. This remarkable structural likeness to the old harps of Egypt and Assyria may be accidental, but permits the plausible hypothesis of Eastern descent. The oldest specimen of the beautiful form the Irish harp is now recognized by, with gracefully curved front pillar and sweep of neck (the latter known as the harmonic curve), is the famous harp in Trinity College, Dublin, the possession of which has been attributed to King Brian Boiroimhe. From this mystic ownership Dr. Petrie (see essay in Bunting) has delivered it; but he can only deduce the age from the ornamentation and heraldry, which fix its date in the 14th century or a little later. There is a cast of it in South Kensington Museum, accurately described in the catalogue by Mr. Carl Engel. The next oldest is in the Highlands of Scotland, the *Clarsach Lumanach*, or Lamont's Clarschoe, belonging, with another of later date, to the old Perthshire family of Robertson of Lude. Both are described in detail by Gunn. This Lamont harp was taken by a lady of that family from Argyleshire about 1460, on her marriage into the family of Lude. It had about thirty strings tuned singly, but the scale was sometimes doubled in pairs of unisons like lutes and other contemporary instruments. The Dalway harp in Ireland (fig. 3) inscribed "Ego sum Regina Cithararum," and dated 1621, appears to have had pairs of strings in the centre only. These were of brass wire, and played with the pointed finger nails. The Italian contemporary "Arpa Doppia" was entirely upon the duplex principle, but with gut strings played by the fleshy ends of the fingers. When Bunting met at Belfast in 1792 as many Irish harpers as could be at that late date assembled, he found the com-

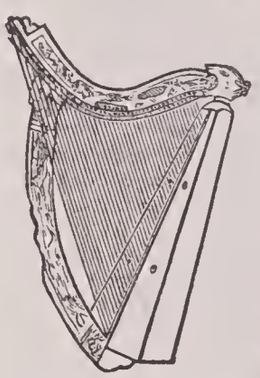
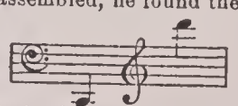


Fig. 3.—Irish (Dalway) Harp.

pass of their harps to comprise  thirty notes which were tuned diatonically in the key of G, under certain circumstances transposable to C and rarely to D, the scales being the major of these keys. The harp first appeared in the coat of arms of Ireland in the reign of Henry VIII.; and some years after in a map of 1567 preserved in a volume of State Papers, we find it truly drawn according to the outlines of the national Irish instrument. References to the Highlands of Scotland are of necessity included with Ireland; and in both we find another name for the harp, viz., "cruit." Bunting particularly mentions the "cinnard cruit" (harp with a high head) and the "crom cruit" (the curved harp). In the Ossianic MSS. of the Dean of Lismore (1512) the word "crwt" occurs several times, and in Neill M'Alpine's *Gaelic Dictionary* (1832), which gives the dialect of Islay, closely related to that of Ulster, the word "cruit" is rendered "harp." In Irish of the 8th and 9th centuries (Zeuss) "citbara" is always glossed by "crot." True the modern Welsh "crwth" is not a harp; but the expression of Fortunatus, "Chrotta Britanna canat," has been too readily accepted as meaning the half-fiddle half-lyre which also bears the name of "crwth" or "crowd." An old Welsh harp, not triple strung, exists, which bears a great resemblance to the Irish harp in neck, soundboard, and soundholes. The inference is fair that this was the form, although dimensions may have materially differed, of the Irish "crom cruit," while the triple strung harp with its elevated neck might be the form of the "cinnard cruit." But this does not imply derivation of the

harp of Wales from that of Ireland or the reverse. There is really no good historical evidence, and there may have been a common or distinct origin on which ethnology only can throw light. The Welsh like the Irish harp was often an hereditary instrument to be preserved with great care and veneration, and used by the bards of the family, who were alike the poet-musicians and historians. A slave was not allowed to touch a harp, and it was exempted by the Welsh laws from seizure for debt. The old Welsh harp appears to have been at one time strung with horsehair, and by the Eisteddfod laws the pupil spent his noviciate of three years in the practice of a harp with that stringing. The comparatively modern Welsh triple harp (fig. 4) is always strung with gut. It has a rising neck as before stated, and three rows of strings,—the outer rows tuned diatonic, the centre one chromatic for the sharps and flats. Jones gives it 98 strings and a compass of 5 octaves and one note, from violoncello C. As in all Celtic harps, the left is the treble hand, and in the triple harps there are 27 strings on that side, the right or bass hand having 37, and the middle or chromatic row 34.

Fig. 4.—Welsh Triple Harp.

Turning to the modern harp, the first pattern of it is discovered in German and Anglo-Saxon illuminated MSS. as far back as the 9th century. A diatonic instrument, it must have been common throughout Europe, as Orcagna, Fra Angelico, and other famous Italian painters depict it over and over again in their masterpieces. No accidental semitones were possible with this instrument, unless the strings were shortened by the player's finger. This lasted until the 17th century, when a Tyrolese maker adapted hooks (perhaps suggested by the fretted or bonded clavichord) that, screwed into the neck, could be turned downwards to fix the desired semitone at pleasure. At last, somewhere about 1720, Hochbrucker, a Bavarian, invented pedals that, acting through the pedestal of the instrument, governed by mechanism the stopping, and thus left the player's hands free, an indisputable advantage; and it became possible at once to play in no less than eight major scales. By a sequence of improvements, in which two Frenchmen named Cousineau took an important part, the various defects inherent in Hochbrucker's plan became ameliorated. The pedals were doubled, and, the tuning of the instrument being changed from the key of E♭ to C♭, it became possible to play in fifteen keys, thus exceeding the power of the keyboard instruments, over which the harp has another important advantage in the simplicity of the fingering, which is the same for every key.

It is to Sebastian Erard we owe the perfecting of the pedal harp (fig. 5), a triumph he gained in Paris by unremitting studies begun when he adopted a "fork" mechanism in 1786 and ended in 1810 when he had attained complete success. The mechanical perfection of Erard's apparatus must be seen to be appreciated. The pedals give the extent of movement the disks perform from which the studs project that stop the strings, as it may be required to raise the string in pitch a half tone or a whole tone. Erard's merit was not confined to this improvement only; he modified the structure of the comb that conceals the mechanism, and constructed the sound-body of the instrument upon a modern principle more advantageous to the tone.

Fig. 5.—Modern Erard Harp.

Notwithstanding these improvements and the great beauty of tone the harp possesses, the domestic use of it has for years past been declining. The great cost of a good harp, and the trouble to many amateurs of tuning, may have led to the supplanting of the harp by the more convenient and useful pianoforte. With this comes naturally a diminution in the number of solo-players on the instrument. Were it not for the increasing use of the harp in the orchestra, the color of its tone having attracted the masters of instrumentation, so that the great scores of Meyerbeer and Gounod, of Berlioz, Liszt, and Wagner are not complete without it, we should perhaps know little more of the harp than of the dulcimer, in spite of the efforts of distinguished virtuosi whose devotion to their instrument maintains its technique on an equality with that of any other, even the most in public favor.

See, in addition to the works already referred to, Engel's *Musical Instruments in the South Kensington Museum*, 1874; and the articles "Harp," in Rees's *Cyclopædia*, written by Dr. Burney, in Stainer and Barrett's *Dictionary of Musical Terms*, 1876, and in Grove's *Dictionary of Music and Musicians*, 1879. (A. J. H.)

HARPER'S FERRY, a post village of Jefferson county, West Virginia, United States, is grandly situated at the foot of Bolivar heights and at the confluence of the Shenandoah and Potomac rivers, where they intersect the Blue Ridge, 45 miles N. W. of Washington. It is the junction-point of the Baltimore and Ohio and the Winchester and Potomac railways; and the Ohio and Chesapeake canal passes along the Maryland side of the Potomac river. The village since the civil war has been in a decaying condition. It is the seat of Stover college, for students of color. Previous to the war Harper's Ferry contained an extensive arsenal and armory, and during the war it was the scene of several exploits which have given it a name in history. On the 16th October, 1859, it was seized by John Brown, the celebrated abolitionist, and a small handful of followers, but as he was unsupported by a rising of the slaves he was overpowered on the morning of the 18th and taken prisoner. On the 18th April, 1861, it was captured by the Confederates, who on evacuating it in the following June destroyed the arsenal and armory and the bridge across the Potomac. The village was afterwards held by a Union garrison of 12,000 men, who, however, on the 15th September, 1862, after a brave resistance of several days, surrendered to a strong Confederate force under Jackson and A. P. Hill. After the battle of Antietam, on the 17th of the same month, it was reoccupied by the army of the Potomac under General McClellan, who left a strong garrison in the place. In June, 1863, it was again abandoned to the Confederates on their march to Pennsylvania. After their defeat at Gettysburg, the town again fell into the hands of the Federal troops, who held it until the demonstration against Washington in July, 1864. After the battle of Monocacy on July 9th it was occupied by the United States forces, and held by them until the end of the war. The most flourishing part of the town was nearly destroyed by a flood in the Shenandoah, October, 1878. The population is about 896.

HARPIES, or Harpyiæ, a word from the root seen in *ἁρπάζω*, to snatch, are in Homer merely the embodiment of the rapacious power of violent winds. When a man has disappeared in a sudden and inexplicable fashion, it is said that the Harpies have carried him off; and the words *ἅρπυιαι* and *θύελλαι* are used indifferently (*cf. Od.* xiv. 371 with 727, and xx. 66 with 77) to indicate the agent in his sudden disappearance. But *Od.* xx. 63–5 shows that the winds were conceived as carrying the man away to the banks of Oceanus, in other words, to the sky. So it is said (*H. Ven*, 208; Schol. *Il.* xx. 244) that a *θέσπις ἀελλα* carried off Ganymede to heaven. There can be no doubt that the wind was by the primitive Indo-Germanic people considered to be the agent that carried off the souls of the dead to dwell with their fathers in heaven, and that this idea appears in the *Odyssey* (also *Il.* vi. 345) in a more fanciful form. As messengers of Zeus the Harpies are called *Διὸς κύνες* (Ap. Rh., ii. 289). In some accounts a Harpy is said to have become by Poseidon the mother of the horse Arion, and another form of the same union appears in *Il.* xvi. 148, when the harpy Podarge, grazing in a meadow by the stream of Oceanus, bears to Zephyrus (the fruitful generative wind) the two horses of Achilles. This myth, which occurs in numberless forms, has been explained in article Gorgons; from which it is clear that ultimately Harpy is another epithet, like Gorgo and Erinys, of the swift, sudden, violent thunder-storm of a southern country. It is therefore with good ground that the three forms are compared by Æschylus (*Eum.*, 48). The function of snatching away mortals to the other world leads up to the duty which the Greeks came to assign to the Erinyes of pursuing and punishing certain kinds of offenders (see Furies). In *Od.* xx. 66 *sq.* it is related that the orphan daughters of Pandareus grew up under the care of the gods; but when Aphrodite went to Olympus to beg to perfect their life by a marriage, the Harpies carried them off and

delivered them to the Erinyes. In these two daughters, one of whom is the nightingale (*Od.* xx. 518), and the other probably the swallow (*v.* Sonne in Kuhn's *Zeitschrift*, x., 121), we recognize the spring growing up in beauty till it is suddenly snatched away from the earth by the storms of autumn. Hesiod (*Theog.*, 267) says that the Harpies, Aello and Ocypete, winged goddesses with beautiful locks, are the daughters of Thaumas and Electra. Other accounts make them children of Poseidon or of Phineus, always the sun in some form; while a third, Celæno, is often added to their number. As we come down later in literature, a more hateful and repulsive character attaches to the Harpies. This is especially seen in the myth of the blind king Phineus, the sun-god in the dark winter months, tormented by the Harpies, where the transforming fancy of the poets can be traced more and more. Hesiod related (Strabo, vii. 463) that the Harpies carried off Phineus to the land of the Galactophagi, a mythic people, who represent like the Hyperboreans or the Phæacians the race of the dead, the Pitris or Manes. The myth was incorporated as an episode in the tale of the Argonauts, and is then imitated by Virgil with still more nauseous details (*Æn.* iii. 212). On the so-called Harpy monument from Lycia, now in the British Museum, they appear as winged figures, the body like that of a bird with the head and bust of a woman. They are carrying off small figures, probably departed souls.

HARPOCRATES, originally an Egyptian deity, was adopted by the Greeks, and became in later times an object of worship both to Greeks and Romans. In Egypt Harpakhruti, Horus the child, was one of the forms of Horus, the sun-god, the child of Osiris (see EGYPT, vol. vii. p. 622). Hence Herodotus (ii. 144) considers him the same as the Greek Apollo. He was said by the Greeks to have been born with his finger on his lips, and is thus represented in statues. As the god of silence he became a favorite deity among the later mystic schools of philosophy. Festivals with certain mysterious rites were celebrated in his honor.

HARPY, a large diurnal bird of prey, so named after the mythological monster of the classical poets,—the *Thrasaetus harpyia* of modern ornithologists,—an inhabitant of the warmer parts of America from Southern Mexico to Brazil.

Harpy.

Though known for more than two centuries, its habits have come very little under the notice of naturalists, and what is said of them by the older writers must be received with some suspicion. A cursory inspection of the bird, which is not unfrequently brought alive to Europe, its size, and its enormous bill and talons, at once suggest the vast powers of destruction imputed to it, and are enough to account for the stories told of its ravages on mammals,—sloths, fawns, peccaries, and spider-monkeys. It has even been asserted to attack the human race. How much of this is fabulous there seems no means at present of determining, but some of the statements are made by veracious travellers—D'Orbigny and Tschudi. It is not uncommon in the forests of the isthmus of Panama, and Mr. Salvin says (*Proc. Zool. Society*, 1864, p. 368) that its flight is slow and heavy. Indeed its Owl-like visage, its short wings and soft plumage, do not indicate a bird of very active habits, but the weapons of offence with which, as above stated, it is armed, show that it must be able to cope with vigorous prey. Its appearance is sufficiently striking—the head and lower parts, except a pectoral band, white, the former adorned with an erectile crest, the upper parts dark gray banded with black, the wings dusky, and the tail barred; but the huge bill and powerful scutellated legs most of all impress the beholder. The precise affinities of the Harpy cannot be said to have been determined. By some authors it is referred to the Eagles, by others to the Buzzards, and by others again to the Hawks; but possibly the first of these alliances is the most likely to be true. (A. N.)

HARRIER. See DOG.

HARRIER, or HEN-HARRIER, name given to certain birds of prey which were formerly very abundant in parts

Hen-Harrier (Male and Female).

of the British Islands, from their habit of harrying poultry. The first of these names has now become used in a generic sense for all the species ranked under the genus *Circus* of Lacépède, and the second confined to the particular species which is the *Falco cyaneus* of Linnæus and the *Circus cyaneus* of modern ornithologists.

On the wing Harriers have much resemblance to Buzzards, using the same flapping stroke of the pinions, and wheeling or sailing aloft as they fly. One European species indeed, *C. æruginosus*, though called in books the Marsh-Harrier, is far more commonly known in England and Ireland as the Moor-Buzzard. But Harriers are not, like Buzzards, arboreal in their habits, and always affect open country, generally, though not invariably, preferring marshy or fenny districts, for snakes and frogs form the great part of their ordinary food. On the ground their carriage is utterly unlike that of a Buzzard, and their long wings and legs render it easy to distinguish the two groups when taken in the hand. All the species also have a more or less well-developed ruff or frill of small thickset feathers surrounding the lower part of the head, nearly like that seen in Owls, and accordingly many systematists consider that the genus *Circus*, though undoubtedly belonging to the *Falconidæ*, connects that Family with the *Striges*. No osteological affinity, however, can be established between the Harriers and any section of the Owls, and the superficial resemblance will have to be explained in some other way. Harriers are found almost all over the world,[1] and fifteen species are recognized by Mr. Sharpe (*Cat. Birds Brit. Museum*, i. pp.

[1] The distribution of the different species is rather curious, while the range of some is exceedingly wide,—one, *C. maillardi*, seems to be limited to the island of Réunion (Bourbon).

50–73). In most if not all the Harriers the sexes differ greatly in color, so much so that for a long while the males and females of one of the commonest and best known, the *C. cyaneus* above mentioned, were thought to be distinct species, and were or still are called in various European languages by different names. The error was maintained with the greater persistency since the young males, far more abundant than the adults, wear much the same plumage as their mother, and it was not until after Montagu's observations were published at the beginning of the present century that the "Ringtail," as she was called (the *Falco pygargus* of Linnæus), was generally admitted to be the female of the "Hen-Harrier." But this was not Montagu's only good service as regards this genus. He proved the hitherto unexpected existence of a second species,[1] subject to the same diversity of plumage. This was called by him the Ash-colored Falcon, but it now generally bears his name, and is known as Montagu's Harrier, *C. cinereaceus*. In habits it is very similar to the Hen-Harrier, but it has longer wings, and its range is not so northerly, for while the Hen-Harrier extends to Lapland, Montagu's is but very rare in Scotland, though in the south of England it is the most common species. Harriers indeed in the British Islands are rapidly becoming things of the past. Their nests are easily found, and the birds when nesting are easily destroyed. In the south-east of Europe, reaching also to the Cape of Good Hope and to India, there is a fourth species, the *C. Swainsoni* of some writers, the *C. pallidus* of others. In North America *C. cyaneus* is represented by a kindred form, *C. hudsonius*, usually regarded as a good species, the adult male of which is always to be recognized by its rufous markings beneath, in which character it rather resembles *C. cinereaceus*, but it has not the long wings of that species. South America has in *C. cinereus* another representative form, while China, India, and Australia possess more of this type. Thus there is a section in which the males have a strongly contrasted black and gray plumage, and finally there is a group of larger forms allied to the European *C. æruginosus*, wherein a gray dress is less often attained, of which the South African *C. ranivorus* and the New Zealand *C. gouldi* are examples. (A. N.)

HARRINGTON, James (1611–1677), a distinguished writer on the philosophy of government, was sprung from an old family in Rutlandshire, and was born in January, 1611. He received a careful education, and in his eighteenth year entered Trinity College, Oxford, as a gentleman commoner. One of his tutors was the famous Chillingworth. At the close of his university career he set out to travel on the Continent, and proceeded first to Holland, where he spent several years. He served some time in the Dutch army, and enjoyed the friendship both of the Prince of Orange and of the Queen of Bohemia. After visiting France and Italy, he returned to England and lived in retirement till 1646, when he was named one of the grooms of the bed-chamber to Charles I., who was at that time being conveyed south from Newcastle as prisoner of the parliament. Though republican in his ideas, Harrington secured the confidence and respect of the king, who showed strong personal regard for him. On the removal of Charles to the Isle of Wight, Harrington was prevented from accompanying him, and was for a short time put in confinement because he would not swear to refuse assistance to the king should he attempt to escape. His feelings of respect led him also to accompany Charles to the scaffold in the following year.

After Charles's death Harrington once more withdrew into private life and devoted his time to the composition of his work on the theory of the state, afterwards published under the title of *Oceana*. The nature of his views was well known, and, as they pleased neither republicans nor royalists, the work was naturally regarded with some suspicion. By order of Cromwell the *Oceana* was seized when passing through the press. Harrington, however, managed to secure the favor of the Protector's favorite daughter, Mrs. Claypole; the work was restored to him, and appeared in 1656, dedicated to Cromwell. The views embodied in *Oceana*, particularly that bearing on vote by ballot and rotation of magistrates and legislators, Harrington and others who formed a club called the "Rota" endeavored to push practically, but with no success. In December, 1661, by order of Charles II., Harrington was arrested on a charge of conspiracy, and though there seem to have been no sufficient grounds for the accusation, he was thrown into prison. Despite his repeated request no public trial could be obtained, and when at length he endeavored to protect himself by claiming the right of *habeas corpus*, he was secretly removed to a small island off Plymouth. There his health completely gave way, and his mind appeared to be affected. By careful treatment he was restored to bodily vigor, but it is supposed that his mind never recovered its tone. After his release he married,—at what date does not seem to be precisely known. He died September 11, 1677.

Harrington's books consist of the *Oceana*, and of papers, pamphlets, aphorisms, even treatises, in support and defence of the *Oceana*. The *Oceana* is not a philosophical romance; it is a hard, prolix, and in many respects heavy exposition of a new method for constituting civil society. The details are elaborated with infinite care, even the salaries of officials being computed, but the important or leading ideas in the book are two in number, with two practical precepts following from them. The first is that the determining element of power in a state is property generally, property in land in particular; the second is that the executive power ought not to be vested for any considerable length of time in the hands of the same men or class of men. As practical corollary to his first proposition Harrington recommends an agrarian law, limiting the portion of land held to that yielding a revenue of £2000, and consequently insisting on particular modes of distributing landed property. As a practical maxim following from the second he lays down the rule of rotation by ballot. A third part of the executive, senate, or whatever it might be, are voted out by ballot every year (not being capable of being elected again for three years). Harrington explains very carefully how the state and its governing parts are to be constituted by his scheme, and *Oceana* undoubtedly contains many valuable ideas. As a book, however, it is irretrievably dull.

His *Works* were edited by Toland in 1700; Toland's edition, with additions by Birch, appeared in 1747, and again in 1771.

HARRINGTON, Sir John. See Harington.

HARRIOT, or Harriott, Thomas (1560–1621), an English mathematician and astronomer, was born at Oxford in 1560. After studying at St. Mary's Hall, Oxford, where he took his bachelor's degree in 1579, he became tutor to Sir Walter Raleigh, who in 1585 appointed him to the office of geographer to the second expedition to Virginia. Harriot published an account of this expedition in 1588, and the work was afterwards reprinted in Hakluyt's *Voyages*. On his return to England after an absence of two years, he resumed his mathematical studies with zeal and success; and having made the acquaintance of Henry Percy, earl of Northumberland, distinguished for his patronage of men of science, he received from him a yearly pension of £120. He died at London 2d July, 1621, after having suffered much from a cancer in the lip, occasioned it is supposed by a habit he had contracted of holding in his mouth instruments of brass often charged with verdigris. A manuscript of Harriot's entitled "Ephemeris Chrysometria" is preserved in Sion College; and his *Artis Analyticæ Praxis ad Æquationes Algebraicas resolvendas* was published at London in 1631. An account of his contributions to the science of algebra will be found in the article Algebra, vol. i. p. 454; and Wallis's *History of Algebra* (1685) may also be consulted. From some papers of Harriot's discovered in 1784 it would appear that he had either procured a telescope from Holland, or divined the construction of that instrument, and that he coincided in point of time with Galileo in discovering the spots on the sun's disk.

HARRIS, James (1709–1780), a distinguished English writer on the subject of grammar, was born at Salisbury on the 20th of July, 1709. He received his early education at Salisbury, whence he was removed to Oxford at the age of sixteen; and, having passed the usual number of years as a gentleman commoner at Wadham College, he was entered at Lincoln's Inn as a student of law, though not intended for the bar. When he had attained his twenty-fourth year his father died; and this event, having at once freed him from all control, and placed him in the possession

[1] A singular mistake, which has lately been productive of further error, was made by Albin, who drew his figure (*Hist. Birds*, ii., pl. 5) from a specimen of one species, and colored it from a specimen of the other.

of an independent fortune, enabled him to exchange the study of law for other pursuits more congenial to his taste. The decided bent of his mind had always been towards the Greek and Latin classics; and to the study of these he now applied himself with unremitting assiduity during a period of fourteen or fifteen years. The first fruit of this lengthened course of application was a volume which he published in 1744, containing three treatises—one on art, another on music, painting, and poetry, and a third on happiness. In 1751 appeared the work by which he is best known, *Hermes*, a philosophical inquiry concerning universal grammar. Although *Hermes* had considerable reputation in its day as a treatise on grammar, it must now be regarded as antiquated, and even as erroneous in conception. It is not so much a work on grammar as an attempt to force upon grammatical forms a strictly logical significance, to discover the groundwork of all grammars by analyzing the thoughts to be expressed in words. This method, as we now recognize, is incapable of throwing light upon the oral structure and growth of language and grammatical forms. In 1775 Harris published his *Philosophical Arrangements*, part of a larger work which he had meditated, but did not complete, on the peripatetic logic. It is in fact a commentary on Aristotle's categories, and an attempt to discuss problems of more recent philosophy by the Aristotelian notions. The *Philological Inquiries* is a pleasantly written but slight work on the principles of literary criticism and style. It is the least pedantic of all his works. Harris died in December, 1780. His works were collected and published in 2 vols., 1801, by his son, Lord Malmesbury, who prefixed a brief biography.

HARRIS, John, D. D. (*c.* 1667–1719), an English writer, best known as the editor of the *Lexicon Technicum*, which ranks as the earliest of the long line of English encyclopædias, and as the compiler of the *Collection of Voyages and Travels* which passes under his name. He was educated at St. John's College, Cambridge, where he took his B. A. degree in 1687, and proceeded M. A. in 1690. Having entered the church, he was soon presented to the rectory of Winchelsea in Sussex; and as early as 1698 he was in sufficient repute as a learned divine to be entrusted with the delivery of the seventh series of the Boyle lectures—*Atheistical Objections against the Being of God and His Attributes fairly considered and fully refuted.* Between 1702 and 1704 we find him lecturing on mathematics on the foundation of Charles Cox, and advertising himself as a mathematical tutor at Amen Corner. The friendship of Sir William Cowper, afterwards lord chancellor, soon after raised him to a much higher position. Besides receiving the office of private chaplain to Sir William, he was presented in 1708 with a prebend in Rochester Cathedral, and appointed to the rectory of the united parishes of St. Mildred, Bread Street, and St. Margaret Moses. In this position he showed himself an ardent supporter of the Government, and got into a bitter quarrel with the Rev. Charles Humphreys, who afterwards was chaplain to Dr. Sacheverel. Harris was one of the early members of the Royal Society, and for a time acted as vice-president. Besides his contributions to the society's *Transactions*, and the two important works by which he is still remembered, he published a number of treatises on mathematics and occasional sermons; and at his death on September 7, 1719, he was busy completing an elaborate *History of Kent*, of which the first volume had just left the press. He is said to have died in poverty brought on by his own bad management of his affairs. There is only one good account of his life, that by Nichols in the *Literary Anecdotes*, vol. ix., and this even, owing to the scarcity of materials, is strangely defective.

HARRIS, John (1802–1856), divine and theologian, was born at Ugborough in Devonshire, March 8, 1802. At the age of fifteen he joined the Independent Church, and began to preach to the rustics of the neighborhood as a member of the Bristol Itinerant Society. After studying at the Independent college at Hoxton he was in 1827 ordained pastor of a small congregation at Epsom. There in 1836 he wrote his essay, *Mammon, or Covetousness the Sin of the Christian Church*, which won a prize of 100 guineas offered by Dr. Conquest, and brought its author into notice, thirty thousand copies being sold within a few years. In 1838 he received the degree of doctor of divinity from Brown University, America, and was appointed president and professor of theology in Cheshunt college; and in 1850, when the Independent colleges at Highbury, Homerton, and Coward, near London, were united, Dr. Harris was elected principal of the New College thus formed. He died December 21, 1856

Besides *Mammon*, he wrote the *Great Teacher* (1835); two prize essays, *Britannia* (1837) and *The Great Commission* (1842); and *Contributions to Theological Science. The Pre-Adamite Earth* (1847), *Man Primæval* (1849), and *Patriarchy* (1855), form the beginning of a series, intended to illustrate the history of man from a theological point of view, but interrupted by his death.

HARRIS, Sir William Snow (1791–1867), a distinguished electrician, was descended from an old family of Plymouth solicitors, and was born there 1st April, 1791. He received his early education at the Plymouth grammar-school, and completed a course of medical studies at the university of Edinburgh, after which he established himself as a general medical practitioner in Plymouth. On his marriage in 1824 he resolved to abandon his profession on account of its duties interfering too much with his favorite study of electricity. As early as 1820 he had invented a new method of arranging the lightning conductors of ships, the peculiarity of which was that the metal was permanently fixed in the masts and extended throughout the hull; but it was only with great difficulty, and not till nearly thirty years afterwards, that his invention was adopted by the Government for the royal navy. In 1826 he read a paper before the Royal Society "On the relative Powers of various Metallic Substances as Conductors of Electricity," which led to his being elected a member of the society in 1831. Subsequently, in 1834, 1836, and 1839, he read before the society several valuable papers on the elementary laws of electricity, and he also communicated to the Royal Society of Edinburgh various interesting accounts of his experiments and discoveries in the same field of inquiry. In 1835 he received the Copley gold medal from the Royal Society for his papers on the "Laws of Electricity by High Tension," and in 1839 he was chosen to deliver the Bakerian lecture. Meanwhile, although a Government commission had recommended the general adoption of his conductors in the royal navy, and the Government had granted him an annuity of £300 "in consideration of services in the cultivation of science," the naval authorities continued to offer various objections to his invention; to aid in removing these he in 1843 published his work on *Thunderstorms*, and also about the same time contributed a number of papers to the *Nautical Magazine* illustrative of damage by lightning. His system was actually adopted in the Russian navy before he succeeded in removing the prejudices against it in England, and in 1845 the emperor of Russia in acknowledgment of his services presented him with a valuable ring and a superb vase. At length, every doubt as to the efficiency of his system having been removed, he received in 1847 the honor of knighthood, and subsequently a grant of £5000. After succeeding in introducing his invention into general use Harris resumed his labors in the field of original research, but as he failed to realize the advances that had been made by the new school of science his application resulted in no discoveries of much value. His manuals of *Electricity*, *Galvanism*, and *Magnetism*, contributed to Weale's rudimentary series, were however written with great clearness, and passed through several editions. He died 22d January, 1867, while having in preparation a *Treatise on Frictional Electricity*, which was published posthumously in the same year, with a memoir of the author by Charles Tomlinson, F. R. S.

HARRISBURG, a city of the United States, capital of Dauphin county and of the State of Pennsylvania, is beautifully situated on the east bank of the Susquehanna river, on the Pennsylvania canal, and at the junction of several railways, 126 miles by rail N. of Washington and 105 W. by N. of Philadelphia. The river, which is here a mile in width, is crossed by two bridges, one of which is for the use of the railways. Two other bridges of great beauty and strength span the river in view of the State-house. The State buildings, dating from 1819, occupy an eminence in the centre of the busiest portion of the city, and consist of the State capitol, 180 feet long by 80 feet wide, with a circular portico in front supported by six Ionic columns and surmounted by a dome, and, on two sides of the capitol, smaller buildings uniform in design, containing the executive chamber, the State treasury and various other offices. The capitol park contains a monument to those who died in the Mexican war. Among the other public buildings are the county court-house, the State

arsenal, the county prison, and the opera-house. Harrisburg is a bishop's see of the Roman Catholic Church. It is well provided with academies and schools, and possesses about 30 churches, several of which are costly and ornamental edifices. It is also the seat of the State library of over 40,000 volumes. Among the benevolent institutions are the city hospital, the home for the friendless, and the State lunatic hospital. An abundant water supply is obtained from the river. Coal and iron are largely wrought in the neighborhood, and the great facilities of communication both by canal and railway have enabled the city to become one of the centres of the iron trade. It possesses large iron-foundries, manufactories of steel, machines, boilers, engines, carriages, nails, files, galvanized iron, brooms, soap, and shoes, rolling-mills, saw and planing mills, flour-mills, cotton-mills, potteries, tanneries, and breweries. The inhabitants in 1860 numbered 13,405, and in 1870 23,104. The population of the city proper for 1880 is estimated at 31,700, and that of the suburbs at 4900, making a total of 36,600. Population (1900) 50,167.

Harrisburg received its name from John Harris, an Englishman who settled on the site of the town in 1726, and whose son established a ferry over the Susquehanna in 1753. The town was founded in 1785 under the name of Harrisburg, which was afterwards changed to Louisbourg; in 1791 it was incorporated under its present name; in 1812 it became the capital of the State; and in 1860 it was made a city.

HARRISON, John (1693–1776), an eminent mechanician, was the son of a carpenter, and was born at Faulby, near Pontefract, in Yorkshire, in the year 1693. Thence his father and family removed in 1700 to Barrow, in Lincolnshire. Young Harrison at first learned his father's trade, and worked at it for several years, at the same time occasionally making a little money by land-measuring and surveying. The strong bent of his mind, however, was towards mechanical pursuits; and this showed itself specially in endeavors to improve the construction of clocks and watches so as to render them more accurate measurers of time. He soon learned that, to enable a clock to keep accurate time, the pendulum must be so constructed as to preserve the distance between the point of suspension and centre of oscillation invariable, notwithstanding the expansion and contraction of the rod caused by changes of temperature. To accomplish this Harrison devised, in 1726, his ingenious "gridiron pendulum," which consists in having the bob suspended by a series of parallel rods, alternately of steel and brass, so arranged that the downward expansion of the steel rods from change of temperature is exactly compensated for by the upward expansion of the brass rods. This principle of compensation modified to suit particular cases, is now applied to all good watches and chronometers. Another ingenious improvement in clockmaking devised by Harrison was his recoil escapement which obviated the necessity of keeping the pallets well-oiled. He was led to invent this, as he himself tells us, by having on one occasion had to go a long distance to set right a turret clock which had stopped simply from want of oil on the pallets. This escapement, although answering admirably the intended purpose, is rather too delicate to be adopted in ordinary practice. Harrison was also the first to employ the commonly used and effective form of "going ratchet," which is a spring arrangement for keeping the timepiece going at its usual rate during the interval of being wound up.

In Harrison's time the Government of the country had become fully alive to the necessity of determining more accurately the longitude at sea. For this purpose they passed an Act in 1714 offering rewards of £10,000, £15,000, and £20,000 to any who should construct chronometers that would determine the longitude within 60, 40, and 30 miles respectively. Harrison applied himself vigorously to the task, and in 1735 went to the Board of Longitude with a watch which he also showed to Halley, Graham, and others. Through their influence he was allowed to proceed in a king's ship to Lisbon to test it; and the result was so satisfactory that the commissioners gave him £500 to carry out further improvements. Harrison worked at the subject with the utmost perseverance, and, after making several watches, went up to London in 1761 with one which he considered very perfect. His son William was sent on a voyage to Jamaica to test it; and, on his return to Portsmouth in 1762, the watch was found to have lost only 1 minute 54½ seconds. This was surprisingly accurate, as it determined the longitude within 18 miles, and Harrison claimed the full reward of £20,000. After some further trials £10,000 of it was paid to him in 1765, and the remainder in 1767, after he had written such a description of his instrument as would enable other artists to copy it. Harrison died in 1776, at the age of eighty-two. His want of early education was felt by him greatly throughout life. He was unfortunately never able to express his ideas clearly in writing, although in conversation he could give a very precise and exact account of his many intricate mechanical contrivances. He wrote a book entitled *Description concerning such Mechanism as will afford a Nice or True Mensuration of Times.*

HARRISON, William Henry (1773–1841), ninth president of the United States, third son of Governor Benjamin Harrison,[1] was born at Berkeley, Charles City county, Virginia, February 9, 1773. In 1792 he joined the army with the commission of ensign, and in the following year he became lieutenant and acted as aide-de-camp to Wayne in his expedition against the Western Indians. He was promoted to a captaincy in 1795, but resigned in 1797 on being appointed secretary of the North-West Territory. In 1799 he was chosen to represent that territory in congress, and after its division in 1801 he became governor of the new territory of Indiana and superintendent of negotiations with the Indians, over whom, on the breaking out of hostilities in 1811, he gained the important victory of Tippecanoe. In 1813 as major-general and commander of the north-western army he defeated the British forces at the battle of the Thames. In 1814 he concluded a treaty with the North-Western Indians, and in the same year he resigned his commission. He was elected in 1816 member of congress for Cincinnati, in 1819 member of the State senate of Ohio, in 1824 United States senator, and in 1828 minister to Colombia, an office which he held for less than a year, when he retired for a time into private life. By the urgent request of the Whigs he was induced in 1836 to stand for the presidency of the United States, and though unsuccessful, he at the next election in 1840 defeated the same candidate Van Buren by an overwhelming majority, after a canvass memorable for the extraordinary enthusiasm it awakened, and historically important for its introduction of new political methods—many of the most characteristic features of Western elections having their origin in this "Harrison campaign." He was scarcely spared, however, to enter upon the discharge of his duties as president, dying April 4, 1841, about a month after his inauguration. Harrison published at Cincinnati in 1838 a small treatise on the Indians entitled *A Discourse on the Aborigines of the Ohio Valley.*

HARROGATE, a town and watering-place in the West Riding of Yorkshire, England, is beautifully situated on a fine plateau near the River Nidd, 18 miles W. of York. It is indebted for its rise and importance to its medicinal springs, and is now the principal inland watering-place in the north of England. It consists of two scattered townships, Low Harrogate and High Harrogate, which have gradually been connected by a continuous range of handsome houses and villas. A common of 200 acres, which is secured by act of parliament from ever being built upon, stretches in front of the main line of houses, and on this account Harrogate, notwithstanding its rapid increase, has retained all its rural charm. As the town is equidistant from the east and west coasts, its air is supposed to possess certain special qualities, and there is the further advantage of a choice between the more bracing atmosphere of High Harrogate and the sheltered and warm climate of the low town. The waters are chalybeate, sulphurous, and saline, and some of the springs possess all these qualities to a greater or less extent. The principal chalybeate springs are the Tewitt well, called by Dr. Bright, who wrote the first account of it, the "English Spa," discovered by Captain William Slingsby of Bilton Hall about the year 1570; the Royal Chalybeate Spa, more commonly known as John's Well, discovered in 1631 by Dr. Stanhope of York, and provided with a neat octagonal building erected in 1842; Muspratt's chalybeate or chloride of iron spring discovered in 1819, but first properly analyzed by Dr. Sheridan Muspratt in 1865; and the Starbeck springs, midway between High Harrogate and Knaresborough. The principal sulphur springs are the old sulphur well in the centre of Low Harrogate, discovered about the year 1656; the Montpellier springs, the principal well of which was discovered in 1822, situated in the

[1] [(1740-91), a signer of the Declaration of Independence from Virginia. The ninth president's grandson, Benjamin (born 1833), became the twenty-third President of the United States in 1889, having been a senator from Indiana (1881–87).—Am. Ed.]

grounds of the Crown Hotel and surmounted by a handsome building in the Chinese style containing pump-room, baths, and reading room; and the Harlow Car springs, situated in a wooded glen about a mile west from Low Harrogate. Near Harlow Car is Harlow observatory, a square tower 100 feet in height, standing on elevated ground and commanding a very extensive view. A saline spring situated in Low Harrogate was discovered in 1783. Besides the hotels and churches, the principal public buildings are the High Harrogate college, a boarding-school for young gentlemen; the new Victoria baths, erected in 1871 at a cost of £20,000; the Bath hospital for poor patients, founded in 1824; and the Rogers almshouses, founded in 1869. About a mile to the south-east of Harrogate the Crymple valley is spanned by a railway viaduct 1850 feet in length. The population of the town in 1861 was 4737, and in 1901 28,414.

HARROW-ON-THE-HILL, a village of Middlesex, England, 10 miles N. W. of London, derives the latter part of its name from its position on a hill which rises from the surrounding plain to the height of about 200 feet. On the summit, and forming a conspicuous landmark, is the church of St. Mary, said to have been founded by Lanfranc, archbishop of Canterbury, in the reign of William I., but of the original building very little is now left. Harrow is chiefly celebrated for its school, founded in 1571 by John Lyon, a yeoman of the neighboring village of Preston who had yearly during his life set aside 20 marks for the education of poor children of Harrow. Though the charter was granted by Queen Elizabeth in 1571, and the statutes drawn up by the founder in 1590, two years before his death, it was not till 1611 that the first building was opened for scholars. Lyon originally settled about two-thirds of his property on the school, leaving the remainder for the maintenance of the highway between London and Harrow, but in the course of time the values of the respective endowments have changed, and while the road commissioners receive about £3500, the school's share is only about £1600. In 1660 the headmaster, taking advantage of a concession in Lyon's statutes, began to receive "foreigners," *i. e.*, boys from other parishes, who were to pay for their education. From this time the prosperity of the school may be dated. In 1809 the parishioners of Harrow appealed to the Court of Chancery against the manner in which the school was conducted, but the decision, while it recognized their privileges, confirmed the right of admission to foreigners. At present foundationers receive their education at a slightly cheaper rate than foreigners; there are none who are taught gratis. The government of the school was originally vested in six persons of standing in the parish, who had the power of filling vacancies in their number by election among themselves; but under the Public Schools Act of 1868 the governing body now consists of the surviving members of the old board, besides six new members elected respectively by the Lord Chancellor, the universities of Oxford, Cambridge, and London, the Royal Society, and the assistant masters of the school. There is a considerable number of fellowships and scholarships in connection with the school to both the great English universities, some to special colleges, others to colleges in the choice of the holders. The general mode of instruction and discipline is modelled on that of Eton, where most of the former headmasters of Harrow were educated. Originally an exclusively classical school, mathematics became in 1837 a compulsory study at Harrow; modern languages, compulsory on the upper forms only since 1851, were extended to the whole school in 1855; while English history and literature began to be more especially studied about 1869. Science, music, and drawing are now also taught. Among the famous men who have been educated here may be mentioned Bruce, the Abyssinian traveller, Sir William Jones, the Orientalist, Dr. Parr, who was born at Harrow, Admiral Rodney, Sheridan, Byron, Peel, Theodore Hook, Lord Palmerston, Lord Herbert of Lea, the earl of Shaftesbury, and Archbishop Trench. Comparatively little change was made in the school buildings till 1819, when the new portion was begun; but since that time improvements and additions have steadily increased. In 1839 a school-chapel was consecrated; but this has been gradually replaced by a handsomer edifice completed in 1857. The Vaughan library was built in 1861–63, and a hospital for the boys in 1865. A new speech room, a gymnasium, and laboratories have been erected out of the Lyon Tercentenary Fund, subscribed since 1871. The population of the parish in 1901 was 10,220.

HARRY, Blind, or Henry the Minstrel, author of a poem in twelve books, entitled *The Actis and Deidis of the illuster and vailzeand campioun, Schir William Wallace, Knicht of Ellerslie.* All that is known of Henry's personal history is contained in the following quotation from Major: —"Henry, who was blind from his birth, composed in the time of my youth the whole book of William Wallace, and embodied all the traditions about him in the ordinary measure, in which he was well skilled. By the recitation of these in the presence of the great, he procured, as indeed he deserved, food and clothing." Major was born about 1469, and the only MS. copy of Henry's works is that in the Advocates' Library, Edinburgh, dated 1488. It was first printed at Edinburgh in 1570. In his *Lives of Scottish Worthies*, P. F. Tytler claims for it a certain historical worth, as "the work of an ignorant man, who was yet in possession of valuable and authentic materials." On account of its glorification of the national hero it has enjoyed a long popularity among the Scottish peasantry, but it possesses no poetical merit except a certain rude fire and energy, and as a literary production its place must be reckoned a very humble one.

HARTE-BEEST (*Alcelaphus caama*), a species of antelope, occurring in considerable numbers throughout southern and central Africa. It stands nearly 5 feet high at the shoulders, and is somewhat ungainly in form owing to the disproportionate development of its fore and hind quarters —a difference which gives to the posterior limbs when in motion an appearance of weakness. The head is long and narrow, and is crowned in both sexes by a pair of nearly cylindrical horns, ringed throughout their lower half and smooth above. The hair of this species is short, soft, and

Harte-beest.

recumbent, and is of a brownish-yellow color above and nearly white beneath, the color, however, being to some extent dependent on age and sex and on the season of the year. The harte-beest is gregarious, living in herds of from five to ten individuals, and frequenting tracts of uninhabited wilderness, or the light brush forest in the neighborhood of rivers. It is exceedingly wary, and consequently difficult of approach, and when suddenly come upon, the entire herd, according to Sir Andrew Smith, scampers off in the train of a leader,—the herd being rarely seen, when in flight, otherwise than in a string, one treading on the footsteps of another. Of a mild and gentle disposition, the harte-beest seeks safety, whenever it can, in flight; when at bay, however, it does not hesitate to turn upon its pursuers and to make use of its powerful horns as weapons of offence. During the heat of the day it is said to rest leaning against the trunks of trees when the color of its body so harmonizes

with that of the bark as frequently to enable it to elude observation. Dr. Schweinfurth, who had frequent opportunity of observing these animals in central Africa, describes a curious and as yet unexplained habit of which he was himself a witness. Having approached nearer to a herd of harte-beests than usual without attracting their attention, he observed them running in couples like the horses in a circus, "going round and round a clump of trees, whilst the others stood in groups of three or four intently watching them. After a time these in turn took their places, and, two at a time, ran their own circuit in a similar fashion." He conjectures that the performance had probably some connection with pairing time. The flesh of this species is considered superior to that of any other South African antelope, the eland alone excepted.

HARTFORD, a city in the United States of North America, in 41° 45′ 59″ N. lat., 72° 40′ 45″ W. long., is the eastern portion of the town of the same name, the county seat of Hartford county, and the capital of the State of Connecticut. It is situated on the west bank of the Connecticut river, 60 miles from Long Island Sound, at the head of steamboat and sloop navigation, and 100 miles N. E. of New York and 95 W. S. W. of Boston by rail. An important centre of railway communication, it has also regular lines of steamboats and packets, besides some 200 sailing craft engaged in the coasting trade. The river is usually closed from the middle of December to the middle of March, and at the breaking up of the ice in spring sometimes rises 29 feet. The city is intersected by the sluggish and dirty Park river, which is spanned by 10 bridges. A covered toll bridge, 1000 feet long, across the Connecticut river connects the city with East Hartford. There are about 80 miles of streets, mostly lighted with gas, well-drained, and macadamized or paved, and running north-and-south or east-and-west with considerable regularity. The city is for the most part compactly built of brick, granite, and freestone—the public buildings and those of many private corporations being elegant and substantial. The old State-house, a Doric edifice, completed in 1795, has become the city-hall, while the State, since 1879, occupies a capacious new building of white marble in the modern Gothic style, costing over $3,100,000, and standing conspicuously in the midst of the city on a slight elevation at the south side of Bushnell Park (a beautiful area of 46 acres). There are also in the city three other public squares. Of the seven cemeteries the most noteworthy is Cedar Hill, in the south-west part of the town, comprising 268 acres. Wadsworth's tower on Talcott mountain, to the north-west, affords one of the finest views in New England. Hartford is a healthy city, and its mean annual temperature is 50° Fahr. The area of the city is 10 square miles; and the population in 1870 was 37,180, of whom 10,817 were foreigners. A careful estimate of the population in 1900 gives 53,230.

The city is divided into 8 wards, and is governed by a mayor and 16 aldermen elected biennially, and 32 councilmen elected annually. The water supply is from four reservoirs in West Hartford with a capacity of 1,208,450,367 gallons. In 1873 a free public bathing-house was established. Since 1864 the city has had a paid fire-department, and now has seven steam fire-engines and a fire-alarm telegraph with 26 miles of wire. The total real estate and personal property in the city assessed for taxation, October 1, 1878, was $44,001,245. The debt of the town in 1879 was $1,298,158, and of the city $2,152,308.

The principal business of the city is insurance. In 1879 there were 9 fire insurance companies, with assets of $19,104,603; 8 life insurance companies, with assets of $101,101,368; and 1 accident insurance company, with assets, $1,170,163. There were 16 banks and trust companies, with an aggregate capital of over $8,000,000, and 4 savings banks, with deposits, October 1, 1878, amounting to $9,528,893. There are also, exclusive of railroads, 73 mechanical and manufacturing corporations, though several of the larger ones have their works in adjacent towns. These have a capital of $17,347,000, and some of them a world-wide reputation, as the Colt Firearms Company, with works occupying grounds of 123 acres reclaimed by an extensive dyke along the Connecticut river. They also include carpet, linen, and silk works, and a manufactory of edgetools. The publication of books too is a considerable interest. A very important branch of trade is the sale of leaf tobacco, which is the chief crop of the Connecticut river valley.

In 1879 there were 36 churches and 15 chapels of all denominations, including a fine Jewish synagogue. Here, too, is the seat of the Roman Catholic bishop, and the headquarters, in the United States, of the Chinese educational commission. Beside the 17 public schools and school-houses, which have cost $1,032,000, and with their 163 teachers and 7680 pupils cost about $200,000 a year, there were in 1879 43 educational and charitable corporations, several of them of notable importance, especially Trinity College (Episcopal), founded in 1823 as Washington College, which now has beautiful and commodious buildings in the south part of the city; the Theological Institute of Connecticut (Congregational), founded in 1834; the Hartford high and grammar school, founded 1655, the oldest educational institution in the State, and occupying one of the finest school edifices in the country; the Watkinson library of reference, with 34,000 volumes; the rooms and library of the Connecticut historical society, with its valuable collections of relics, books, and MSS.; the young men's institute, a circulating library of 27,000 volumes (the last three, with a picture gallery, occupy a roomy and accessible building known as the Wadsworth Athenæum); the very complete State law library at the State-house; the American asylum for the deaf and dumb, retreat for the insane, Hartford hospital and orphan asylum (see CONNECTICUT, vol. vi. p. 256). Thomas Green in 1764 opened the first printing-office in the city, and established the *Connecticut Courant*, which has ever since been regularly published. There were in 1879 three daily newspapers, seven weekly, and four monthly. In 1797 A. Kinsley exhibited the first steam locomotive in Hartford streets; and a portion of the Hartford and New Haven railroad was in operation in 1838. The railroads, however, have not been pecuniarily successful, that to New York being the only one of those meeting at Hartford which is in a prosperous condition.

Hartford was known to the aborigines as Suckiang; it was first permanently settled in 1635 by emigrants from eastern Massachusetts, and called Newtown. In 1637 it was named Hartford after Hertford in England. The Dutch had built a fort there in 1633, but it passed wholly into English hands in 1654. The first town meeting was held in 1635, and the first place of worship built, and school put in operation, in 1638. In 1639 was written at Hartford the constitution for the colony, the first framed in America, and embodying the characteristic features of all which follow. The first code of laws was drawn up in 1650, reducing the capital offences from 160 under English law to 15. In 1687 Sir E. Andros came to Hartford while the assembly was in session, and demanded the charter, but it was concealed in the notorious Charter Oak by Captain Joseph Wadsworth, and remained hidden till 1689. The historic tree survived till 1856. The city was incorporated in 1784, and in 1875 it became the sole capital of Connecticut.

HARTIG, GEORG LUDWIG (1764–1836), a German writer on forestry, was born at Gladenbach near Marburg, 2d September, 1764. After obtaining a practical knowledge of forestry from his uncle at Harzburg, he studied from 1781 to 1783 at the university of Giessen. In 1786 he became inspector of forests to the prince of Solms-Braunfels at Hungen in the Wetterau, where he founded a school for the teaching of forestry. After obtaining in 1797 the appointment of inspector of forests to the prince of Orange-Nassau, he continued his school of forestry at Dillenburg, where its attendance considerably increased. On the dissolution of the principality by Napoleon I. in 1805 he lost his situation, but in 1806 he went as chief superintendent of forests to Stuttgart, whence in 1811 he was called to Berlin as principal superintendent of forests under the Prussian Government. There he again opened his institution for instruction in forestry, and succeeded in connecting it with the university of Berlin, where in 1830 he was named honorary professor. He died at Berlin 2d February, 1836.

Hartig was the author of a number of valuable works on forestry, new editions of which have been published by his son Theodor. The principal of these works are *Lehrbuch für Jäger; Lehrbuch für Förster; Kubiktabellen für geschnittene, beschlagene, und runde Hölzer;* and *Lexikon für Jäger und Jagdfreunde.*

HARTLEPOOL, and WEST HARTLEPOOL, respectively a municipal borough and a town of England, county of Durham, and included in the parliamentary borough of the Hartlepools, are situated the one on the north and the other on the south side of Hartlepool Bay, about a mile apart, but having connection by railway, and practically forming portions of one town. By railway Hartlepool is 10 miles and West Hartlepool 12 miles N. N. E. of Stockton-on-Tees. The principal buildings of Hartlepool are the parish church, in the Early English style, dedicated to St. Hilda; the borough hall, in the Italian style, erected in 1866, behind which there is a large market; the Dur-

ham militia artillery depôt, erected in 1861; the temperance hall, the mechanics' institute, and the theatre. New schools for boys, girls, and infants have been erected by the school board; and Prissick's schools, founded in 1826, have been constituted elementary schools under the Education Act of 1870. Among the other schools are Crook's endowed school, founded in 1755, and the school in connection with Henry Smith's charity. The town was originally surrounded by walls, of which considerable remains may yet be seen. It is well supplied with water. The principal buildings of West Hartlepool are the athenæum, the town hall, the exchange, in the Gothic style, erected in 1875 at a cost of £10,000, the mechanics' institute, and the theatre. A Government school of art was established in 1874. The manufactures of the two towns are very much alike: they possess iron-works, puddling furnaces, brass and iron foundries, engine and boiler works, sawmills, cement works, tile works, and breweries. With the addition of the new docks, completed in 1879, the dock area between the towns is 86 acres, besides which there are ponds with an area of about 80 acres. Considerable difficulty has been found in maintaining a sufficient depth of water at the harbor bar of Hartlepool, and although the use of a powerful dredge has been so far effectual, it is probable that the only adequate remedy will be the extension of the breakwater. A large lighthouse for guiding the entrance of vessels was erected in 1846–47 at a cost of nearly £6000. In the shipping returns Hartlepool and West Hartlepool are classed together as one port; in 1878 the number of vessels that entered the port, including those in ballast, was 4640, with a tonnage of 885,762; the number that cleared 4662, with a tonnage of 992,370. For the five years ending 1878 the average number of vessels that entered was 5371, with a tonnage of 975,039, while 5447 cleared, with a tonnage of 1,005,740. The principal exports are coal, coke, machines, and cotton, linen and woollen goods, and the principal imports, timber, cattle, corn, provisions, and wool. The fisheries are considerable. The town is much resorted to in summer for sea-bathing. Several caverns, which may be explored for nearly fifty yards, have been excavated by the sea out of the rocks on the shore of the peninsula. The parliamentary borough of the Hartlepools has an area of 7267 acres, and besides Hartlepool includes Stranton (in which parish West Hartlepool is situated), Seaton Carew, and Throston. Its population in 1861 was 27,475, and in 1871, 38,203. The population of the municipal borough of Hartlepool in 1861 was 12,245, and in 1871, 13,166; and the population of Stranton in 1861 was 13,601, and in 1901, 22,737.

The name Hartlepool means the pool or lake of Hart. The town grew up round a monastery which had St. Hilda as its abbess, and the harbor was of some consequence as early as 1171. In the 13th century Hartlepool belonged to the Bruces of Annandale in Scotland, the progenitors of the royal family of that name. The town was erected into a borough about 1200. After Bruce ascended the Scottish throne his English possessions were forfeited, and Hartlepool was granted to the Cliffords. It suffered severely from the Scots in 1312, and again in 1315 after the battle of Bannockburn. During the great northern rebellion in the reign of Elizabeth it was seized by the insurgents. In 1644 it was taken by the Scottish army, and it remained in the possession of Scotland till 1647. West Hartlepool was founded in 1844 by Mr. R. W. Jackson, the first M. P. for the borough of the Hartlepools. Its first dock was constructed in 1847, after which it increased with great rapidity.

HARTLEY, DAVID (1705–1757), who may justly be called the founder of the English Association school of psychologists, was born on the 30th August, 1705. His father, who was vicar of Armley in Yorkshire, wished him to enter the church; and with this view he was sent at the age of fifteen to Jesus College, Cambridge, where he studied under Saunderson the mathematician, and distinguished himself so much that he was elected a fellow of his college. But his university career so far modified his opinions that, feeling himself no longer able conscientiously to sign the Thirty-nine Articles, he abandoned his first intention and devoted himself to the study of medicine. He, however, remained in the communion of the English Church, living on intimate terms with the most distinguished churchmen of his day, among whom may be named Joseph Butler, Warburton, Law, Hoadley, and the poet Young. Indeed he asserted it to be a duty to obey ecclesiastical as well as civil authorities. The doctrine to which he most strongly objected was that of eternal punishment. His keen interest in theology is proved by the fact that he devoted a large part of his *Observations* to that subject, the objective side of which he treated upon orthodox lines. The life of Hartley was the useful life of a benevolent and studious physician. He practised at Newark, Bury St. Edmunds, London, and lastly at Bath, where he died on the 28th August, 1757, within two days of his fifty-second birthday. It was at the age of twenty-five that he commenced the series of essays that was to make up his *Observations on Man; his Frame, his Duty, and his Expectations.* The praise of originality cannot be denied him. It is noteworthy, however, that very nearly at the same time with the publication of Hartley's *Observations* (1749), two works appeared in French expounding theories essentially similar to his—Condillac's *Traité sur l'Origine des Connoissances humaines* (1746) and the *Traité Analytique de l'Âme* by Charles Bonnet of Geneva, whose coincidence with Hartley in the most distinctive features of his philosophy is extremely remarkable. But Hartley's own account of the matter is so straightforward as to command immediate assent. His physical theory, he tells us, was drawn from certain speculations as to nervous action which Newton had published in his *Principia.* His psychological theory was suggested by an *Essay on the Fundamental Principle of Virtue or Morality* (written by a clergyman named Gay, and prefixed by Law to his translation of Archbishop King's Latin work on the *Origin of Evil*), the chief object of which was to show that sympathy and conscience are developments by means of association from the selfish feelings. It is greatly to Hartley's credit that he so frankly owned his obligations to a work so far inferior to his own in completeness and tone of thought.

The outlines of Hartley's theory are as follows. With Locke he asserted that, prior to sensation, the human mind is a blank. By a growth from simple sensations those states of consciousness which appear most remote from sensation come into being. And the one law of growth of which Hartley took account was the law of contiguity, synchronous and successive. By this law he sought to explain, not only the phenomena of memory, which others had similarly explained before him, but also the phenomena of emotion, of reasoning, and of voluntary and involuntary action.

By his physical theory Hartley gave the first strong impulse to the modern study of the intimate connection of physiological and psychical facts which has proved so fruitful, though his physical theory in itself is inadequate, and has not been largely adopted. He held that sensation is the result of a vibration of the minute particles of the medullary substance of the nerves, to account for which he postulated, with Newton, a subtle elastic ether, rare in the interstices of solid bodies and in their close neighborhood, and denser as it recedes from them. Pleasure is the result of moderate vibrations, pain of vibrations so violent as to break the continuity of the nerves. These vibrations leave behind them in the brain a tendency to fainter vibrations or "vibratiuncles" of a similar kind, which correspond to "ideas of sensation." Thus memory is accounted for. The course of reminiscence and of the thoughts generally, when not immediately dependent upon external sensation, is accounted for on the ground that there are always vibrations in the brain on account of its heat and the pulsation of its arteries. What these vibrations shall be is determined by the nature of each man's past experience, and by the influence of the circumstances of the moment, which causes now one now another tendency to prevail over the rest. Sensations which are often associated together become each associated with the ideas corresponding to the others; and the ideas corresponding to the associated sensations become associated together, sometimes so intimately that they form what appears to be a new simple idea, not without careful analysis resolvable into its component parts.

Starting, like the modern Associationists, from a detailed account of the phenomena of the senses, Hartley tries to show how, by the above laws, all the emotions, which he analyzes with considerable skill, may be explained. Locke's incomplete phrase "association of ideas" is employed throughout, "idea" being taken as including every mental state but sensation. He emphatically asserts the existence of pure disinterested sentiment, while declaring it to be a growth from the self-regarding feelings. Voluntary action is explained as the result of a firm connection between a motion and a sensation or "idea," and, on the physical side, between an "ideal" and a motory vibration. Therefore in the Freewill controversy Hartley took his place as a Determinist. It is singular that, as he tells us, it was only with reluctance, and when his speculations were nearly complete, that he came to a conclusion on this subject in accordance with his theory.

Hartley's theory of reasoning is forced into agreement with the rest of his system. He declares that "assent and dissent,

whatever their precise and particular nature may be, must come under the notion of ideas, being only those very complex internal feelings which adhere by association to such clusters of words as are called propositions. . . . And thus a mathematical proposition is nothing more than a group of ideas united by association," this group of ideas including "not only the sum of the ideas belonging to the terms of the proposition, but also those which belong to equality, coincidence, and truth."

The remaining half of the *Observations* is devoted to discussion of theological questions and to practical ethics, and does not call for detailed notice. While emphatically asserting his faith in supernatural religion, in the psychological part of his work he treats, not only conscience, but also the religious emotions entirely as developments from sensation, in the same sense as the pleasures of imagination.

Clearness, freedom from redundancy, and a severe simplicity and brevity are the best characteristics of his style. "No book," writes Sir James Mackintosh, "perhaps exists which, with so few of the common allurements, comes at last so much to please by the picture it presents of the writer's character. . . . Whoever bestows a careful perusal on the work must be unfortunate if he does not see, feel, and own that the writer was a great philosopher and a good man." (T. M. W.)

HARTLIB, SAMUEL (*c.* 1600–1662), was born towards the beginning of the 17th century at Ebling in Prussia, his father being a refugee from Poland. His mother was English. About 1628 Hartlib came to England, where he carried on a mercantile agency, and at the same time found leisure to enter with interest into the public questions of the day. An enthusiastic admirer of Comenius, he published in 1637 his *Conatum Comenianorum Præludia*, and in 1639 *Comenii Pansophiæ Prodromus et Didactica Dissertatio*. In 1641 appeared his *Relation of that which hath been lately attempted to procure Ecclesiastical Peace among Protestants*, and *A Description of Macaria*, containing his ideas of what a model state should be. During the civil war Hartlib occupied himself with the peaceful study of agriculture, printing at his own expense several treatises by others on the subject. In 1650 he issued the *Discourse of Flanders Husbandry* by Sir Richard Weston; and in 1651 his *Legacy, or an Enlargement of the Discourse of Husbandry used in Brabant and Flanders*, by Robert Child (see AGRICULTURE, vol. i. p. 265). For his various labors Hartlib received from Cromwell a pension of £100, afterwards increased to £300, as he had spent all his fortune on his experiments. He planned a school for the sons of gentlemen, to be conducted on new principles, and this probably was the occasion of his friend Milton's *Tractate on Education*, addressed to him in 1644, and of Sir William Petty's *Two Letters* on the same subject, in 1647 and 1648. His own literary labors were mostly confined to prefaces and short essays. Blythe, a contemporary, says that Ad. Speed, while engaged on his *Improvements in Husbandry*, was lodged and entertained by Samuel Hartlib. At the Restoration Hartlib lost his pension, which had already fallen into arrears; he petitioned parliament for a new grant of it, but what success he met with is unknown, as his latter years and death are wrapped in obscurity. 1662 has been assigned as the probable year of his death, as the latest of his extant letters bears that date.

His other publications are the following:—*Considerations tending to England's Reformation in Church and State*, 1647; *Vindication of Mr. John Durie*, 1650; *Twisse's Doubting Conscience Resolved*, 1652; *A true and ready way to learn the Latin Tongue*, 1654; *The Reformed Commonwealth of Bees, and the Reformed Virginian Silkworm*, 1655; and *The Compleat Husbandman*, 1659. See *Biographical Memoir of Samuel Hartlib*, by H. Dircks, 1865; *Gentleman's Magazine*, January, 1802; Warton's *Milton;* Harte's *Agricultural Essays;* Donaldson's *Agricultural Biography;* and Masson's *Milton*.

HARTMANN, MORITZ (1821–1872), a German poet and novelist, was born of Jewish parents at Duschnik in Bohemia, October 15, 1821. He studied at Prague and Vienna, and after a tour in Italy, Switzerland, and South Germany became a teacher in Vienna. He left Austria, however, in 1844, in order to publish without danger a volume of patriotic poems entitled *Kelch und Schwert*, which appeared at Leipsic in 1845, and in which he gave expression to somewhat radical sentiments as regards both church and state, in language full of the fire of youthful passion and tinged with considerable poetic fancy. After residing for some years in Belgium and France, he came to Leipsic, where in 1847 he published *Neuere Gedichte*. On his venturing towards the close of this year to return to Austria he suffered a short imprisonment, from which he was freed by the revolution of the following March. In the same year he was chosen to represent the district of Leitmeritz in the Frankfort parliament, where he took his seat on the extreme left. In October he accompanied Blum and Fröbel to Vienna, but he made his escape before the execution of Blum, and took part in the deliberations of the "Rump Parliament" at Stuttgart. In 1849 he published the *Reimchronik des Pfaffen Maurizius*, a satirical political poem in the style of the old chronicles. After the dissolution of the "Rump Parliament," he went to Switzerland, then to England and Ireland, and in 1850 to Paris, where, besides other literary engagements, he held that of correspondent to the *Kölnische Zeitung*. On the outbreak of the Russian war he became correspondent of the same paper in the Crimea, where he remained eighteen months. After several years' residence at Paris he settled in 1860 at Ghent, where he delivered courses of lectures on German literature and history in some of the principal academies. In 1863 he removed to Stuttgart to edit the *Freya*, and in 1868 he undertook the editorship at Vienna of the *Neue Freie Presse*. He died at Oberdöbling near Vienna, May 13, 1872. Hartmann published several volumes of poems in addition to those already mentioned, and besides his spirited accounts of his travels and adventures he is the author of various novels of more than average merit. A series of tales (*Novellen*, 3 vols.) appeared in 1863, and a second series (*Nach Natur*, 3 vols.) in 1866. His collected works were published at Stuttgart in 10 vols., 1873–74, and a selection of his poems at the same place in 1874.

HARTMANN VON AUE, a Middle High German poet, was born about 1170. He was of knightly rank, and held a fief at Aue, which was probably on the upper Neckar. He seems to have been educated in a monastery, and was able to read and write. Among his accomplishments was a knowledge of French, and as he took part in the third crusade he must be considered to have passed under the influences which were in his time most favorable to poetic impulse. Although his lyrics are not without merit he excels chiefly in narrative poetry; and the best known of his narrative poems, which was also one of the earliest, is *Der arme Heinrich* ("Poor Henry"). Some of the incidents of this tale are exceedingly repulsive, but others are marked by delicate grace and pathos. Two other tales, *Erec* and *Iwein*, the former written before 1197 and the latter before 1204, treat of the Arthurian legend, and are based upon French poems by Chrétien de Troies. The story of each is clearly conceived, and the diction is fresh, harmonious, and animated. Hartmann has neither the exquisite finish and charm of Gottfried of Strasburg nor the soaring imagination of Wolfram von Eschenbach; but he stands next to these supreme mediæval writers in the power of giving artistic shape to strong feeling. He is mentioned as alive in 1207 by Gottfried of Strasburg, but in 1220 his death is deplored by Heinrich von dem Türlein in the *Krone*.

Each of his works has found a special editor; and a complete edition of his writings has been issued by F. Bech in the *Deutsche Classiker des Mittelalters*. See L. Schmid, *Stand, Heimat, und Geschlecht des Minnesängers Hartmann* (1874).

HARTSHORN, SPIRITS OF, a name signifying originally the ammoniacal liquor obtained by the distillation of horn shavings, afterwards applied to the partially purified similar products of the action of heat on nitrogenous animal matter generally, and now popularly used to designate solution of ammonia. See AMMONIA, vol. i. p. 649, and CHEMISTRY, vol. v. p. 441.

HARUN ER RASHID. See HAROUN AL RASCHID.

HARUSPICES (literally entrail-observers, *cf.* Skt. *hilā*, Gr. *χορδή*), a class of soothsayers in Rome. Their art consisted especially in deducing from the appearance presented by the entrails of the slain victim the will of the gods. They also interpreted all portents or unusual phenomena of nature, especially thunder and lightning, and prescribed the expiatory ceremonies after such events. To please the god, the victim must be without spot or blemish, and the practice of observing whether the entrails presented any abnormal appearance, and thence deducing the will of heaven, was also very important in Greek religion. This art, however, appears not to have been, as some other modes of ascertaining the will of the gods undoubtedly were, of genuine Aryan growth. It is foreign to the Homeric poems, and must have been introduced into Greece after their composition. In like manner, as the Romans themselves believed, the art was not indigenous in Rome, but

derived from Etruria. The Etruscans were said to have learned it from a being named Tages, grandson of Jupiter, who had suddenly sprung from the ground near Tarquinii. The art was practised in Rome chiefly by Etruscans, seldom by native-born Romans who had studied in the priestly schools of Etruria. Though it was of great importance under the early republic, it never became a part of the state religion. In this respect the haruspices ranked lower than the augurs; the latter were a more ancient and purely Roman institution, and were a most important element in the political organization of the city. In later times the art fell into disrepute, and the saying of Cato the censor is well known, that he wondered one haruspex could look another in the face without laughing (Cic., *De Div.*, ii. 24). Under the empire, however, we hear of a regular collegium of sixty haruspices; and Claudius is said to have tried to restore the art and put it under the control of the pontifices.

HARVARD COLLEGE, the earliest institution of learning in the United States and on the continent of North America. The record gives its origin thus. The English colonists on Massachusetts Bay, settling at what is now Boston in 1630, began a plantation the next year three miles up Charles River, which they called "New Towne." The colony court of September, 1636, "agreed to give £400," which exactly doubled the public tax for the year, "towards a schoole or collidge, whereof £200 to be paid the next yeare, and £200 when the work is finished, and the next court to appoint wheare and what building." In November, 1637, "the Colledge is ordered to be at New Towne," the name of which had been changed to Cambridge, and a committee was appointed "to take order" for it. In March, 1638–39, "it is ordered that the colledge agreed upon formerly to bee built at Cambridge shalbee called Harvard Colledge." The reason was that the Rev. John Harvard, B. A., 1632, and M. A., 1635, of Emmanuel College, Cambridge, England, dying in Charlestown, Massachusetts, September 14, 1638, by will left half his estate, about £800, and his library, to the wilderness seminary. The college charter of 1650 declared the object to be "the education of the English and Indian youth of this country in knowledge and godlynes." The first brick edifice on the college grounds, having rooms for twenty of the aborigines, was called "the Indian college." In it was printed the apostle Eliot's translation of the Bible into the language of the natives, with primers, grammars, tracts, etc. Several of the natives were members of the college; only one graduated from it. By generous aid received from abroad for this special object, the college was greatly helped in its infancy.

Thus from the beginning private munificence rather than the public treasury fostered and sustained the college, and with steadily increasing preponderance all through its history have its supplies and endowments come from the generosity of individuals. Grants from the colony, province, and State, of small sums for salaries and incidental purposes, made annually or at intervals, wholly ceased more than sixty years ago. With scarce an exception all the present invested funds of the college and of its professional schools, amounting to $3,615,538·87, with the halls, library, and apparatus, are benefactions of its friends.

The charter constitutes as a corporation a president, treasurer, and five fellows, who initiate all measures concerning the college, hold its funds, and have the nomination for filling vacancies in their own body, as also of all the officers for instruction and for the internal government of the institution in all its departments, subject, however, to the advice and approval and final action of a board of overseers. The State, claiming as founder and patron, till quite recently regarded the college as a State institution, over which it should exercise a direct control through the legislature and the executive, by its authority in the membership and the election of the whole or a part of the board of overseers. Various modifications made from time to time in the composition or method of choice of the members of this board not relieving the controversies and embarrassments incident to legislative action, which proved prejudicial to the best interests of the college, its organic connection with the State by this tie was severed by statute in 1866. The board of overseers as now constituted is composed of thirty of the alumni, besides the president and the treasurer elected by the ballots of the alumni on commencement day at the college, in sections of five, serving a term of six years. With its complement of professional schools of law, medicine, theology, science, and many special departments of the latter, more than any other institution in America, and with but a few gaps yet to be filled in its completeness of method and equipment to bring it to comparison with foreign institutions of learning, Harvard College may claim to be in the most comprehensive sense of the term a university, a title which is, indeed, assumed, and generally applied to it. Recent changes in the course of study in the college have allowed a wide range for elective studies to undergraduates, the proportions being, one-fourth obligatory, three-fourths elective. In the professional schools most of the studies are obligatory. The number of bound volumes in the library and schools is 232,200. The number of halls owned and occupied for college uses is twenty-nine of brick or stone, including ten for students' chambers. The whole number of professors, instructors, etc., in all departments, is 581; of librarians, proctors, and other officers in the service of the college, 28. The number of the alumni of the college proper is 5,358.

HARVEST-BUG, a name erroneously applied to the hexapod larval condition of a mite, not one of the *Insecta*, but belonging to the division *Acaridea* of the class *Arachnida*. It is very small, of a brick-red color, and swarms both among wild vegetation and cultivated plants, especially near the sea, attaching itself, however, on the first opportunity to the bodies of human beings, hares, dogs, cats, and other mammals, and even insects. On reaching the skin, it rapidly burrows deeply into it, causing a painful itching, followed by a swelling of irritation and size varying with the individuals attacked, and enduring for several days. It is usually at the end of July or in August that these mites make their appearance; and the frequency with which they attach themselves to the lower extremities of people walking in fields at harvest-time has given rise to their trivial name. The effect of their subcutaneous presence varies in different people, as above mentioned; in some it assumes so intensely painful an aspect as to originate a disease called autumnal erythrema. Such severity of symptoms is generally found in warmer climates than that of Great Britain; the mite however is plentiful, and causes much annoyance, in Scotland. Extraction with a fine needle, under a magnifying power, is the best way to get rid of the pests; but the application of a solution of carbolic acid, benzine, sulphur ointment, or any other powerful and easily diffused insecticide agent will usually soon destroy them.

The scientific name of this creature is *Acarus* (*Leptus* or *Tetranychus*) *autumnalis*, and in France it has received various common names, that of "rouget" being the best known. It has been placed in different genera by modern authors, who have hitherto considered it as a fully developed form, of somewhat doubtful affinities. The old naturalist Degeer appears to have suspected its correct status as an imperfect *Acarus*; but it has been reserved for the French naturalist, M. P. Mégnin, to prove from actual observation the fact that it is only the larva of a well-known mite, *Trombidium holosericeum*, a silky bright scarlet species often found in spring and early summer in gardens and fields. This distinguished biologist has in like manner put beyond doubt the identity of various other members of the *Acaridea*, hitherto dissociated. In April he found both sexes of the perfect mite, but at the end of May and in June only gravid females occurred. These in June and July deposited their eggs, from which was hatched the creature heretofore known as *Acarus* (or *Leptus*) *autumnalis*. As soon as this has implanted its mandibles into the skin of the individual attacked, its abdomen dilates perceptibly, finally becoming about five times as large as on leaving the egg, though the cephalothorax and limbs remain unchanged. It turns to an octopod nymph, or pupa; and after hibernation, during which the nutritive fluids imbibed in the parasitic stage are assimilated, the adult stage of a purely phytophagous *Trombidium*, capable of reproduction, is reached.

There seems every reason to believe that the skin irritation caused in Mexico by a supposed insect, called *Thalsahuate* or *Tlalsahuate* by the Indians, is really produced by this or a closely allied mite. Similar complaints are apparently caused by mites in Brazil, Martinique, Honduras, etc.; and the symptoms are naturally aggravated in such tropical localities.

An account, with figures, of all the stages of *Trombidium holosericeum* and the allied *T. fuliginosum* (of which the octopod *T. phalangii*, parasitic upon very long-legged spiders, is the nymph or pupa) will be found in the *Annales des Sciences Naturelles*, 6me série, iii. (1876), article No. 5, by M. Mégnin.

HARVEY, Gabriel (1545–1630), an English writer of the Elizabethan period, was the eldest son of a rope-maker at Saffron Walden, and received his education at Christ's College and Pembroke Hall, Cambridge, where we find him about 1576–78 lecturing on rhetoric. Immediately afterwards he appears to have been sent abroad by his patron the earl of Leicester, to whom he refers in his *Gratulationum Waldinensium libri quatuor* (Lond., 1578), a collection of pieces in honor of the queen's visit to Audley End, near his native town. In 1585 he became doctor of laws. Though Harvey expresses a desire to be "epitaphed the Inventor of the English Hexameter," his name, familiar enough to his more learned contemporaries, would probably have been well nigh forgotten had it not been for his friendship with Spenser and his hostilities with Greene and Nash. To the student of Spenser he is familiar as one of the poet's principal correspondents, and as the Hobbinol who wrote the poem prefixed to the "Faerie Queen." His quarrel with Greene and Nash was begun by Greene alluding in his *Quip for an Upstart Courtier* (1592) to the fact that Harvey was the son of a rope-maker; and after Greene's death it raged with ever increasing violence until the archbishop of Canterbury issued an order for the seizure of all works written by either of the combatants.

Harvey's extant publications, which contain many minor matters of interest to the student of literature, are—*Ciceronianus*, London, H. Binnemann, 1577; *Rhetor, vel duorum dierum Oratio de Natura, Arte, et Exercitatione Rhetorica*, 1577; *Smithus vel Musarum Lachrymæ*, Lond., 1578, in honor of the scholarly Sir Thomas Smith; *Foure Letters and certaine Sonnets, especially touching Robert Greene and other parties by him abused*, 1592; *Pierce's Supererogation, or a new Prayse of the Old Asse*, 1593, reprinted, but inaccurately, by Mr. Collier, 4to, 1868; *A new Letter of Notable Contents*, 1593; *The Trimming of Thomas Nash, Gentleman, by the high tituled Don Richardo de Medico Campo*, 1597, reprinted in *The Old Book Collector's Miscellany*, Lond., 1871. See Warton's *History of English Poetry*, Hazlitt's edition, and J. P. Collier's *Bibliographical and Critical Account of the Rarest Books in the English Language*, Lond., 1865, under "Harvey," "Nash," and "Greene."

HARVEY, Sir George (1806–1876), a Scottish painter and president of the Royal Scottish Academy, was the son of a watchmaker, and was born at St. Ninians, near Stirling, in February, 1806. Soon after his birth his parents removed to Stirling, where George was apprenticed to a bookseller. His love for art having, however, become very decided, he in his eighteenth year entered the Trustees' Academy at Edinburgh. Here he so distinguished himself that in 1826 he was invited by the Scottish artists, who had resolved to found a Scottish academy, to join it as an associate. Indeed it was chiefly to the zeal and judgment of Harvey and of two others that it owed its early success. Harvey's first picture, A Village School, was exhibited in 1826 at the Edinburgh Institution; and from the time of the opening of the Academy in the following year he continued annually to enrich its exhibitions by a succession of pictures which, although they never obtained much fame beyond the limits of Scotland, appealed with such effect to Scottish sentiment as to win for him in his native land an unrivalled popularity. His best known pictures are those depicting historical episodes in religious history from a puritan or evangelical point of view, such as Covenanters Preaching, Covenanters' Communion, John Bunyan and his Blind Daughter, Sabbath Evening, and the Quitting of the Manse. He was, however, equally successful in subjects not directly religious; and the Bowlers, A Highland Funeral, The Curlers, A Schule Skailin', and Children Blowing Bubbles in the Churchyard of Greyfriars, Edinburgh, manifest the same close observation of character, artistic conception, and conscientious elaboration of details. In the Night Mail and Dawn Revealing the New World to Columbus the aspects of nature are made use of in different ways, but with equal happiness, to lend impressiveness and solemnity to human concerns. It was chiefly in his later years that he devoted his attention to landscape, the branch of art in which on the whole he was most successful, and there perhaps in suggesting the deep calm and the sweet and varied charm which broods among the hills when nature is at rest. He also devoted some attention to portraiture, among his works in this branch of art being a portrait of Professor Wilson, now at the Philosophical Institution, Edinburgh. In 1829 he was elected a fellow of the Royal Scottish Academy, and in 1864 he succeeded Sir J. W. Gordon as president. He received the honor of knighthood in 1867. His death took place at Edinburgh, January 22, 1876.

Sir George Harvey was the author of a paper on the "Color of the Atmosphere," read before the Edinburgh Royal Society, and afterwards published with illustrations in *Good Words;* and in 1870 he published a small volume entitled *Notes of the Early History of the Royal Scottish Academy. Selections from the Works of Sir George Harvey, P. R. S. A., described by the Rev. A. L. Simpson, F. S. A. Scot., and photographed by Thomas Annan*, appeared at Edinburgh in 1869.

HARVEY, William (1578–1657), the discoverer of the circulation of the blood, was the eldest son of Thomas Harvey, a prosperous Kentish yeoman, and was born at Folkestone on April 1, 1578. After passing through the grammar school of Canterbury, on the 31st of May, 1593, having just entered his sixteenth year, he became a pensioner of Caius College, Cambridge; at nineteen he took his B. A. degree, and soon after, having chosen the profession of medicine, he went to study at Padua under Fabricius and Casserius (see Anatomy, vol. i. p. 710). At the age of twenty-four Harvey became doctor of medicine, April, 1602. Returning to England in the first year of James I., he settled in London; and two years later he married the daughter of Dr. Lancelot Brown, who had been physician to Queen Elizabeth. In the same year Harvey became a candidate of the Royal College of Physicians, and was duly admitted a fellow (June, 1607). In 1609 he obtained the reversion of the post of physician to St. Bartholomew's Hospital. His application was supported by the king himself and by Dr. Atkins, the president of the college. On the death of Dr. Wilkinson in the course of the same year he succeeded to the post. He was thrice censor of the college, and in 1615 was appointed Lumleian lecturer. In the following year—the year of Shakespeare's death—he began his course of lectures, and first brought forward his views upon the movements of the heart and blood.[1] Meantime his practice increased, and he had the lord chancellor, Francis Bacon, and the earl of Arundel among his patients. In 1618 he was appointed physician extraordinary to James I., and on the next vacancy physician in ordinary to his successor. In 1628, the year of the publication of the *Exercitatio Anatomica de Motu Cordis et Sanguinis*, he was elected treasurer of the College of Physicians, but at the end of the following year he resigned the office, in order, by command of Charles I., to accompany the young duke of Lennox (James Stuart, afterwards duke of Richmond) on his travels. He appears to have visited Italy, and returned in 1632. Four years later he accompanied the earl of Arundel on his embassy to the emperor. He was eager in collecting objects of natural history, sometimes causing the earl anxiety for his safety by his excursions in a country infested by robbers after the Thirty Years' War. In a letter written on this journey, he says—"By the way we could scarce see a dog, crow, kite, raven, or any bird, or anything to anatomize; only some few miserable people, the reliques of the war and the plague, whom famine had made anatomies before I came." Having returned to his practice in London at the close of the year 1636, he accompanied Charles I. in one of his journeys to Scotland (1639 or 1641). While at Edinburgh he visited the Bass Rock; he minutely describes its abundant population of sea-fowl in his treatise *De Generatione*, and incidentally speaks of the then credited account of the solan goose growing on trees as a fable. He was in attendance on the king at the battle of Edgehill (October, 1642), where he withdrew under a hedge with the prince of Wales and the duke of York (then boys of twelve and ten years old), "and took out of his pocket a book and read. But he had not read very long before a bullet of a great gun grazed on the ground near him, which made him remove his station," as he afterwards told Aubrey. After the indecisive battle, Harvey followed Charles I. to Oxford, "where," writes the same gossiping narrator, "I first saw him, but was then too young to be acquainted with so great a doctor. I remember he came several times to our college (Trinity) to George Bathurst, B. D., who had a hen to hatch eggs in his chamber, which they opened daily to see the progress and way of generation." In Oxford he remained three years, and there was some chance of his being superseded in his office at St.

[1] A venerable MS. notebook in Harvey's own crabbed handwriting was discovered only lately in the British Museum, with the title "Prælectiones anatomicæ," etc.; this, so far as it has been deciphered, contains the germs of his great discovery.

Bartholomew's Hospital, "because he hath withdrawn himself from his charge, and is retired to the party in arms against the Parliament." It was no doubt at this time that his lodgings at Whitehall were scarched, and not only the furniture seized but also invaluable manuscripts and anatomical preparations.[1]

While with the king at Oxford he was made warden of Merton College, but a year later, in 1646, that city surrendered to Fairfax, and Harvey returned to London. He was now sixty-eight years old, and, having resigned his appointments and relinquished the cares of practice, lived in learned retirement with one or other of his brothers. It was in his brother Daniel's house at Combe that Dr. (afterwards Sir George) Ent, a faithful friend and disciple (1604–1689), visited him in 1650. "I found him," he says, "with a cheerful and sprightly countenance invcstigating, like Democritus, the nature of things. Asking if all were well with him—'How can that be,' he replied, 'when the state is so agitated with storms and I myself am yet in the open sea? And indeed, were not my mind solaced by my studies and the recollection of the observations I have formerly made, there is nothing which should make me desirous of a longer continuance. But thus employed, this obscure life and vacation from public cares which would disgust other minds is the medicine of mine.'" The work on which he had been chiefly engaged at Oxford, and indeed since the publication of his treatise on the circulation in 1628, was an investigation into the recondite but deeply interesting subject of generation. Charles I. had been an enlightened patron of Harvey's studies, had put the royal deer parks at Windsor and Hampton Court at his disposal, and had watched his demonstration of the growth of the chick with no less interest than the movements of the living heart. Harvey had now collected a large number of observations, though he would probably have delayed their publication. But Ent succeeded in obtaining the manuscripts, with authority to print them or not as he should find them. "I went from him," he says, "like another Jason in possession of the golden fleece, and when I came home and perused the pieces singly, I was amazed that so vast a treasure should have been so long hidden." The result was the publication of the *Exercitationes de Generatione* (1651).

This was the last of Harvey's labors. He had now reached his seventy-third year. His theory of the circulation had been opposed and defended, and was now generally accepted by the most eminent anatomists both at home and abroad. He was known and honored throughout Europe, and his own college erected a statue in his honor (1652), "viro monumentis suis immortali." In 1654 he was elected to the highest post in his profession, that of president of the college; but the following day he met the assembled fellows, and, declining the honor for himself on account of the infirmities of age, recommended the re-election of the late president Dr. Prujean. He accepted, however, the office of consiliarius, which he again held in the two following years. He had already enriched the college with other gifts besides the honor of his name. He had raised for them "a noble building of Roman architecture (rustic work with Corinthian pilasters), comprising a great parlor or conversation room below and a library above;" he had furnished the library with books, and filled the museum with "simples and rarities," as well as with specimens of instruments used in the surgical and obstetric branches of medicine. At last he determined to give to his beloved college his paternal estate at Burmarsh in Kent. His wife had died some years before, his brothers were wealthy men, and he was childless, so that he was defrauding no heir when, in July, 1656, he made the transfer of this property, then valued at £56 per annum, with provision for a salary to the college librarian and for the endowment of an annual oration, which is still given on the anniversary of the day. The orator, so Harvey orders in his deed of gift, is to exhort the fellows of the college "to search out and study the secrets of nature by way of experiment, and also for the honor of the profession to continue mutual love and affection among themselves."

Harvey, like his contemporary and great successor Sydenham, was long afflicted with gout, but he preserved his activity of mind to an advanced age. In his eightieth year, on the 3d of June, 1657,[2] he was attacked by paralysis, and though deprived of speech was able to send for his nephews and distribute his watch, ring, and other personal trinkets among them. He died the same evening, "the palsy giving him an easy passport," and was buried with great honor in his brother Eliab's vault at Hempstead in Essex, "annorum et famæ satur."

Aubrey, to whom we owe most of the minor particulars about Harvey which have been preserved, says—"In person he was not tall, but of the lowest stature; round faced, olivaster complexion, little eyes, round, very black, full of spirits; his hair black as a raven, but quite white twenty years before he died." The best portrait of him extant is by Cornelius Jansen in the library of the College of Physicians, one of those rescued from the great fire, which destroyed their original hall in 1666. It has been often engraved, and is prefixed to the fine edition of his works published in 1766.

Harvey's Work on the Circulation.—In estimating the character and value of the discovery announced in the *Exercitatio de Motu Cordis et Sanguinis*, it is necessary to bear in mind the previous state of knowledge on the subject. Aristotle taught that in man and the higher animals the blood was elaborated from the food in the liver, thence carried to the heart, and sent by it through the veins over the body. His successors of the Alexandrian school of medicine, Erasistratus and Herophilus,[3] further elaborated his system, and taught that, while the veins carried blood from the heart to the members, the arteries carried a subtle kind of air or spirit. For the practical physician only two changes had been made in this theory of the circulation between the Christian era and the 16th century. Galen had discovered that the arteries were not, as their name implies, merely air-pipes, but that they contained blood as well as vital air or spirit. And it had been gradually ascertained that the nerves (*νεῦρα*) which arose from the brain and conveyed "animal spirits" to the body were different from the tendons or sinews (*νεῦρα*) which attach muscles to bones. *First*, then, the physicians of the time of Linacre knew that the blood is not stagnant in the body. So did Shakespeare and Homer, and every augur who inspected the entrails of a victim, and every village barber who breathed a vein. Plato even uses the expression *τὸ αἷμα κατὰ πάντα τὰ μέλη σφοδρῶς περιφερέσθαι*. But no one had a conception of a continuous stream returning to its source (a circulation in the true sense of the word) either in the system or in the lungs. If they used the word *circulatio*, as did Cæsalpinus,[3] it was as vaguely as the French policeman cries "Circulez." The movements of the blood were in fact thought to be slow and irregular in direction as well as in speed, like the "circulation" of air in a house, or the circulation of a crowd in the streets of a city. *Secondly*, they supposed that one kind of blood flowed from the liver to the right ventricle of the heart, and thence to the lungs and the general system by the veins, and that another kind flowed from the left ventricle to the lungs and general system by the arteries. *Thirdly*, they supposed that the septum of the heart was pervious and allowed blood to pass directly from the right to the left side. *Fourthly*, they had no conception of the functions of the heart as the motor power of the movement of the blood. They doubted whether its substance was muscular; they supposed its pulsation to be due to expansion of the spirits it contained; they believed the only dynamic effect which it had on the blood to be sucking it in during its active diastole, and they supposed the chief use of its constant movements to be the due mixture of blood and spirits.

Of the great anatomists of the 16th century, Sylvius (*In Hipp. et Gal. Phys. Partem Anatom. Isagoge*) described the

[1] "Ignoscant mihi niveæ animæ, si, summarum injuriarum memor, levem gemitum effudero. Doloris mihi hæc causa est: cum, inter nuperos nostros tumultus et bella plusquam civilia, serenissimum regem (idque non solum senatus permissione sed et jussu) sequor, rapaces quædam manus non modo ædium mearum supellectilem omnem expilarunt, sed etiam, quæ mihi causa gravior querimoniæ, adversaria mea, multorum annorum laboribus parta, e museo meo summoverunt. Quo factum est ut observationes plurimæ, præsertim de generatione insectorum, cum republicæ literariæ (ausim dicere) detrimento, perierint."—*De Gen.*, Ex. lxviii. To this loss Cowley refers—

"O cursed war! who can forgive thee this?
Houses and towns may rise again,
And ten times easier 'tis
To rebuild Paul's than any work of his.'

[2] This is the date usually given according to the college annals. Granger's *Biographical History of England* makes it June 30; Hamey, a contemporary, June 15; while Dr. Lawrence, following the inscription on the tomb, gives June 3, 1658.

[3] Indeed the same word, *περίοδος αἵματος*, occurs in the Hippocratic writings, and was held by Van der Linden to prove that to the father of medicine himself, and not to Columbus or Cæsalpinus, belonged the laurels of Harvey.

valves of the veins; Vesalius (*De Humani Corporis Fabrica*, 1542) ascertained that the septum between the right and left ventricles is complete, though he could not bring himself to deny the invisible pores which Galen's system demanded. Servetus, in his *Christianismi Restitutio* (1553), goes somewhat further than his fellow-student Vesalius, and says—"Paries ille medius non est aptus ad communicationem et elaborationem illam, licet aliquid resudare possit;" and, from this anatomical fact and the large size of the pulmonary arteries, he concludes that there is a communication in the lungs by which blood passes from the pulmonary artery to the pulmonary vein—"Eodem artificio quo in hepato fit transfusio a vena portæ ad venam cavam propter sanguinem, fit etiam in pulmone transfusio a vena arteriosa ad arteriam venosam propter spiritum." The natural spirit of the left side and the vital spirit of the right side of the heart were therefore, he concluded, practically the same, and hence two instead of three distinct *spiritus* should be admitted. It seems doubtful whether even Servetus rightly conceived of the entire mass of the blood passing through the pulmonary artery and the lungs. The transference of the *spiritus naturalis* to the lungs, and its return to the left ventricle as *spiritus vitalis*, was the function which he regarded as important. Indeed a true conception of the lesser circulation as a transference of the whole blood of the right side to the left was impossible until the corresponding transference in the greater or systemic circulation was discovered. Servetus, however, was the true predecessor of Harvey in physiology and his claims to that honor are perfectly authentic and universally admitted.[1]

The way then to Harvey's great work had been paved by the discovery of the valves in the veins, and by that of the lesser circulation,—the former due to Sylvius and Fabricius, the latter to Servetus,—but the significance of the valves was unsuspected, and the fact of even the pulmonary circulation was not generally admitted in its full meaning.

In his treatise Harvey proves (1) that it is the contraction, not the dilatation, of the heart which coincides with the pulse, and that the ventricles as true muscular sacs squeeze the blood which they contain into the aorta and pulmonary artery; (2) that the pulse is not produced by the arteries enlarging and so filling, but by the arteries being filled with blood and so enlarging; (3) that there are no pores in the septum of the heart, so that the whole blood in the right ventricle is sent to the lungs and round by the pulmonary veins to the left ventricle, and also that the whole blood in the left ventricle is again sent into the arteries, round by the smaller veins into the venæ cavæ, and by them to the right ventricle again—thus making a complete "circulation;" (4) that the blood in the arteries and that in the veins is the same blood; (5) that the action of the right and left sides of the heart, auricles, ventricles, and valves, is the same, the mechanism in both being for reception and propulsion of liquid and not of air, since the blood on the right side, though mixed with air, is still blood; (6) that the blood sent through the arteries to the tissues is not all used, but that most of it runs through into the veins; (7) that there is no to and fro undulation in the veins, but a constant stream from the distant parts towards the heart, (8) that the dynamical starting-point of the blood is the heart and not the liver.

The *method* by which Harvey arrived at his complete and almost faultless solution of the most fundamental and difficult problem in physiology has been often discussed, and is well worthy of attention. He begins his treatise by pointing out the many inconsistencies and defects in the Galenical theory, quoting the writings of Galen himself, of Fabricius, Columbus, and others, with great respect, but with unflinching criticism. For, in his own noble language, wise men must learn anatomy, not from the decrees of philosophers, but from the fabric of nature herself, 'nec ita in verba jurare antiquitatis magistræ, ut veritatem amicam in apertis relinquant, et in conspectu omnium deserant.' He had, as we know, not only furnished himself with all the knowledge that books and the instructions of the best anatomists of Italy could give, but, by a long series of dissections, had gained a far more complete knowledge of the comparative anatomy of the heart and vessels than any contemporary—we may almost say than any successor, until the times of Hunter and Meckel. Thus equipped, he tells us that he began his investigations into the movements of the heart and blood by looking at them—*i. e.*, by seeing their actions in living animals. After a modest preface, he heads his first chapter 'Ex vivorum dissectione, qualis sit cordis motus." He minutely describes what he saw and handled in dogs, pigs, serpents, frogs, and fishes, and even in slugs, oysters, lobsters, and insects, in the transparent *minima squilla*, "quæ Anglice dicitur *a shrimp*," and lastly in the chick while still in the shell. In these investigations he used a *perspicillum* or simple lens. He particularly describes his observations and experiments on the ventricles, the auricles, the arteries, and the veins. He shows how the arrangement of the vessels in the fœtus supports his theory. He adduces facts observed in disease as well as in health to prove the rapidity of the circulation. He explains how the mechanism of the valves in the veins is adapted, not, as Fabricius believed, to moderate the flow of blood from the heart, but to favor its flow to the heart. He estimates the capacity of each ventricle, and reckons the rate at which the whole mass of blood passes through it. He elaborately and clearly demonstrates the effect of obstruction of the blood-stream in arteries or in veins, by the forceps in the case of a snake, by a ligature on the arm of a man, and illustrates his argument by figures. He then sums up his conclusion thus:—"Circulari quodam motu, in circuitu, agitari in animalibus sanguinem, et esse in perpetuo motu; et hanc esse actionem sive functionem cordis quam pulsu peragit; et omnino motus et pulsus cordis causam unam esse." Lastly, in the 15th, 16th, and 17th chapters, he adds certain confirmatory evidence, as the effect of position on the circulation, the absorption of animal poisons, and of medicines applied externally, the muscular structure of the heart and the necessary working of its valves. The whole treatise, which occupies only 67 pages of large print in the quarto edition of 1766, is a model of accurate observation, patient accumulation of facts, ingenious experimentation, bold yet cautious hypothesis, and logical deduction.

In one point only was the demonstration of the circulation incomplete. Harvey could not discover the capillary channels by which the blood passes from the arteries to the veins. This gap in the circulation was supplied several years later by the great anatomist Malpighi, who in 1661 saw in the lungs of a frog, by the newly invented microscope, how the blood passes from the one set of vessels to the other. Harvey saw all that could be seen by the unaided eye in his observations on living animals; Malpighi, four years after Harvey's death, by another observation on a living animal, completed the splendid chain of evidence. If this detracts from Harvey's merit it leaves Servetus no merit at all. But in fact the existence of the channels first seen by Malpighi was as clearly pointed to by Harvey's reasoning as the existence of Neptune by the calculations of Le Verrier and of Adams.

Harvey himself and all his contemporaries were well aware of the novelty and importance of his theory. He says in the admirable letter to Dr. Argent, president of the College of Physicians, which follows the dedication of his treatise to

[1] Realdus Columbus (*De Re Anatomica*, 1559) formally denies the muscularity of the heart, yet correctly teaches that blood and spirits pass from the right to the left ventricle, not through the septum, but through the lungs, "quod nemo hactenus aut animadvertit aut scriptum reliquit." The fact that Harvey quotes Columbus and not Servetus is explained by the almost entire destruction of the writings of the latter, which are now among the rarest curiosities. The great anatomist Fabricius, Harvey's teacher at Padua, described the valves of the veins more perfectly than had Sylvius. Ruini, in his treatise on the *Anatomy and Diseases of the Horse* (1590), taught that the left ventricle sends blood and vital spirits to all parts of the body except the lungs—the ordinary Galenical doctrine. Yet on the strength of this phrase Professor Ercolani has actually put up a tablet in the veterinary school at Bologna to Ruini as the discoverer of the circulation of the blood! The claims of Cæsalpinus, a more plausible claimant to Harvey's laurels, are scarcely better founded. In his *Quæstiones Peripateticæ* (1571) he followed Servetus and Columbus in describing what we now know as the pulmonary "circulation" under that name, and this is the only foundation for the assertion (first made in Bayle's dictionary) that Cæsalpinus knew "the circulation of the blood." He is even behind Servetus, for he only allows part of the blood of the right ventricle to go round by this "circuit;" some, he conceives, passes through the hypothetical pores in the septum, and the rest by the superior cava to the head and arms, by the inferior to the rest of the body—"Hanc esse venarum utilitatem ut omnes partes corporis sanguinem pro nutrimento deferant. Ex dextro ventre cordis vena cava sanguinem crassiorem, in quo calor intensus est magis, ex altero autem ventre, sanguinem temperatissimum ac sincerissimum habente, egreditur aorta." Cæsalpinus seems to have had no original views on the subject; all that he writes is copied from Galen or from Servetus except some erroneous observations of his own. His greatest merit was as a botanist; and no claim to the "discovery of the circulation" was made by him or by his contemporaries. When it was made, Haller decided conclusively against it. The fact that an inscription was lately placed on the bust of Cæsalpinus at Rome, which states that he preceded others in recognizing and demonstrating "the general circulation of the blood," is only a proof of the blindness of misplaced national vanity.

Charles I., that he should not have ventured to publish "a book which alone asserts that the blood pursues its course and flows back again by a new path, contrary to the received doctrine taught so many ages by innumerable learned and illustrious men," if he had not set forth his theory for more than nine years in his college lectures, gradually brought it to perfection, and convinced his colleagues by actual demonstrations of the truth of what he advanced. He anticipates opposition, and even obloquy or loss, from the novelty of his views. These anticipations, however, the event proved to have been groundless. If we are to credit Aubrey indeed, he found that after the publication of the *De Motu* "he fell mightily in his practice; 'twas believed by the vulgar that he was crackbrained, and all the physicians were against him." But the last assertion is demonstrably untrue; and if apothecaries and patients ever forsook him, they must soon have returned, for Harvey left a handsome fortune. By his own profession the book was received as it deserved. So novel a doctrine was not to be accepted without due inquiry, but his colleagues had heard his lectures and seen his demonstrations for years; they were already convinced of the truth of his theory, urged its publication, continued him in his lectureship, and paid him every honor in their power. Abroad the book was widely read and much canvassed. Few accepted the new theory; but no one dreamt of claiming the honor of it for himself, nor for several years did any one pretend that it could be found in the works of previous authors. The first attack on it was a feeble tract by one Primerose, a pupil of Riolanus (*Exerc. et Animadv. in Libr. Harvei de Motu Cord. et Sang.*, 1630). Five years later Parisanus, an Italian physician, published his *Lapis Lydius de Motu Cord. et Sang.* (Venice, 1635), a still more bulky and futile performance. Primerose's attacks were "imbellia pleraque" and "sine ictu;" that of Parisanus "in quamplurimis turpius," according to the contemporary judgment of Vessling. Their dulness has protected them from further censure. Caspar Hoffmann, professor at Nuremberg, while admitting the truth of the lesser circulation in the full Harveian sense, denied the rest of the new doctrine. To him the English anatomist replied in a short letter, still extant, with great consideration yet with modest dignity, beseeching him to convince himself by actual inspection of the truth of the facts in question. He concludes—"I accept your censure in the candid and friendly spirit in which you say you wrote it; do you also the same to me, now that I have answered you in the same spirit." This letter is dated May, 1636, and in that year Harvey passed through Nuremberg with the earl of Arundel, and visited Hoffmann. But he failed to convince him; "nec tamen valuit Harveius vel coram," writes Schlegel, who, however, afterwards succeeded in persuading the obstinate old Galenist to soften his opposition to the new doctrine, and thinks that his complete conversion might have been effected if he had but lived a little longer—"nec dubito quin concessisset tandem in nostra castra." While in Italy the following year Harvey visited his old university of Padua, and demonstrated his views to Professor Vessling. A few months later this excellent anatomist wrote him a courteous and sensible letter, with certain objections to the new theory. The answer to this has not been preserved, but it convinced his candid opponent, who admitted the truth of the circulation in a second letter (both were published in 1640), and afterwards told a friend, "Harveium nostrum si audis, agnosces cœlestem sanguinis et spiritus ingressum ex arteriis per venas in dextrum cordis sinum." Meanwhile a greater convert, Descartes, in his *Discours sur la Méthode* (1637), had announced his adhesion to the new doctrine, and refers to "the English physician to whom belongs the honor of having first shown that the course of the blood in the body is nothing less than a kind of perpetual movement in a circle." Walæus of Leyden, Regius of Utrecht, and Schlegel of Hamburg successively adopted the new physiology. Of these professors, Regius was mauled by the pertinacious Primerose and mauled him in return (*Spongia qua eluuntur sordes quæ Jac. Primirosius*, etc., and *Antidotum adv. Spongiam venenatam Henr. Regii*). Descartes afterwards repeated Harvey's vivisections, and, more convinced than ever, demolished an unlucky Professor Plempius of Louvain, who had written on the other side. Dr. George Ent also published an *Apologia pro Circulatione Sanguinis* in answer to Parisanus.

At last Riolan ventured to publish his *Enchiridium Anatomicum* (1648), in which he attacks Harvey's theory, and proposes one of his own. Riolan had accompanied the queen dowager of France (Maria de' Medici) on a visit to her daughter at Whitehall, and had there met Harvey and discussed his theory. He was, in the opinion of the judicious Haller, "vir asper et in nuperos suosque cœvos immitis ac nemini parcens, nimis avidus suarum laudum præco, et se ipso fatente anatomicorum princeps." Harvey replied to the *Enchiridium* with perfectly courteous language and perfectly conclusive arguments, in two letters *De Circulatione Sanguinis*, which were published at Cambridge in 1649, and are still well worth reading. He speaks here of the "circuitus sanguinis a me inventus." Riolan was unconvinced, but lived to see another professor of anatomy appointed in his own university who taught Harvey's doctrines. Even in Italy, Trullius, professor of anatomy at Rome, expounded the new doctrine in 1651. But the most illustrious converts were Pecquet of Dieppe, the discoverer of the thoracic duct, and of the true course of the lacteal vessels, and Thomas Bartholinus of Copenhagen, in his *Anatome ex omnium Veterum Recentiorumque Observationibus, imprimis Institutionibus beati mei parentis Caspari Bartholini, ad Circulationem Harveianam et vasa lymphatica renovata* (Leyden, 1651). At last Plempius also retracted all his objections; for, as he candidly stated, "having opened the bodies of a few living dogs, I find that all Harvey's statements are perfectly true." Hobbes of Malmesbury could thus say in the preface to his *Elementa Philosophiæ* that his friend Harvey, "solus quod sciam, doctrinam novam superata invidia vivens stabilivit."

It has been made a reproach to Harvey that he failed to appreciate the importance of the discoveries of the lacteal and lymphatic vessels by Aselli, Pecquet, and Bartholinus. In three letters on the subject, one to Dr. Morrison of Paris (1652) and two to Dr. Horst of Darmstadt (1655), a correspondent of Bartholin's, he discusses these observations, and shows himself unconvinced of their accuracy. He writes, however, with great moderation and reasonableness, and excuses himself from investigating the subject further on the score of the infirmities of age; he was then above seventy-four. The following quotation shows the spirit of these letters:—"Laudo equidem summopere Pecqueti aliorumque in indaganda veritate industriam singularem, nec dubito quin multa adhuc in Democriti puteo abscondita sint, a venturi sæculi indefatigabili diligentia expromenda." Bartholin, though reasonably disappointed in not having Harvey's concurrence, speaks of him with the utmost respect, and generously says that the glory of discovering the movements of the heart and of the blood was enough for one man.

Harvey's Work on Generation.—We have seen how Dr. Ent persuaded his friend to publish this book in 1651. It is between five and six times as long as the *Exerc. de Motu Cord. et Sang.*, and is followed by excursus *De Partu, De Uteri Membranis, De Conceptione;* but, though the fruit of as patient and extensive observations, its value is far inferior. The subject was far more abstruse, and in fact inaccessible to proper investigation without the aid of the microscope. And the field was almost untrodden since the days of Aristotle. Fabricius, Harvey's master, in his work *De Formatione Ovi et Pulli* (1621), had alone preceded him in modern times. Moreover, the seventy-two chapters which form the book lack the co-ordination so conspicuous in the earlier treatise, and some of them seem almost like detached chapters of a system which was never completed or finally revised.

Aristotle had believed that the male parent furnished the body of the future embryo, while the female only nourished and formed the seed; this is in fact the theory on which, in the *Eumenides* of Æschylus, Apollo obtains the acquittal of Orestes. Galen taught almost as erroneously that each parent contributes seeds, the union of which produced the young animal. Harvey, after speaking with due honor of Aristotle and Fabricius, begins rightly "ab ovo;" for, as he remarks, "eggs cost little and are always and everywhere to be had," and moreover "almost all animals, even those which bring forth their young alive, and man himself, are produced from eggs" ("omnia omnino animalia, etiam vivipara, atque hominem adeo ipsum, ex ovo progigni"). This dictum, usually quoted as "omne vivum ex ovo," would alone stamp this work as worthy of the discoverer of the circulation of the blood, but it was a prevision of genius, and was not proved to be a fact until Von Baer discovered the mammalian ovum in 1827. Harvey proceeds with a careful anatomical description of the ovary and oviduct of the hen, describes the new-laid egg, and then gives an account of the appearance seen on the successive days of incubation, from the 1st to the 6th, the 10th, and the 14th, and lastly describes the process of hatching. He then comments upon and corrects the opinions of Aristotle and Fabricius, declares against spontaneous generation (though in one passage he seems to admit the current doctrine of production of worms by putrefaction as an exception), proves that there is no *semen fœmineum*, that the chalazæ of the hen's egg are not the *semen galli*, and that both parents contribute to the formation of the egg. He describes accurately the first appearance of the ovarian ova as mere specks, their assumption of yelk, and afterwards of albumen. In chapter xlv. he describes two methods of production of the embryo from the ovum: one is *metamorphosis*, or the direct transformation of pre-existing material, as a worm from an egg, or a butterfly from an *aurelia* (chrysalis); the other is *epigenesis*, or development with addition of parts, the true generation observed in all higher animals. Chapters xlvi.–l. are devoted to the abstruse question of the efficient cause of generation, which, after much discussion of the opinions of Aristotle and of Sennertus, Harvey refers to the action of

both parents as the efficient instruments of the first great cause.[1] He then goes on to describe the order in which the several parts appear in the chick. He states that the *punctum saliens* or fœtal heart is the first organ to be seen, and explains that the nutrition of the chick is not only effected by yelk conveyed directly into the midgut, as Aristotle taught, but also by absorption from yelk and white by the umbilical (omphalomeseraic) veins; on the fourth day of incubation appear two masses (which he oddly names *vermiculus*), one of which develops into three vesicles, to form the cerebrum, cerebellum, and eyes, the other into the breastbone and thorax; on the sixth or seventh day come the viscera, and lastly, the feathers and other external parts. Harvey points out how nearly this order of development in the chick agrees with what he had observed in mammalian and particularly in human embryos. He notes the bifid apex of the fœtal heart in man and the equal thickness of the ventricles, the soft cartilages which represent the future bones, the large amount of liquor amnii and absence of placenta which characterize the fœtus in the third month; in the fourth the position of the testes in the abdomen, and the uterus with its Fallopian tubes resembling the uterus bicornis of the sheep; the large thymus; the cæcum, small as in the adult, not forming a second stomach as in the pig, the horse, and the hare; the lobulated kidneys, like those of the seal (*"vitulo,"* sc. *marino*) and porpoise, and the large suprarenal veins, not much smaller than those of the kidneys (li.–lvi.). He failed, however, to trace the connection of the urachus with the bladder. In the following chapters (lxiii.–lxxii.) he describes the process of generation in the fallow deer or the roe. After again insisting that all animals arise from ova, that a "conception" is an internal egg and an egg an extruded conception, he goes on to describe the uterus of the doe, the process of impregnation, and the subsequent development of the fœtus and its membranes, the *punctum saliens*, the cotyledons of the placenta, and the "uterine milk," to which Professor Turner has lately recalled attention. The treatise concludes with detached notes on the placenta, parturition, and allied subjects.

Harvey's other Writings and Medical Practice.—The remaining writings of Harvey which are extant are unimportant. A complete list of them will be found below, together with the titles of those which we know to be lost. Of these the most important were probably that on respiration, and the records of post-mortem examinations. From the following passage (*De Partu*, p. 550) it seems that he had a notion of respiration being connected rather with the production of animal heat than, as then generally supposed, with the cooling of the blood. "Hæc qui diligenter perpenderit, naturamque aeris diligenter introspexerit, facile opinor fatebitur eundem nec refrigerationis gratia nec in pabulum animalibus concedi. Hæc autem obiter duntaxat de respiratione diximus, proprio loco de eadem forsitan copiosius disceptaturi."

Of Harvey as a practising physician we know very little. Aubrey tells us that "he paid his visits on horseback with a footcloth, his man following on foot, as the fashion then was." He adds—"Though all of his profession would allow him to be an excellent anatomist, I never heard any that admired his therapeutic way. I knew several practitioners that would not have given threepence for one of his bills" (the apothecaries used to collect physicians' prescriptions and sell or publish them to their own profit), "and that a man could hardly tell by his bill what he did aim at." However this may have been,—and rational therapeutics was impossible when the foundation-stone of physiology had only just been laid,—we know that Harvey was an active practitioner, performing such important surgical operations as the removal of a breast, and he turned his obstetric experience to account in his book on generation. Some good practical precepts as to the conduct of labor are quoted by Willoughby, a contemporary. He also took notes of the anatomy of disease; these unfortunately perished with his other manuscripts. Otherwise we might regard him as a forerunner of Morgagni; for Harvey saw that pathology is but a branch of physiology, and like it must depend first on accurate anatomy. He speaks strongly to this purpose in his first epistle to Riolanus: "Sicut enim sanorum et boni habitus corporum dissectio plurimum ad philosophiam et rectam physiologiam facit, ita corporum morbosorum et cachecticorum inspectio potissimum ad pathologiam philosophicam." The only specimen we have of his observations in morbid anatomy is his account of the post-mortem examination made by order of the king on the body of the famous Thomas Parr, who died in 1635, at the reputed age of 152. Harvey insists on the value of physiological truths for their own sake, independently of their immediate utility; but he himself gives us an interesting example of the practical application of his theory of the circulation in the cure of a large tumor by tying the arteries which supplied it with blood (*De Generat.*, Exerc. xix.).

[1] So in Exerc. liv.: "Superior itaque et divinior opifex, quam est homo, videtur hominem fabricare et conservare, et nobilior artifex, quam gallus, pullum ex ovo producere. Nempe agnoscimus Deum, creatorem summum atque omnipotentem, in cunctorum animalium fabrica ubique præsentem esse, et in operibus suis quasi digito monstrari: cujus in procreatione pulli instrumenta sint gallus et gallina. . . . Nec cuiquam sane hæc attributa conveniunt nisi omnipotenti rerum Principio, quocunque demum nomine idipsum appellare libuerit: sive Mentem divinam cum Aristotele, sive cum Platone Animam Mundi, aut cum aliis Naturam naturantem, vel cum ethnicis Saturnum aut Iovem; vel potius (ut nos decet) Creatorem ac Patrem omnium quæ in cœlis et terris, a quo animalia eorumque origines dependent, cujusque nutu sive effato fiunt et generantur omnia."

The following is believed to be a complete list of all the known writings of Harvey, published and unpublished:—

Exercitatio Anatomica de Motu Cordis et Sanguinis, 4to, Frankfort-on-the Maine, 1628; *Exercitationes duæ Anatomicæ de Circulatione Sanguinis, ad Johannem Riolanum, filium, Parisiensem*, Cambridge, 1649; *Exercitationes de Generatione Animalium, quibus accedunt quædam de Partu, de Membranis ac Humoribus Uteri, et de Conceptione*, 4to, Lond., 1651; *Anatomia Thomæ Parr*, first published in the treatise of Dr. John Betts, *De Ortu et Natura Sanguinis*, 8vo, Lond., 1669. Letters:—(1) to Caspar Hoffmann of Nuremberg, May, 1636: (2) to Schlegel of Hamburg, April, 1651; (3) three to Giovanni Nardi of Florence, July, 1651, Dec., 1653, and Nov., 1655; (4) two to Dr. Morrison of Paris, May, 1652; (5) two to Dr. Horst of Darmstadt, Feb., 1654–5 and July, 1655; (6) to Dr. Vlackveld of Haarlem, May, 1657. His letters to Hoffmann and Schlegel are on the circulation; those to Morrison, Horst, and Vlackveld refer to the discovery of the lacteals; the two to Nardi are short letters of friendship. All these letters were published by Sir George Ent in his collected works (Leyden, 1687). Of two MS. letters, one on official business to the secretary Dorchester was printed by Dr. Aveling, with a facsimile of the crabbed handwriting (*Memorials of Harvey*, 1875), and the other, about a patient, appears in Dr. Willis's *Life of Harvey*, 1878. *Prælectiones anatomiæ universalis per me Gul. Harveium medicum Londinensem, anat. et chir. professorem, an. dom. 1616, ætat. 37*,—MS. notes of his Lumleian lectures in Latin,—are in the British Museum library; they are almost illegible, but were partly deciphered and a photograph of one of the pages taken by Dr. Sieveking; for an account of them see his Harveian Lecture for 1877. A second MS. has been discovered in the British Museum, entitled *Gulielmus Harveius de Musculis, Motu Locali*, etc., and an account of it was published by Dr. George Paget (*Notice of an unpublished MS. of Harvey*, Lond., 1850). The following treatises, or notes towards them, were lost either in the pillaging of Harvey's house, or perhaps in the fire of London, which destroyed the old College of Physicians:—*A Treatise on Respiration*, promised, and probably at least in part completed (pp. 82, 550, ed. 1766); *Observationes de usu Licnis; Observationes de motu locali*, perhaps identical with the above-mentioned manuscript; *Tractatum physiologicum; Anatomia medicalis* (apparently notes of morbid anatomy); *De Generatione Insectorum*. The fine 4to edition of Harvey's *Works*, published by the Royal College of Physicians in 1766, was superintended by Dr. Mark Akenside; it contains the two treatises, the account of the post-mortem examination of old Parr, and the six letters enumerated above. A translation of this volume by Dr. Willis, with Harvey's will, was published by the Sydenham Society, 8vo, Lond., 1849.

The following are the principal biographies of Harvey:—in Aubrey's *Letters of Eminent Persons*, etc. (vol. ii., Lond., 1813), first published in 1685, the only contemporary account; in Bayle's *Dictionnaire Historique et Critique*, 1698 and 1720 (Eng. ed., 1738); in the *Biographia Britannica*, and in Aitken's *Biographical Memoirs;* the Latin Life by Dr. Lawrence, prefixed to the college edition of Harvey's *Works* in 1766; memoir in *Lives of British Physicians*, Lond., 1830; a Life by Dr. Robert Willis, founded on that by Lawrence, and prefixed to his English edition of Harvey in 1847; the much enlarged Life by the same author, published in 1878; the biography by Dr. Monk in the *Roll of the College of Physicians*, 2d ed., vol. i., 1879.

The literature which has arisen on the great discovery of Harvey, on his methods and his merits, would fill a library. The most important contemporary writings have been mentioned above. The following list gives some of the most remarkable in modern times:—the article in Bayle's dictionary quoted above; *Anatomical Lectures*, by Wm. Hunter, M. D., 1784; Sprengell, *Geschichte der Arzneikunde*, Halle, 1800, vol iv.; Flourens, *Histoire de la Circulation*, 1854; Lewes, *Physiology of Common Life*, 1859, vol. i., pp. 291–345; Ceradini, *La Scoperta della Circolazione del Sangue*, Milan, 1878, Tollin, *Die Entdeckung des Blutkreislaufs durch Michael Servet*, Jena, 1876; Kirchner, *Die Entdeckung des Blutkreislaufs*, Berlin,

1878; Willis, in his Life of Harvey; Wharton Jones, "Lecture on the Circulation of the Blood," *Lancet* for Oct. 25 and Nov. 1, 1879, and the *Harveian Orations*, especially those by Dr. Sieveking, Dr. Guy, and Prof. Rolleston. (P. H. P. S.)

HARWICH, a municipal and parliamentary borough and seaport town of Essex, England, is situated on the extremity of a small peninsula projecting into the estuary of the Stour and Orwell, 70 miles N. E. of London by the Great Eastern Railway. It occupies an elevated situation, and a good view is obtained from Beacon Hill at the southern end of the esplanade. The town is somewhat irregularly built, but the streets though narrow are well paved. It is defended by a redoubt mounted with heavy guns and by three martello towers. The only public building of importance is the church of St. Nicholas, an edifice of white brick in the Perpendicular style, with stone buttresses and steeple, erected in 1821 at a cost of £20,000. The harbor is one of the best on the east coast of England, and in stormy weather is largely taken advantage of for shelter. Its entrance is, however, encumbered with rocks, and is dangerous without a pilot. The rapid accumulation of shingle threatened some years ago to block up the principal entrance, but this has been prevented by the construction of two breakwaters, having a length respectively of 1350 and 1000 feet. The shipping trade of the port was much injured by the removal, after the introduction of steamships, of the Hamburg and other packets from the station; but since the construction of the Great Eastern Railway steam packets have plied regularly between Harwich and Antwerp and Rotterdam. In 1878 1198 British ships entered the port with a tonnage of 298,227, and 35 foreign ships with a tonnage of 10,921. The number of British ships that cleared was 1233, with a tonnage of 296,095, and of foreign ships, 28, with a tonnage of 8544. The principal imports are grain, timber, and tobacco, and the principal exports cement and fish. Shipbuilding has declined since the discontinuance of the Government dockyards. The prosperity of the town depends now largely on its shrimp and lobster fisheries, but there are also Roman cement works, breweries, and manufactories for artificial manure and for sails and tackle. It is much frequented for sea-bathing, and its suburb of Dovercourt possesses a chalybeate spring, the spa-house of which contains a library and museum. Harwich in all probability occupies the site of a Roman station. In 855 a great naval battle took place opposite the town between the Danes and the fleet of King Alfred, and in 1666 another took place between the Dutch and the English. Harwich was created a parliamentary borough by King Edward II. in 1318 with the privilege of returning two members, but since the Reform Act of 1867, it has returned only one. The population of the municipal and parliamentary borough in 1901 was 10,019.

HARZ MOUNTAINS, The (also spelt Hartz, the German *Harzgebirge*, and the ancient *Silva Hercynia*), the most northerly mountain system of Germany, situated between the rivers Weser and Elbe, occupy an area of about 786 square miles, of which 457 belong to Prussia, 286 to Brunswick, and 43 to Anhalt. Their greatest length extends in a S. E. and N. W. direction for about 56 miles, and their maximum breadth is about 20 miles. The group is made up of an irregular series of terraced plateaus, rising here and there into rounded summits, and intersected in various directions by narrow, deep valleys. The N. W. and higher part of the mass is called the Ober or Upper Harz; the S. E. and more extensive part, the Unter or Lower Harz; while the N. W. and S. W. slopes of the Upper Harz form the Vorharz. The Brocken group, which divides the Upper and Lower Harz, is generally regarded as a part of the former. The prevalent upper geological formation of the whole district is greywacke and clay-slate, through which the granite here and there protrudes, as in the case of the Brocken. The highest summits of the Upper Harz are the Brocken (3743 feet), the Heinrichshöhe (3042 feet), the Greater and Less Königsberg (3376 feet and 3369 feet), and the Wormberg (3182 feet); the Lower Harz, the Auersberg (1870 feet), and the Victorshöhe (1762 feet). The towns in the district, though not large, are tolerably numerous. The principal are—in the Upper Harz, Goslar, Klausthal, Zellerfeld, Andreasberg, Altenau, Lautenthal, Wildemann, Grund, Harzburg, Ilsenburg, and Wernigerode; and in the Lower Harz, Harzgerode, Elbingerode, Rübeland, Quedlinburg, Ballenstedt, Gernrode, Suderode, Blankenburg, Thale, and Stolberg.

The chief industry is mining, which has been carried on since the middle of the 10th century. The Harz is second only to the Erzgebirge among the mountains of Germany in mineral wealth. The most important mineral is a peculiarly rich argentiferous lead, but gold in small quantities, copper, iron, sulphur, alum, and arsenic are also found. Marble, granite, and gypsum are worked; and large quantities of vitriol are manufactured. The vast forests that cover the mountain-slopes supply the materials for a very considerable trade in timber. Much wood is exported for building and other purposes, while in the Harz itself no other fuel is used, whether for smelting the ores, which is done at the mines, or for domestic use. Employment is thus given to a large number of charcoal burners. The saw-dust of the numerous wood factories is collected for use in the manufacture of paper. Turf-cutting, coarse lace-making, and the breeding of canaries and native song-birds also occupy many of the people. Agriculture is carried on chiefly on the plateaus of the Lower Harz; but there is excellent pasturage both in the north and in the south. In the Lower Harz, as in Switzerland, the cows, which carry bells harmoniously tuned, are driven up into the heights in early summer, returning to the sheltered regions in late autumn.

The Harz being the first obstacle to oppose the moist, cold winds from the North Sea, the northern summits are destitute of trees, but the lower slopes of the Upper Harz are heavily wooded with pines and firs. Between the forests of these stretch numerous peat-mosses, which contain in their spongy reservoirs the sources of many small streams. On the Brocken are found one or two arctic and several alpine plants. In the Lower Harz the forests contain a great variety of timber. The oak, elm, and birch are common, while the beech especially attains an unusual size and beauty. The walnut-tree grows in the eastern districts.

The last bear was killed in the Harz in 1705, and the last lynx in 1817, and since that time the wolf too has become extinct; but deer, foxes, wild cats, and badgers are still to be found in the forests.

The streams are very numerous, but are all small. While they are rendered extensively useful by various skilful artifices, in working the mines underground, at other parts of their course they present the most picturesque scenery in all the picturesque Harz. Perhaps the finest valley is the rocky Bodethal, with the Ross-Trappe, the Hexentanzplatz, the Baumannshöhle, and the Bielshöhle.

The inhabitants, about 70,000 in number, are descended from various stocks. The Upper and Lower Saxon, the Thuringian, and the Frankish races have all contributed to form the present people, and their respective influences are still to be traced in the varieties of dialect. The boundary line between High and Low German passes through the Harz.

The Harz is now one of the most frequented tourist resorts of Germany. It is traversed by excellent roads in all directions, and is completely girt by railways from the principal towns of the empire. The chief point of interest is undoubtedly the Brocken or Blocksberg, famous as the scene of the "Walpurgisnacht" in Goethe's *Faust*, as well as for the atmospherical phenomena of which the "spectre of the Brocken" (see Halo) is the best known. The Harz was the last stronghold of paganism in Germany, and to that fact are due the weird legends, in which no district is richer, and the wild and fanciful names that are given by the people to the peculiar objects and appearances of nature.

Literature.—A very full list of works on the Harz, especially on the Brocken, will be found appended to the pamphlet *Zur Geschichte der Brockenreisen*, 4th ed., Aschersleben and Leipsic, 1875. See also Holzmann, *Hercynisches Archiv.*, Halle, 1803; Honemann, *Die Alterthümer des Harzes*, Klausthal, 1827; Zimmermann, *Harzgebirge*, Darmstadt, 1834; Hoffmann, *Burgen und Burgfesten des Harzes*, Quedlinburg, 1836; Hausmann, *Ueber die Bildung des Harzgebirges*, Göttingen, 1842; *Brockenstammbuch*, 1850; Brederlow, *Der Harz, zur Belehrung und Unterhaltung für Harzreisende*, Brunswick, 1851; Lachmann, *Nivellement des Harzgebirges*, Brunswick, 1851; Spieker, *Der Harz seine Ruinen und Sagen*, Berlin, 1852 and 1856; Ey, *Harzbuch*, Goslar, 1855; Pröhle, *Harzsagen*, 1854; *Harzbilder*, 1856; *Harz und Kyffhäuser in Gedichten, Schilderungen*, etc., 1870, and *Der Harz*, 1878; *Wegweiser im Harz und dessen Umgegend*, Berlin, 1857; Nauenburg, *Der Lustwanderer im Harz*, Eisleben, 1857; Mrs. Burton, *Our Summer in the Harz Forest*, Edinburgh, 1865; Groddeck, *Abriss der Geognosie des*

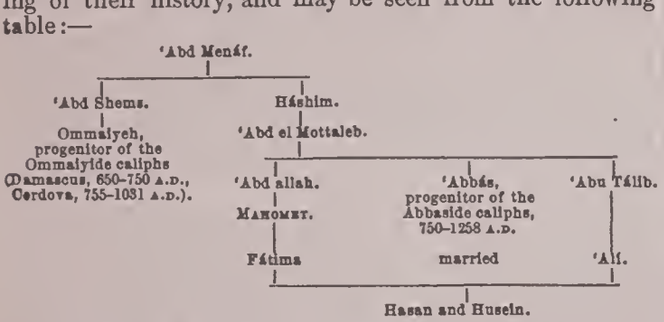
Harzes, Klausthal, 1871; Hampe, *Flora Hercynia*, Halle, 1873; Blackburn, *The Harz Mountains, a Tour*, London, 1873; Buch (*Gesammelte Schriften*), "Ueber den Harz," 1877; Rev. J. S. Hill and J. W. Tanley, in *Colliery Guardian*, vol. xxx.; Heine, *Harzreise*. Among the Handbooks may be noted those of Schweizer, Werner, Gottschalk, Meyer, Muller, Prediger, and Grieben.

HARZBURG, or NEUSTADT-HARZBURG, the chief town of an office in the Brunswick circle of Wolfenbüttel, Prussia, is situated 727 feet above sea-level on the right bank of the Radau, a tributary of the Ocker, and at the terminus of the Brunswick-Harzburg Railway, 5 miles E.S.E. from Goslar and 18 miles S. from Wolfenbüttel. The opening of the railway has made the Harzburg route a principal one for persons visiting the Harz, and the town is also much frequented as a summer residence. It possesses a salt-water bath and also a hydropathic establishment. A mile and a half south from the town lies the Burgberg, 1500 feet above sea-level, on whose summit, according to tradition, there was at one time an altar to the heathen idol Krodo, still to be seen in the Ulrich chapel at Goslar. There are now on the summit of the hill a hotel, the remains of an old castle, and a monument erected in 1875 to the honor of Prince Bismarck, with an inscription taken from one of his speeches against the Ultramontane claims of Rome—"Nach Canossa gehen wir nicht." The population of Harzburg in 1905, including the villages of Bündheim, Schulenrode, and Schlewecke, was 4,396.

The castle was built by the emperor Henry IV. between 1065 and 1069, but was laid in ruins by the Saxons about 1080. By Frederick I. it was granted to Henry the Lion, who caused it to be rebuilt with great splendor about 1180. It was a frequent residence of Otto IV., who died at it, and by his will granted it to the counts of Woldenberg. After being frequently besieged and taken, it finally, after the battle of Mühlberg, in 1546, passed to the house of Brunswick. It ceased to be of importance as a fortress after the Thirty Years' War, and gradually fell into ruins.

See Delius, *Untersuchungen über die Geschichte der Harzburg*, Halberstadt, 1826; Dommes, *Harzburg und seine Umgebung*, Goslar, 1862; Holmstein, *Die Harzburg nach Sage und Geschichte*, Brunswick, 1878.

HASAN AND HUSEIN, the sons of 'Alí ibn Abu Tálib, cousin and son-in-law of Mahomet, and heroes of the passion play performed annually throughout India and Persia by Shiah Mahometans in the month of Moharram. Their relationship to the prophet is important to the understanding of their history, and may be seen from the following table:—



The office of guardian of the kaabeh or temple of Mecca, and chief of the tribe of Koreish, which was vested in 'Abd Menáf, would have descended to 'Abd Shems, his eldest son, had it not been given to Háshim, the second, in reward for some military successes, and this circumstance caused a bitter enmity between the two families. When Mahomet died, 'Alí claimed the right to the office of caliph (*khalífeh*, "vicegerent" or "successor"), but found formidable rivals in Abu Bekr, the father of 'Ayesha the prophet's favorite wife, 'Omar, another of his fathers-in-law, and 'Othmán, the only member of the rival house of Ommaiyeh who had joined the Muslim ranks. 'Ayesha, whom 'Alí had mortally offended by listening to a charge of incontinence which had been made against her, made common cause with the Ommaiyides, and strenuously opposed 'Alí's accession. A compromise was effected by the election of Abu Bekr; on his death Omar was made caliph, and when he in turn died, 'Othman was elected, as 'Alí refused to subscribe to the conditions imposed upon him that he should govern in accordance with the "traditions" as well as the Korán. These "traditions" are the whole body of ceremonial laws and customs by which the imperfect code of the Koráu was supplemented; they are derived from ancient Arab and even Jewish usage, although to give them a proper sanction and force they have been attributed to Mahomet himself, who is supposed to have enunciated them at different times as separate *ahádith* (singular *hadíth*); and the tracing of them through the various authorities to the prophet himself is still a most important branch of Muslim theology.

The "traditions" are spoken of collectively as the *Sunneh*, whence the name Sunní, given to that sect of Mahometans who follow them, and it was to this that Alí refused to subscribe. 'Othman on his accession displayed an unblushing partisanship for his own, the Ommaiyide, family, and appointed Mo'áwiyeh, a bitter enemy of the Háshimi family, governor of Syria. 'Othman was assassinated in 655 A.D., and 'Alí was then unconditionally elected caliph. He immediately recalled Mo'áwiyeh, who refused to obey, and, supported by the influence of the implacable 'Ayesha, claimed the caliphate for himself. A severe struggle between the two parties ensued, and 'Alí was at first successful, but was at length compelled by intrigue to submit his claims to arbitration, instead of following up his military advantages. A number of his followers, about 12,000, taking umbrage at this, deserted him, thus originating the sect of Khárejíyeh or "Separatists," who reject the lawful government established by public consent. A conspiracy of three of these deserters resulted in the murder of 'Alí, who was slain at the door of a mosque in Kúfa, and buried at a spot about 5 miles from that town. A magnificent mausoleum was afterwards erected over his tomb, which became later on the site of the town Meshed Alí, "'Alí's shrine," one of the great places of resort for Shiah pilgrims. On 'Alí's death his eldest son Hasan was elected caliph, but resigned the office in favor of Mo'áwiyeh on condition that he should resume it at the latter's death. Mo'áwiyeh, however, who wished his own son Yezíd to succeed him, caused Hasan to be foully murdered by his own wife eight years later. Yezíd succeeded his father, on the latter's death, without opposition or election, and the Ommaiyide dynasty became thus firmly established on the throne. The partisans of 'Alí's family were, however, far from content, and Husein, 'Alí's surviving son, was secretly invited to Kúfa to place himself at the head of the party, and revolt against Yezíd. Prompt measures were taken by the caliph, who had obtained timely warning of the movement. 'Obeidallah, a vigorous officer, was appointed governor of Kúfa, seized upon Husein's envoy, Muslim, and one Háni in whose house he had been concealed, and when the populace assembled and clamored for their release he caused them to be beheaded and their heads to be cast down among the crowd. Husein was intercepted on the borders of Babylonia by Harro, with a company of horse, who told him he had orders to bring him alone to Kúfa, but allowed him to proceed by what route he chose without losing sight of him. A horseman met them on the road with secret orders from 'Obeidallah to lead Husein into an open and undefended place, and halt until 'Amer, the commander of the Syrian army, arrived with his forces. This happened the next day, and Husein and his small escort were surrounded by 4000 horse, and slaughtered, after a stubborn resistance, on the plain of Kerbelá by the banks of the Euphrates, under peculiarly tragic circumstances, his little son 'Abdallah, and his nephew, a beautiful child, both being murdered in his arms. This took place on the 10th of Moharram 61 A.H. (680 A.D.), and is commemorated during that month by the Shiahs in India and Persia, a long miracle play being performed, the scenes of which are carried on from day to day, and culminate in carrying out the *tabút* or coffins of the martyrs to an open place, generally the cemetery, or in sea-side places to the sea-shore.

The cause of 'Alí and his family was warmly espoused by the Persians, who had been forced to embrace Islám, but who regarded the Sunneh or Semitic law with especial repugnance. The party were known as Shiahs, "Sectarians;" and as the quarrel between them and the Sunnis thus perpetuates the old enmity between Jew and Gentile, between the Semitic and Aryan races, it has produced an irreparable breach in Islám.

The passion play of *Hasan and Husein* has been published in English by Sir Lewis Pelly (London, 1879, 2 vols. 8vo) from the dictation of native teachers and performers of the drama. (E. H. P.)

HASBEYA, or HASBEIYA, a town of the Druses, about 36 miles west of Damascus, is situated at the foot of Mount Hermon in Syria, overlooking a deep amphitheatre, from which a brook flows to the Hasbâni. Both sides of the

valley are planted in terraces with olives, vines, and other fruit trees. The grapes are either dried, or made into a kind of syrup. About four-fifths of the inhabitants are Christians, and in 1846 an American Protestant Mission was established in the town. This little community suffered much persecution at first from the Greek Church, and afterwards from the Druses, by whom in 1860 nearly 1000 Christians were massacred, while others escaped to Tyre or Sidon. The castle in Hasbeya was held by the crusaders under Count Oran; but in 1171 the Druse emirs of the great Shehaab family (see DRUSES) recaptured it. In 1205 this family was confirmed in the lordship of the town and district, which they held till the Turkish authorities took possession of the castle in the present century. Near Hasbeya are bitumen pits let by Government; and to the north, at the source of the Hasbâni, the ground is volcanic. Some travellers have identified Hasbeya with the Biblical Baal-Gad, or Baal-Hermon,—a supposition rendered the more likely by the ruins of several temples near the town. Population about 5000.

HASDRUBAL. Of the bearers of this very common Carthaginian name the most famous are the following:—

1. One of the leaders of the popular party at the close of the First Punic War. He was conspicuous for his dexterous management in politics and his conciliatory manners. He married the daughter of Hamilcar Barca; and his skilful and cordial co-operation was of enormous consequence to Hamilcar during his Spanish wars. He went to Spain with his father-in-law, but soon returned to Carthage, where his talents were specially needed to conduct the party at home. He was, however, in Spain when Hamilcar fell (229); and was soon formally appointed by the home Government to the command which he had at once assumed. Devoting himself most successfully to the task of consolidating the Carthaginian power in Spain, he founded New Carthage as the Spanish capital, and married the daughter of a Spanish chief. His kindly and generous manner attached the natives to him, and brought many over to the Carthaginian alliance. In 221 he fell by the hand of an assassin. The account given of him by Polybius is much more favorable and far more trustworthy than that of the Roman author Fabius whom he refers to.

2. The second son of the great Hamilcar. He was left by Hannibal as commander in Spain (219 B. C.), where he had to contend with the two Scipios, Cneius and Publius. Three years were spent in desultory warfare, in which the Romans were generally successful. After the battle of Cannæ, Hasdrubal was ordered to march into Italy, while Himilco was sent from Carthage with a fresh army to supply his place. But a decisive battle on the Ebro, in which he was totally defeated, checked his northward march. It is hardly possible to exaggerate the importance of this battle. Had a fresh Carthaginian army joined Hannibal in Italy for the campaign of 215 or 214, the danger to Rome would have been infinitely increased. Several years now passed, marked by the Roman historians with fresh Roman victories; and it is certain that the struggle continued doubtful till 212, when both the Scipios were defeated and slain. In spite of this great success, Hasdrubal was not at the moment able to begin the march on Italy. The Romans were skilfully rallied by Lucius Marcius, and in 211 a fresh army under the prætor Nero landed in Spain. At the same time there seems to have been no co-operation among the Carthaginian generals; and when the younger Scipio landed in Spain (210) he found their armies widely separated. Taking advantage of this, Scipio by a sudden attack (209) captured New Carthage, which contained vast military stores, all the Spanish hostages, and 10,000 captives. To achieve this brilliant success he had to leave the road northwards undefended; and although he rapidly returned and (according to the Roman accounts) defeated Hasdrubal at Bæcula in Andalusia, the Carthaginian general was able to make his way with a strong army to the Pyrenees, which he crossed in safety near the western extremity. The whole course of the Spanish wars, and especially the chronology of these later events, are very obscure. At all events Hasdrubal, after a very rapid and skilful march across the whole breadth of Gaul, appeared early in 207 in the north of Italy. When once he had succeeded in getting out of Spain, this brilliant march proved Hasdrubal worthy of his father and his brother; and long as it had taken to carry out his plan, we must remember that after the Romans perceived the necessity of keeping him back from Italy the difficulties in his way were enormous. On hearing of the passage of the Pyrenees, the Romans raised extraordinary levies, but before they had taken any steps to meet him, Hasdrubal was already in Cisalpine Gaul. Hannibal was still in Apulia, perhaps not expecting his brother so soon; Hasdrubal sent to meet him two Numidian horsemen with four Gauls, who almost at the end of their perilous journey fell into the hands of the consul Nero. In the mean time Hasdrubal had advanced into Umbria, where the plebeian consul Livius was encamped near Sena. Nero, with 7000 men, left his own camp, and by a rapid march, which must be ranked among the most important events of the war, joined his colleague. The united army was much too strong for Hasdrubal. He tried to avoid a battle, but his guides failed him, and he was forced to fight on the south bank of the Metaurus. A long and bloody conflict resulted in the complete defeat of the Carthaginians, and Hasdrubal, after all was lost, fell sword in hand in the midst of the enemy. His head, which was thrown by Nero's soldiers into Hannibal's camp, first revealed to the latter his brother's defeat and the ruin of the Carthaginian cause.

HASLINGDEN, a market-town of Lancashire, England, is situated 7 miles S. E. of Blackburn, in a hilly district on the borders of the forest of Rossendale, and is supposed by some to derive its name from the hazel trees which at one time abounded in its neighborhood. The town formerly stood on the slope of a hill, but the modern part, which is substantially built of stone, has been erected at its base. The parish church dedicated to St. James was, with the exception of the tower, which dates from the time of Henry VIII., rebuilt in 1780, and the whole structure was restored in 1879. Handsome schools are attached, to which there is an endowment for ten poor boys, founded in 1749. The principal other buildings are the mechanics' institute, the town-hall, where the sessions and county court are held, and the public hall for assemblies. The woollen manufacture, formerly the staple of the town, has now been superseded by that of cotton, and there are also silk manufactures, iron-works, and size-works. In the vicinity there are collieries and quarries for stone, flags, and slate. The population of the town according to the census of 1901, was 18,543.

HASPE, a town of Prussia, province of Westphalia, government district of Arnsberg, and circle of Hagen, is situated in the valley of the Ennepe where the Hasper stream joins that river, and on the railway from Düsseldorf to Dortmund, 25 miles north-east of Düsseldorf. It has iron foundries, rolling mills, puddling furnaces, and manufactures of iron, steel, and brass wares, and of machines. Haspe was raised to the rank of a town in 1874. The population in 1905 was 19,813.

HASSAN, a district of Mysore, India, lying between 12° 30′ and 13° 22′ N. lat. and between 75° 32′ and 76° 58′ E. long. It is bounded on the S. W. by the Madras district of South Kanara, and on the S. partly by the state of Coorg. The main portion of the district consists of the river basin of the Hemavati and its tributaries. It naturally divides into two portions, the Malnád or hill country, which includes some of the highest ranges of the Western Ghâts, and the Maidán or plain country, sloping towards the south. The Hemavati, which flows into the Cauvery in the extreme south, is the great river of the district; its most important tributary is the Yagachi. The upper slopes of the Western Ghâts are abundantly clothed with magnificent forests, and wild animals of all sorts abound. Among the mineral products are kaolin, felspar, and quartz. The soil of the valleys is a rich red alluvial loam.

The area extends to 3291 square miles. The census of 1871 returned the inhabitants at 669,961—329,097 males and 340,864 females—the Hindus numbering 650,877, Mahometans 14,460, Jains 1954, Christians 2670. Hassan town and Narsipur each contain more than 5000 inhabitants. The staple crops consist of *rágí*, rice, tobacco, sugar-cane, the cocoa-nut and areca-nut palms, plantain trees, and chillies. Coffee cultivation has been on the increase of late years. The first plantation was opened in 1843, and now there are 155 coffee estates owned by Europeans and 9500 native holdings. The statistics of irrigation show a total of 6905 tanks in the district and 215 miles of canals. The exports are large, consisting chiefly of food-grains and coffee. The imports are European piece-goods, hardware of all sorts, and spices. The largest weekly fair is held at Alur. A great annual religious gathering and fair, attended by about

10,000 persons, takes place every year at Melukot. The gross revenue amounted in 1873–74 to £126,908, and the police force (1874) numbered 470 men of all ranks, maintained at a cost of £3692. There were 243 schools in 1874 aided by Government, attended by 4379 pupils, and 147 unaided with 1657 pupils. The average mean temperature of the district is 76°, and the average rainfall at Hassan town during seven years was 36 inches. In the Ghâts as much as 100 inches sometimes fall in the year. Malarious fever prevails in the Malnâd during the early rains.

The real history of Hassan does not begin until the epoch of the Ballala dynasty, which lastod from the 10th till the 14th century. Their capital was at Dwarávati-pura, the ruins of which are still to be seen scattered round the village of Halebid in this district. The earlier kings professed the Jain faith, but the finest temples were erected to Siva by the later monarchs of the line. While they were at the zenith of their power the whole of southern India acknowledged thoir sway. After the Mahometan invasion in the 14th century, the district of Hassan ceased to exist as the seat of a metropolis, and became a remote province known as Balam. Since 1832 the district, with the rest of Mysore, has been under direct British administration.

HASSAN. See Assassins, vol. ii. p. 632.

HASSE, Johann Adolph (1699–1783), a musical composer, is a striking instance of the instability of fame. One of the most prolific and most celebrated composers of the 18th century, he is now all but forgotten, and his extant works rest quietly on the shelves of public libraries. He was born at Bergedorf near Hamburg, on March 25, 1699, and received his first musical education from his father. Being possessed of a fine tenor voice, he chose the theatrical career, and joined the operatic troupe conducted by Reinhard Keiser at Hamburg, the same Keiser in whose orchestra Handel had played the second violin some years before. Hasse's success led to an engagement at the court theatre of Brunswick, and it was there that, in 1723, he made his début as a composer with the opera *Antigonus*. The success of this first work induced the duke to send Hasse to Italy for the completion of his studies, and in 1724 he went to Naples and placed himself under the tuition of the celebrated Porpora, with whom, however, he seems to have disagreed both as a man and as an artist. On the other hand he gained the friendship of Alessandro Scarlatti, to whom he owed his first commission for a serenade for two voices, sung at a family celebration of a wealthy merchant by two of the greatest singers of Italy, Farinelli and Signora Tesi. This event established Hasse's fame; he soon became very popular by the name of "il caro Sassone," and his opera *Sesostrato*, written for and produced at the Royal Opera at Naples in 1726, made his name known all over Italy. At Venice, where he went in 1727, he and his works were received with equal favor. It was there that he became acquainted with the celebrated singer Faustina Bordoni, better known as Faustina Hasse, for she became the composer's wife in 1730. The artist-couple soon afterwards went to Dresden, in compliance with a brilliant offer made to them by the splendor-loving elector of Saxony, Augustus II. There Hasse remained for two years, after which he again journeyed to Italy, and also in 1733 to London, in which latter city he was tempted by the aristocratic clique inimical to Handel to become the rival and antagonist of that great master. But this he modestly and wisely declined, remaining in London only long enough to superintend the rehearsals for his opera *Artaserse*. All this while Faustina had remained at Dresden, the declared favorite of the public and unfortunately also of the elector, her husband, who remained attached to her, being allowed to see her only at long intervals. In 1739, after the death of Augustus II., Hasse settled permanently at Dresden till 1763, when he and his wife retired from court service with considerable pensions. But Hasse was still too young to rest on his laurels. He went with his family to Vienna, and added several operas to the great number of his works already in existence. His last work for the stage was the opera *Ruggiero*, written for the wedding of Archduke Ferdinand at Milan. On the same occasion a dramatic cantata by Mozart, then (1771) fourteen years old, was performed, and Hasse is said to have prophesied Mozart's future greatness much in the same manner as Mozart himself predicted that of Beethoven. By desire of his wife Hasse settled at her birthplace Venice, and there he died December 23, 1783. His compositions were innumerable, including as many as 120 operas, besides oratorios, cantatas, masses, and almost every variety of instrumental music. It would be needless to criticise or give the titles of these compositions, for most of them are, as was said before, totally and not unjustly forgotten. Moreover, comparatively few of them have escaped destruction. During the siege of Dresden by the Prussians in 1760, most of his manuscripts, collected for a complete edition to be brought out at the expense of the elector, were burnt. Some of his works, amongst them an opera *Alcide al Bivio*, have been published, and the libraries of Vienna and Dresden possess the autographs of others. Hasse's instrumentation is certainly not above the low level attained by the average musicians of his time, and his *ensembles* do not present any features of interest. In dramatic fire also he was wanting, but he had a fund of gentle and genuine melody, and by this fact his enormous popularity during his life must be accounted for. The two airs which Farinelli had to repeat every day for ten years to the melancholy king of Spain, Philip V., were both from Hasse's works. Of Faustina Hasse, almost as celebrated as her husband, most that is necessary has been said above. It will be sufficient to add that she was born at Venice in 1700, sang at Vienna, London (under Handel, 1726), and Dresden, and was, according to the unanimous verdict of the critics (including Dr. Burney), one of the greatest singers of a time rich in vocal artists. The year of her death is not exactly known. Most probably it shortly preceded that of her husband.

HASSELQUIST, Frederick (1722–1752), a Swedish traveller and naturalist, was born near Linkoeping in East Gothland, 3d January, 1722. He lost his father at an early age, and his uncle, his sole remaining protector, in his thirteenth year, but succeeded by means of private teaching in supporting himself while continuing his education. In 1741 he entered the university of Upsala, where his taste for the study of nature was fostered and developed by Linnæus, and where in 1747 he obtained license in medicine, and published a thesis entitled *De Viribus Plantarum*. On account of the frequently expressed regrets of Linnæus at the lack of information regarding the natural history of Palestine, Hasselquist resolved to undertake a journey to that country, and a sufficient subscription having been obtained to defray expenses, he, after making himself acquainted with the languages of the Levant, embarked for Smyrna, where he arrived November 26, 1749. He visited parts of Asia Minor, Egypt, Cyprus, and Palestine, and made large natural history collections, but his constitution, naturally weak, gave way under the fatigues and anxieties of travel, and he died at Smyrna, February 9, 1752, on his way homewards. His collections reached home in safety, and five years after his death the results of his wanderings were published by Linnæus under the title *Resa till Heliga Landet förättad från år 1749 till 1752*. The work is divided into two parts, the first consisting of the traveller's journal and letters, and the second of his remarks on the botany, zoology, and mineralogy of the countries through which he passed, with observations on the prevalent diseases and their cure, and the state of industry, commerce, and the arts. It was translated into French and German in 1762, and into English in 1766.

HASSELT, a town of Belgium, capital of the province of Limburg, is situated on the Demer and on the railway from Aix-la-Chapelle to Maestricht, 20 miles north-west of Liége. It possesses two churches, a hospital, a spacious town-hall, an athenæum, and a public library. Tobacco and madder are cultivated in the neighborhood. The principal manufactures are linen, lace, brandy, and beer. At Hasselt the Dutch under the prince of Orange, gained a victory over the Belgians under General Daine, 6th May, 1831. The population in 1900 was 15,249.

HASSENPFLUG, Hans Daniel Ludwig Friedrich (1793–1862), a minister of state in Hesse-Cassel, celebrated as a reactionary, was born at Hanau, in the electorate of Hesse, in 1793. He studied law at Göttingen, and was appointed by the elector Frederick William I. (then acting as regent) to a subordinate post in that university. He rose rapidly, and proved himself a man of great resolution and energy. From the first he adopted that line of policy which made him so disliked throughout his career. He exercised, that is to say, a suspicious censorship over the press; he reduced to a shadow the power of the legislative chambers he introduced new and harsh measures of army discipline, and contended relentlessly with all disciples of free thought In the matter of education he showed praiseworthy zeal and promoted as far as he could the national schools of Hesse.

But the services he rendered in this way were not sufficient to induce the mass of the people to pardon the reactionary tendency of his general policy, and he was obliged in 1837 to flee from the general hatred he had encountered. He found shelter in Prussia, where the Government entrusted him with the discharge of various judicial offices, and he remained in Prussia till the full tide of reaction had set in after the year 1848. He then (1850) returned to Hesse Cassel, the ministry of the revolution of 1848 having been dismissed. Despite the fact that Hassenpflug had never freed himself from a charge of peculation brought against him in the performance of his judicial duties in Prussia, he was appointed by the elector of Hesse to the head of the new ministry. He acted at once on the old lines, levying taxes without the consent of the chambers, dissolving them when they protested, and finally proclaiming martial law. The soldiers rose, the officers being on the side of the people; the Government was in so precarious a condition that it seemed wise to the elector to flee with his court to Wilhelmsbad. Partly by the influence of Hassenpflug the German bundesrath (or council of all the states) espoused the cause of the elector against his subjects, and by the end of the year (1850) the astute minister had the satisfaction of seeing the reactionary Government (with himself as minister of finance) reinstated in power. His position was, however, difficult, owing to his great unpopularity among all classes. When in 1852 the brother of the elector assaulted him in a fit of lunacy, Hassenpflug at once sent in his resignation, but it was not accepted till 1855. He then retired to Marburg (in Hesse), where he died October 15, 1862. His friend Dr. Vilmar, who pronounced his funeral oration, dwelt chiefly on the piety of the deceased, who he said never travelled without a copy of the New Testament.

HASTINAPUR, an ancient city of India, in the Meerut district, North-Western Provinces, lying on the bank of the Burígangá, or former bed of the Ganges, 22 miles N. E. of Meerut. It formed the capital of the great Pándava kingdom, celebrated in the *Mahábhárata*, and probably one of the earliest Aryan settlements outside the Punjab. Few traces of the ancient city now remain, but tradition points to a group of shapeless mounds as the residence of the children of the moon, the Lunar princes of the house of Bhárata whose deeds are commemorated in the great national epic. After the conclusion of the famous war which forms the central episode of that poem, Hastinapur remained for some time the metropolis of the descendants of Parikshit, but the town was finally swept away by a flood of the Ganges, and the capital was transferred to Kausámbi.

HASTINGS, a municipal and parliamentary borough and market-town of Sussex, England, the principal of the Cinque Ports, is picturesquely situated on the southern coast of England, 74 miles from London by the London, Brighton, and South Coast Railway, and 62 by the London and South-Eastern Railway. It lies in two gorges, surrounded by an amphitheatre of hills and cliffs on every side except the south. At the beginning of the century, when it first came into reputation as a watering-place, Hastings consisted of two main streets; but since then many new streets and squares have been added, and St. Leonards, at that time about a mile distant, is now connected with it by a line of terraces and parades, and forms its more fashionable district. On the brink of the western cliff there still stand a square and a circular tower of the old castle probably erected soon after the time of William the Conqueror, and the ruins, opened up by excavation in 1824, of the castle chapel, a transitional Norman structure 110 feet long, with a nave, chancel, and aisles. Besides the chapel, there was also at one time a college, both being under the control of a dean and secular canons. The deanery was at one time held by Thomas a Becket, and one of the canonries by William of Wykeham. The principal public buildings are the old parish churches of All Saints and St. Clements, both in the Perpendicular style, the former containing in its register for 1619 the baptism of Titus Oates, whose father was rector of the parish, and the latter two brasses to Thomas Weekes (d. 1563) and John Bailey (d. 1592); the town-hall, erected in 1823; the music hall, erected in 1859; the assembly-room, the Roman Catholic college, the Augustinian monastery, and the Albert memorial and drinking fountain, erected in 1864. Among the industries of the town are fishing, boat-building, and coach-making; but its prosperity depends chiefly upon its reputation as a watering-place. Its popularity in this respect is owing to its historical interest, its picturesque situation, the many beautiful walks in the neighborhood, its fine level sands, and its healthy climate, which, while bracing and vigorous in the higher parts of the town, is in its lower parts specially suited, from its mildness, for sufferers from pulmonary complaints. The town is well supplied with hotels, reading rooms, and pleasure gardens, and possesses a line of parades extending along the coast for nearly 3 miles. The Marina, a covered parade 600 feet in length, was built in 1825. There is a fine pier, opened in 1872, 900 feet in length, and possessing a pavilion capable of seating nearly 2000 persons. A public park, 70 acres in extent, is at present being laid out. The sewage of the town is conveyed a considerable distance out to sea before it is discharged. The area of the municipal borough is 1636 acres, and of the parliamentary borough 4617 acres. The population of the municipal borough in 1901 was 61,528.

Hastings is of great antiquity, and was a place of some importance in the time of the Anglo-Saxons. Some derive its name from Hasten, a Danish pirate who ravaged that coast in the time of Alfred the Great. According to the French biographer of Edward the Confessor, it was so called from the hasty manner in which William renewed its fortifications. It is mentioned in the chronicles as *Hæstingas*, and is reckoned as distinct from the shire of Sussex. In the Bayeux tapestry it is called *Hestinga-ceastra*. A mint was established at it by Athelstan in 924, of which there is some notice in the Domesday Book. In 1049, according to the Worcester Chronicle, its seamen distinguished themselves in the pursuit of the pirate Swend after the murder of Beorn, and took two of his ships. Like the other principal seaports on the southern coast, it was garrisoned by Harold in view of the possible landing of William the Conqueror, to whom, however, it surrendered without striking a blow, and who selected it as the site of a permanent camp, and erected a wooden fortress on the cliff on which the castle was afterwards built. From this camp William, on the morning of October 14th, 1066, set out to meet Harold at Senlac Hill; and after his great victory there he returned to it, and remained encamped five days in the hope of receiving the homage of the English. The site of the original town is supposed to be now in great part covered by the sea. By a charter of William the Conqueror Hastings, together with Hythe, was added to the three previously incorporated ports of Sandwich, Dover, and Romney, and invested with certain privileges, the five being subsequently known as the "Cinque Ports." In the reign of Edward I. it was rated at 21 ships with 21 seamen in each, for the service of the king for fourteen days at his own charge. In 1377 the town was burned down by the French, but it was soon afterwards rebuilt. The harbor has fallen almost into disuse since the time of Elizabeth, when the wooden pier was destroyed by a storm; it does not now admit vessels above 100 tons burthen, and this only at full tide. The town received a charter of incorporation from Elizabeth in 1558, which was confirmed and enlarged by Charles II. In the 42d of Edward III. it obtained the privilege of returning two members to parliament.

HASTINGS, Warren (1732–1818), the first governor-general of British India, was born on the 6th of December, 1732, in the little hamlet of Churchill in Oxfordshire. He came of a family which had been settled for many generations in the adjoining village of Daylesford; but his great-grandfather had sold the ancestral manor-house, and his grandfather had been unable to maintain himself in possession of the family living. His mother died a few days after giving him birth; his father, Pynaston Hastings, drifted away to perish obscurely in the West Indies. Thus unfortunate in his birth, young Hastings received the elements of education at a charity school in his native village. At the age of eight he was taken in charge by an elder brother of his father, Howard Hastings, who held a post in the customs. After spending two years at a private school at Newington Butts, he was moved to Westminster, where among his contemporaries occur the names of Lord Thurlow and Lord Shelburne, Sir Elijah Impey, and the poets Cowper and Churchill. In 1749, when his headmaster Dr. Nichols was already anticipating for him a successful career at the university, his uncle died, leaving him to the care of Mr. Chiswick, who was in the direction of the East India Company; and he determined to send his ward to seek his fortune as a "writer" in Bengal.

When Hastings landed at Calcutta in October, 1750, the affairs of the East India Company were at a low ebb. Throughout the entire south of the peninsula French influence was predominant. The settlement of Fort St. George or Madras, captured by force of arms, had only recently

been restored in accordance with a clause of the peace of Aix-la-Chapelle. The lurid genius of Dupleix everywhere overshadowed the native imagination, and the star of Clive had scarcely yet risen above the horizon. The rivalry between the English and the French, which had already convulsed the south, did not penetrate to Bengal. That province was under the able government of Ali Vardi Khan, who peremptorily forbade the foreign settlers at Calcutta and Chandarnagar to introduce feuds from Europe. The duties of a young "writer" were then such as are implied in the name. At an early date Hastings was placed in charge of an *aurang* or factory in the interior, where his duties would be to superintend the weaving of silk and cotton goods under a system of money advances. In 1755 he was transferred to Kásimbázár, the river-port of the native capital of Múrshidábád. In 1756 the old nawáb died, and was succeeded by his grandson Siráj-ud-Daulah, a spoilt boy of 19, whose name is indelibly associated with the tragedy of the Black Hole. When that passionate young prince, in revenge for a fancied wrong, resolved to drive the English out of Bengal, his first step was to occupy the fortified factory at Kásimbázár, and make prisoners of Hastings and his companions. Hastings was soon released at the intercession of the Dutch resident, and made use of his position at Múrshidábád to open negotiations with the English fugitives at Falta, the site of a Dutch factory near the mouth of the Hooghly. In later days he used to refer with pride to his services on this occasion, when he was first initiated into the wiles of Oriental diplomacy. After a while, he found it necessary to fly from the Mahometan court, and join the main body of the English at Falta. When the relieving force arrived from Madras under Colonel Clive and Admiral Watson, Hastings enrolled himself as a volunteer, and took part in the action which led to the recovery of Calcutta. Clive showed his appreciation of Hastings's merits, by appointing him in 1758 to the important post of resident at the court of Múrshidábád. It was there that he first came into collision with the Bengálí Bráhman, Nandkumar, whose subsequent fate throws so deep a shadow upon his own fair fame. During his three years of office as resident he was able to render not a few valuable services to the Company; but it is more important to observe that his name nowhere occurs in the official lists of those who derived pecuniary profit from the necessities and weakness of the native chiefs. In 1761 he was promoted to be member of council, under the presidency of Mr. Vansittart, who had been introduced by Clive from Madras. The period of Vansittart's government has been truly described as "the most revolting page of our Indian history." The entire duties of administration were suffered to remain in the hands of the nawáb, while a few irresponsible English traders had drawn to themselves all real power. The members of council, the commanders of the troops, and the commercial residents plundered on a grand scale. The youngest servant of the Company claimed the right of trading on his own account, free from taxation and from local jurisdiction, not only for himself but also for every native subordinate whom he might permit to use his name. It was this exemption, threatening the very foundations of the Mussulman government, that finally led to a rupture with the nawáb. Macaulay, in his celebrated essay, has said that "of the conduct of Hastings at this time little is known." As a matter of fact, the book which Macaulay was professing to review describes at length the honorable part consistently taken by Hastings in opposition to the great majority of the council. Sometimes in conjunction only with Vansittart, sometimes absolutely alone, he protested unceasingly against the policy and practices of his colleagues. On one occasion he was stigmatized in a minute by Mr. Batson with "having espoused the nawáb's cause, and as a hired solicitor defended all his actions, however dishonorable and detrimental to the Company." An altercation ensued. Batson gave him the lie, and struck him in the council chamber. When war was actually begun, Hastings officially recorded his previous resolution to have resigned, in order to repudiate responsibility for measures which he had always opposed. Waiting only for the decisive victory of Buxar over the allied forces of Bengal and Oudh, he resigned his seat and sailed for England in November, 1764.

After fourteen years' residence in Bengal Hastings did not return home a rich man, estimated by the opportunities of his position. According to the custom of the time he had augmented his slender salary by private trade. At a later date, he was charged by Burke with having taken up profitable contracts for supplying bullocks for the use of the Company's troops. It is admitted that he conducted by means of agents a large business in timber in the Gangetic sandarbans. When at Falta he had married Mrs. Campbell, the widow of an officer. She bore him two children, of whom one died in infancy at Múrshidábád, and was shortly followed to the grave by her mother. Their common gravestone is in existence at the present day, bearing date July 11, 1759. The other child, a son, was sent to England, and also died shortly before his father's return. While at home Hastings is said to have attached himself to literary society; and it may be inferred from his own letters that he now made the personal acquaintance of Samuel Johnson and Lord Mansfield. In 1766 he was called upon to give evidence before a committee of the House of Commons upon the affairs of Bengal. The good sense and clearness of the views which he expressed caused attention to be paid to his desire to be again employed in India. His pecuniary affairs were embarrassed, partly from the liberality with which he had endowed his few surviving relatives. The great influence of Lord Clive was also exercised on his behalf. At last in the winter of 1768, he received the appointment of second in council at Madras. Among his companions on his voyage round the Cape were the Baron Imhoff, a speculative portrait painter, and his wife, a lady of some personal attractions and great social charm, who was destined henceforth to be Hastings's life-long companion. Of his two years' work at Madras it is needless to speak in detail. He won the good-will of his employers by devoting himself to the improvement of their manufacturing business, and he kept his hands clean from the prevalent taint of pecuniary transactions with the nawáb of the Carnatic. One fact of some interest is not generally known. He drew up a scheme for the construction of a pier at Madras, to avoid the dangers of landing through the surf, and instructed his brother-in-law in England to obtain estimates from the engineers Brindley and Smeaton.

In the beginning of 1772 his ambition was stimulated by the nomination to the second place in council at Bengal with a promise of the reversion of the governorship when Mr. Cartier should retire. Since his departure from Bengal in 1764 the situation of affairs in that settlement had scarcely improved. The second governorship of Clive was marked by the transfer of the *díwání* or financial administration from the Mogul emperor to the Company, and by the enforcement of stringent regulations against the besetting sin of peculation. But Clive was followed by two inefficient successors; and in 1770 occurred the most terrible Indian famine on record, which is credibly estimated to have swept away one-third of the population. In April, 1772, Warren Hastings took his seat as president of the council at Fort William. His first care was to carry out the instructions received from home, and effect a radical reform in the system of government. Clive's plan of governing through the agency of the native court had proved a failure. The directors were determined "to stand forth as *díwán*, and take upon themselves by their own servants the entire management of the revenues." All the officers of administration were transferred from Múrshidábád to Calcutta, which Hastings boasted at this early date that he would make the first city in Asia. This reform involved the ruin of many native reputations, and for a second time brought Hastings into collision with the wily Bráhman, Nandkumar. At the same time a new settlement of the land revenue on leases for five years was begun, and the police and military systems of the country were placed upon a new footing. Hastings was a man of immense industry, with an insatiable appetite for details. The whole of this large series of reforms was conducted under his own personal supervision, and upon no part of his multifarious labors did he dwell in his letters home with greater pride. As an independent measure of economy, the stipend paid to the titular nawáb of Bengal, who was then a minor, was reduced by one-half—to sixteen *lákhs* a year (say £160,000). Macaulay imputes this reduction to Hastings as a characteristic act of financial immorality; but in truth it had been expressly enjoined by the court of directors, in a despatch dated six months before he took up office. His pecuniary bargains with Súja Daula, the nawáb wazír of Oudh, stand on a differ-

ent basis. Hastings himself always regarded them as incidents in the general scheme of his foreign policy. The Mahrattas at this time had got possession of the person of the Mogul emperor, Sháh Alam, from whom Clive obtained the grant of Bengal in 1765, and to whom he assigned in return the districts of Allahábád and Kora and a tribute of £300,000. With the emperor in their camp, the Mahrattas were threatening the province of Oudh, and causing a large British force to be cantoned along the frontier for its defence. Warren Hastings, as a deliberate measure of policy, withheld the tribute due to the emperor, and resold Allahábád and Kora to the wazír of Oudh. The Mahrattas retreated, and all danger for the time was dissipated by the death of their principal leader. The wazír now bethought him that he had a good opportunity for satisfying an old quarrel against the adjoining tribe of Rohillas, who had played fast and loose with him while the Mahratta army was at hand. The Rohillas were a race of Afghan origin, who had established themselves for some generations in a fertile tract west of Oudh, between the Himalayas and the Ganges, which still bears the name of Rohilkhand. They were not so much the occupiers of the soil, as a dominant caste of warriors and freebooters. But in those troubled days their title was as good as any to be found in India. After not a little hesitation, Hastings consented to allow the Company's troops to be used to further the ambitious designs of his Oudh ally, in consideration of a sum of money which relieved the ever-pressing wants of the Bengal treasury. The Rohillas were defeated in fair fight. Some of them fled the country; and so far as possible Hastings obtained terms for those who remained. The fighting, no doubt, on the part of the wazír was conducted with all the savagery of Oriental warfare; but there is no evidence that it was a war of extermination.

Meanwhile, the affairs of the East India Company had again come under the consideration of Parliament. The Regulating Act, passed by Lord North's ministry in 1773, effected considerable changes in the constitution of the Bengal Government. The council was reduced to four members with a governor-general, who were to exercise certain indefinite powers of control over the presidencies of Madras and Bombay. Hastings was named in the Act as governor-general for a term of five years. The council consisted of General Clavering and the Hon. Colonel Monson, two third-rate politicians of considerable parliamentary influence; Philip Francis, then only known as an able permanent official; and Barwell, of the Bengal Civil Service. At the same time a supreme court of judicature was appointed, composed of a chief and three puisne judges, to exercise an indeterminate jurisdiction at Calcutta. The chief-justice was Sir Elijah Impey, already mentioned as a schoolfellow of Hastings at Westminster. The whole tendency of the Regulating Act was to establish for the first time the influence of the crown, or rather of parliament, in Indian affairs. The new members of council disembarked at Calcutta on the 19th of October, 1774; and on the following day commenced the long feud which scarcely terminated twenty-one years later with the acquittal of Warren Hastings by the House of Lords. Macaulay states that the members of council were put in ill-humor because their salute of guns was not proportionate to their dignity. In a contemporary letter Francis thus expresses the same petty feeling: "Surely Mr. H. might have put on a ruffled shirt." Taking advantage of an ambiguous clause in their commission, the majority of the council (for Barwell uniformly sided with Hastings) forthwith proceeded to pass in review the recent measures of the governor-general. All that he had done they condemned; all that they could they reversed. Hastings was reduced to the position of a cipher at their meetings. After a time they lent a ready ear to detailed allegations of corruption brought against him by his old enemy Nandkumar. To charges from such a source, and brought in such a manner, Hastings disdained to reply, and referred his accuser to the supreme court. The majority of the council, in their executive capacity, resolved that the governor-general had been guilty of peculation, and ordered him to refund. A few days later Nandkumar was thrown into prison on a stale charge of forgery, tried before the supreme court sitting in bar, found guilty by a jury of Englishmen, and sentenced to be hanged. That Hastings set this prosecution in motion, no reasonable person can doubt; and it is equally clear that Chief-Justice Impey is free from all personal blame. The majority of the council abandoned their supporter, who was executed in due course. He had forwarded a petition for reprieve to the council, which Clavering took care should not be presented in time, and which was subsequently burnt by the common hangman on the motion of Francis. At the time no one dared to impute to Hastings the crime of a judicial murder. But though he had thus silenced the charges brought against him, a combination of circumstances placed him in a position of fresh difficulty. While the strife was at its hottest, he had sent an agent to England, with a general authority to place his resignation in the hands of the Company under certain conditions. The agent thought fit to exercise that authority. The resignation was promptly accepted, and one of the directors was appointed to the vacancy. But in the mean time Colonel Monson had died, and Hastings was thus restored, by virtue of his casting vote, to the supreme management of affairs. He refused to ratify his resignation; and when Clavering attempted to seize on the governor-generalship, he judiciously obtained an opinion of the supreme court in his own favor. From that time forth, though he could not always command an absolute majority in council, Hastings was never again subjected to gross insult, and his general policy was able to prevail.

A crisis was now approaching in foreign affairs which demanded all the experience and all the genius of Hastings for its solution. Bengal was prosperous, and free from external enemies on every quarter. But the Government of Bombay had hurried on a rupture with the Mahratta confederacy at a time when France was on the point of declaring war against England, and when the mother-country found herself unable to subdue her rebellious colonists in America. Hastings did not hesitate to take upon his own shoulders the whole responsibility of military affairs. All the French settlements in India were promptly occupied. On the part of Bombay, the Mahratta war was conducted with procrastination and disgrace. But Hastings amply avenged the capitulation of Wárgáon by the complete success of his own plan of operations. Colonel Goddard with a Bengal army marched across the breadth of the peninsula, from the valley of the Ganges to the western sea, and achieved almost without a blow the conquest of Guzerát. Captain Popham, with a small detachment, stormed the rock fortress of Gwalior, then deemed impregnable and the key of Central India; and by this feat held in check Sindiá, the most formidable of the Mahratta chiefs. The bhonsla, or Mahratta rájá of Nágpur, whose dominions bordered on Bengal, was won over by the diplomacy of an emissary of Hastings. But while these events were taking place, a new source of embarrassment had arisen at Calcutta. The supreme court, whether rightly or wrongly, assumed a jurisdiction of first instance over the entire province of Bengal. The English common law, with all the absurdities and rigors of that day, was arbitrarily extended to an alien system of society. *Zamíndárs*, or government renters, were arrested on mesne process; the sanctity of the *zanána*, or women's chamber, as dear to Hindus as to Mahometans, was violated by the sheriff's officer; the deepest feelings of the people and the entire fabric of revenue administration were alike disregarded. On this point the entire council acted in harmony. Hastings and Francis went joint bail for imprisoned natives of distinction. At last, after the dispute between the judges and the executive threatened to become a trial of armed force, Hastings set it at rest by a characteristic stroke of policy. A new judicial office was created in the name of the Company, to which Sir Elijah Impey was appointed, though he never consented to draw the additional salary offered to him. The understanding between Hastings and Francis, originating in this state of affairs, was for a short period extended to general policy. An agreement was come to by which Francis received patronage for his circle of friends, while Hastings was to be unimpeded in the control of foreign affairs. But a difference of interpretation arose. Hastings recorded it in an official minute that he had found Francis's private and public conduct to be "void of truth and honor." They met as duellists. Francis fell wounded, and soon afterwards returned to England.

The Mahratta war was not yet terminated, but a far more formidable danger now threatened the English in India. The imprudent conduct of the Madras authorities had irritated beyond endurance the two greatest Mussulman powers in the peninsula, the nizám of the Deccan and Hy-

der Ali, the usurper of Mysore, who began to negotiate an alliance with the Mahrattas. A second time the genius of Hastings saved the British empire in the east. On the arrival of the news that Hyder had descended from the highlands of Mysore, cut to pieces the only British army in the field, and swept the Carnatic up to the gates of Madras, he at once adopted a policy of extraordinary boldness. He signed a blank treaty of peace with the Mahrattas, who were still in arms, reversed the action of the Madras Government towards the nizám, and concentrated all the resources of Bengal against Hyder Ali. Sir Eyre Coote, a general of renown in former Carnatic wars, was sent by sea to Madras with all the troops and treasure that could be got together; and a strong body of reinforcements subsequently marched southwards under General Leslie along the coast line of Orissa. The landing of Coote preserved Madras from destruction, though the war lasted through many campaigns and only terminated with the death of Hyder. Leslie's detachment was decimated by an epidemic of cholera (perhaps the first mention of this disease by name in Indian history); but the survivors penetrated to Madras, and not only held in check the bhonsla and the nizám, but also corroborated the lesson taught by Goddard—that the Company's sepoys could march anywhere, when boldly led. Hastings's personal task was to provide the ways and means for this exhausting war. A considerable economy was effected by a reform in the establishment for collecting the land tax. The Government monopolies of opium and salt were then for the first time placed upon a remunerative basis. But these reforms were of necessity slow in their beneficial operation. The pressing demands of the military chest had to be satisfied by loans, and in at least one case from the private purse of the governor-general. Ready cash could alone fill up the void; and it was to the hoards of native princes that Hastings's fertile mind at once turned. Cheyte Sing, rájá of Benares, the greatest of the vassal chiefs who had grown rich under the protection of the British rule, lay under the suspicion of disloyalty. The wazír of Oudh had fallen into arrears in the payment due for the maintenance of the Company's garrison posted in his dominions, and his administration was in great disorder. In his case the ancestral hoards were under the control of his mother, the begum of Oudh, into whose hands they had been allowed to pass at the time when Hastings was powerless in council. Hastings resolved to make a progress up country in order to arrange the affairs of both provinces, and bring back all the treasure that could be squeezed out of its holders by his personal intervention. When he reached Benares and presented his demands, the rájá rose in insurrection, and the governor-general barely escaped with his life. But the faithful Popham rapidly rallied a force for his defence. The native soldiery were defeated again and again; Cheyte Sing took to flight, and an augmented permanent tribute was imposed upon his successor. The Oudh business was managed with less risk. The wazír consented to everything demanded of him. The begum was charged with having abetted Cheyte Sing in his rebellion; and after the severest pressure applied to herself and her attendant eunuchs, a fine of more than a million sterling was exacted from her. Hastings appears to have been not altogether satisfied with the incidents of this expedition, and to have anticipated the censure which it received in England. As a measure of precaution, he procured documentary evidence of the rebellious intentions of the rájá and the begum, to the validity of which Impey obligingly lent his extra-judicial sanction.

The remainder of Hastings's term of office in India was passed in comparative tranquillity, both from internal opposition and foreign war. The centre of interest now shifts to the India House and to the British Parliament. The long struggle between the Company and the ministers of the crown for the supreme control of Indian affairs and the attendant patronage had reached its climax. The decisive success of Hastings's administration alone postponed the inevitable solution. His original term of five years would have expired in 1778; but it was annually prolonged by special Act of Parliament until his voluntary resignation. Though Hastings was thus irremovable, his policy did not escape censure. Ministers were naturally anxious to obtain the reversion to his vacant post, and Indian affairs formed at this time the hinge on which party politics turned. On one occasion Dundas carried a motion in the House of Commons censuring Hastings, and demanding his recall. The directors of the Company were disposed to act upon this resolution; but in the court of proprietors, with whom the decision ultimately lay, Hastings always possessed a sufficient majority. Fox's India Bill led to the downfall of the Coalition Ministry in 1783. The Act which Pitt successfully carried in the following year introduced a new constitution, in which Hastings felt that he had no place. In February, 1785, he finally sailed from Calcutta, after a dignified ceremony of resignation, and amid enthusiastic farewells from all classes.

On his arrival in England, after a second absence of sixteen years, he was not displeased with the reception he met with at court and in the country. A peerage was openly talked of as his due, while his own ambition pointed to some responsible office at home. Pitt had never taken a side against him, while Lord Chancellor Thurlow was his pronounced friend. But he was now destined to learn that his enemy Francis, whom he had discomfited in the council chamber at Calcutta, was more than his match in the parliamentary arena. Edmund Burke had taken the subject races of India under the protection of his eloquence. Francis, who had been the early friend of Burke, supplied him with the personal animus against Hastings, and with the knowledge of details, which he might otherwise have lacked. The Whig party on this occasion unanimously followed Burke's lead. Dundas, Pitt's favorite subordinate, had already committed himself by his earlier resolution of censure; and Pitt was induced by motives which are still obscure to incline the ministerial majority to the same side. To meet the oratory of Burke and Sheridan and Fox, Hastings wrote an elaborate minute with which he wearied the ears of the House for two successive nights, and he subsidized a swarm of pamphleteers. The impeachment was decided upon in 1786, but the actual trial did not commence until 1788. For seven long years Hastings was upon his defence on the charge of "high crimes and misdemeanors." During this anxious period he appears to have borne himself with characteristic dignity such as is consistent with no other hypothesis than the consciousness of innocence. At last, in 1795, the House of Lords gave a verdict of not guilty on all the charges laid against him; and he left the bar at which he had so frequently appeared, with his reputation clear, but ruined in fortune. However large the wealth he brought back from India, all was swallowed up in defraying the expenses of his trial. Continuing the line of eon duct which in most other men would be called hypocrisy, he forwarded a petition to Pitt praying that he might be reimbursed his costs from the public funds. This petition, of course, was rejected. At last, when he was reduced to actual destitution, it was arranged that the East India Company should grant him an annuity of £4000 for a term of years, with £90,000 paid down in advance. This annuity expired before his death; and he was compelled to make more than one fresh appeal to the bounty of the Company, which was never withheld. Shortly before his acquittal he had been able to satisfy the dream of childhood, by buying back the ancestral manor of Daylesford, where the remainder of his life was passed in honorable retirement. In 1813 he was called on to give evidence upon Indian affairs before the two Houses of Parliament, which received him with exceptional marks of respect. The university of Oxford conferred on him the honorary degree of D.C.L.; and in the following year he was sworn of the Privy Council, and took a prominent part in the reception given to the duke of Wellington and the allied sovereigns. He died on the 22d of August, 1818, in his 86th year, and lies buried behind the chancel of the parish church, which he had recently restored at his own charges.

In physical appearance, Hastings "looked like a great man, and not like a bad man." The body was wholly subjugated to the mind. A frame naturally slight had been further attenuated by rigorous habits of temperance, and thus rendered proof against the diseases of the tropics. Against his private character not even calumny has breathed a reproach. As brother, as husband, and as friend, his affections were as steadfast as they were warm. By the public he was always regarded as reserved, but within his own inner circle he gave and received perfect confidence. In his dealings with money, he was characterized rather by liberality of expenditure than by carefulness of acquisition. A classical education and the instincts of family pride saved him from both the greed and the vulgar display which marked the typical "nabob," the self-made man of those days. He could support the position of a governor-

general and of a country gentleman with equal credit. Concerning his second marriage, it suffices to say that the Baroness Imhoff was about forty years of age, with a family of grown-up children, when the complaisant law of her native land allowed her to become Mrs. Hastings. She survived her husband, who seems to have cherished towards her to the last the sentiments of a lover. Her children he adopted as his own; and it was chiefly for her sake that he desired the peerage which was twice held out to him.

Hastings's public career will probably never cease to be a subject of controversy. It was his misfortune to be the scape-goat upon whose head Parliament laid the accumulated sins, real and imaginary, of the East India Company. If the acquisition of our Indian empire can be supported on ethical grounds, Hastings needs no defence. No one who reads his private correspondence will admit that even his least defensible acts were dictated by dishonorable motives. It is more pleasing to point out certain of his public measures upon which no difference of opinion can arise. He was the first to attempt to open a trade route with Thibet, and to organize a survey of Bengal and of the eastern seas. It was he who persuaded the *pandits* of Bengal to disclose the treasures of Sanskrit to European scholars. He founded the Madrasa or college for Mahometan education at Calcutta, primarily out of his own funds; and he projected the foundation of an Indian Institute in England. The Royal Asiatic Society was established under his auspices, though he yielded the post of president to Sir W. Jones. No Englishman ever understood the native character so well as Hastings; none ever devoted himself more heartily to the promotion of every scheme, great and small, that could advance the prosperity of India. Natives and Anglo-Indians alike venerate his name, the former as their first beneficent administrator, the latter as the most able and the most enlightened of their own class. If Clive's sword conquered the Indian empire, it was the brain of Hastings that planned the system of civil administration, and his genius that saved the empire in its darkest hour.

The bibliography dealing with Warren Hastings is not large. The histories of Mill and Thornton both adopt a standpoint that is on the whole adverse. The *Memoirs*, by Gleig, in 3 vols. (Lond., 1841) are too tedious to be read at the present day. The review of those *Memoirs* by Macaulay, despite its exuberance of color, its Whig partiality, and its proved inaccuracies, will not easily be superseded as the one standard authority. There is a recent *Biography* by Captain Trotter (1878). Much interesting information, in correction or amplification of Macaulay, may be found in the *Memoirs of Francis, with Correspondence*, etc., by Parkes and H. Merivale (1867), and in the *Memoirs of Sir E. Impey* by his son (1846), who deposited his private MS. materials in the British Museum. In 1872 the British Museum also obtained by purchase from a Mrs. Kinter 268 vols. of papers relating to Hastings, chiefly letters between 1757 and 1818. These have been partly utilized by Mr. Beveridge in a series of articles contributed to the *Calcutta Review* for October, 1877, April, 1878, and April, 1879. (J. S. Co.)

HASTINGS, Francis Rawdon Hastings, First Marquis of (1754–1826), ranks among those governors-general of India who, completing the work of Clive and Warren Hastings, achieved the creation of the Indian empire of England. The services of Lord Hastings in this respect were special and important. He was both governor-general and commander-in-chief in India from 1813 till the end of 1822; during that period he carried two important wars, the Nepaulese and the Mahratta, to a successful issue; while adding to the territories of the East India Company, he in several respects altered and improved their policy; and by the sagacity and at the same time the generosity of his own administration (in which he exhibited the true qualities of a Christian proconsul) he won reverence from the natives and left a great name in India.

Lord Hastings was in no way connected with Warren Hastings; his family name was Rawdon. His father, Sir John Rawdon of Moira in the county of Down, fourth baronet, was created Baron Rawdon of Moira, and afterwards Earl of Moira, in the Irish peerage. His mother was the Lady Elizabeth Hastings, daughter of the ninth earl of Huntingdon. Both his father and mother appear to have been persons of considerable ability and high cultivation. Lord Rawdon, as he was then called, having gone at an early age to the university of Oxford, joined the army in his seventeenth year as ensign in the 15th foot. His life henceforth was entirely spent in the service of his country, and may naturally be divided into four periods:—from 1773 to 1782 he was engaged with much distinction in the American war; from 1783 to 1813 he held various high appointments at home, and took an active part in the business of the House of Lords; from 1813 to 1823 was the period of his labors in India; after retiring from which, in the last years of his life (1824–1826), he was governor of Malta.

In America Lord Rawdon served at the battles of Bunker's Hill, Brooklyn, White Plains, Monmouth, and Camden, at the attacks on Forts Washington and Clinton, and at the siege of Charleston. In fact he was engaged in all the chief operations of the war. Perhaps his most noted achievements were the raising of a corps at Philadelphia, called the Irish Volunteers, who under him became famous for their fighting qualities, and the victory of Hobkirk Hill, which, when in command of only a small force, he gained by superior military skill and determination against an American *corps d'armée*. In 1782 he was invalided. The vessel in which he returned to England was captured and carried into Brest. This occasioned the loss of his papers and personal records of the war which would doubtless have been interesting. He was speedily released, and on his arrival in England was much honored by George III., who created him an English peer (Baron Rawdon) in March, 1783.

In 1793 Lord Rawdon succeeded his father as earl of Moira. In 1794 he was sent with 10,000 men from Southampton to Ostend to reinforce the duke of York and the allies in Flanders. The march by which he effected a junction was considered extraordinary. In 1803 he was appointed commander-in-chief in Scotland, and in 1804 he married Flora Muir Campbell, countess of Loudon in her own right. He and Lady Loudon lived at Duddingston House near Edinburgh, where they were very popular. The opposition coming into power in 1806, Lord Moira, who had always voted with them, received the place of master general of the ordnance. He was now enabled to carry a philanthropic measure, of which from his first entry into the House of Lords he had been a great promoter, namely, the Debtor and Creditor Bill for relief of poor debtors. Ireland was another subject to which he had given particular attention: in 1797 there was published a *Speech by Lord Moira on the Dreadful and Alarming State of Ireland*. Lord Moira's sound judgment on public affairs, combined with his military reputation and the honorable uprightness of his character, won for him a high position among the statesmen of the day, and he gained an additional *prestige* from his intimate relations with the prince of Wales. On two occasions, in 1809 and again in 1812 after the assassination of Percival, there were negotiations for placing him at the head of affairs. As a further mark of the regent's regard Lord Moira received the order of the Garter, and in the same year was appointed governor-general and commander-in-chief of India. He landed at Calcutta, and assumed office in succession to Lord Minto in October, 1813. He was now fifty-nine years of age. One of the chief questions which awaited him was that of relations with the Goorkha state of Nepaul. The Goorkhas, a brave and warlike little nation, failing to extend their conquests in the direction of China, had begun to encroach on territories held or protected by the East India Company; especially they had seized the districts of Bootwul and Seoraj, in the northern part of Oudh, and when called upon to relinquish these, they deliberately elected (April, 1814) to go to war rather than do so. Lord Moira, having travelled through the northern provinces and fully studied the question, declared war against Nepaul (November, 1814). The enemy's frontier was 600 miles long, and Lord Moira, who directed the plan of the campaign, resolved to act offensively along the whole line. It was an anxious undertaking, because the native states of India were all watching the issue and waiting for any serious reverse to the English to join against them. At first all seemed to go badly, as the British officers too much despised the enemy, and the Sepoys were unaccustomed to mountain warfare, and thus alternate extremes of rashness and despondency were exhibited. But this rectified itself in time, especially through the achievements of General (afterwards Sir David) Ochterlony, who before the end of 1815 had taken all the Goorkha posts to the west, and early in 1816 was advancing victoriously within 50 miles of Katmandoo, the

capital. The Goorknas now made peace; they abandoned the disputed districts, ceded some territory to the English, and agreed to receive a British resident. Ever since they have faithfully kept these terms; the northern frontier of India has been securely fixed, and the Goorkhas have entirely kept aloof from the machinations of disaffected native states. For his masterly conduct of these affairs Lord Moira was created Marquis of Hastings in 1816.

He had now to deal with internal dangers. A treacherous combination of Mahratta powers was constantly threatening the continuance of British rule, under the guise of plausible assurances severally given by the peshwah, Sindia, Holkar, and other princes. At the same time the existence of the Pindháree state was not only dangerous to the English, as being a warlike power always ready to turn against them, but it was a scourge to India itself. In 1816, however, the Pindhárees entered British territory in the Northern Circars, where they destroyed 339 villages. On this, permission was obtained to act for their suppression. Before the end of 1817 the preparations of Lord Hastings were completed, when the peshwah suddenly broke into war, and the British were opposed at once to the Mahratta and Pindháree powers, estimated at 200,000 men and 500 guns. "The whole was utterly shattered in a brief campaign[1] of four months (1817–1818). The peshwah's dominion had been annexed, and those of Sindia, Holkar, and the rajah of Berar lay at the mercy of the governor-general, and were saved only by his exceeding and honorable moderation. There was at last, after sixty years from the battle of Plassy, no question of the supremacy of British power in India, now more perfectly established and more effectively dominant than that of Aurungzebe."[2] The Pindhárees had ceased to exist, and peace and security had been substituted for misery and terror.

"It is a proud phrase to use," said Lord Hastings,[3] "but it is a true one, that we have bestowed blessings upon millions. Nothing can be more delightful than the reports I receive of the sensibility manifested by the inhabitants to this change in their circumstances. The smallest detachment of our troops cannot pass through that district without meeting everywhere eager and exulting gratulations, the tone of which proves them to come from glowing hearts. Multitudes of people have, even in this short interval, come from the hills and fastnesses in which they had sought refuge for years, and have reoccupied their ancient deserted villages. The ploughshare is again in every quarter turning up a soil which had for many seasons never been stirred, except by the hoofs of predatory cavalry."

While the natives of India appreciated the results of Lord Hastings's achievements, the court of directors grumbled at his having extended the British territory. They also disliked and opposed his measures for introducing education among the natives and his encouraging the freedom of the press. Posterity has, however, vindicated the policy of Lord Hastings in all respects. In 1819 he obtained the cession by purchase of the island of Singapore. In finance his administration was very successful, as notwithstanding the expenses of his wars he showed an annual surplus of two millions sterling. He labored much at law reform, and he succeeded in greatly raising the status and character of the civil service of India. Lord and Lady Hastings by their stately and yet genial manners, and by their warm encouragement of literature and science, gave a high tone to the society of Calcutta. And he was the first governor-general to exhibit a personal interest in the exertions of the missionaries. Brilliant and beneficent as his career had been, Lord Hastings did not escape, any more than Clive, Warren Hastings, or Lord Wellesley, the assaults of unjust detraction. His last years of office were embittered by the discussions on a matter very notorious at the time, namely, the affairs of the banking-house of W. Palmer and Company. The whole affair was mixed up with insinuations against Lord Hastings, especially charging him with having been actuated by favoritism towards one of the partners in the firm. From imputations which were inconsistent with his whole character he has subsequently been exonerated. But while smarting under them he tendered his resignation in 1821, though he did not leave India till January, 1823. He was much exhausted by the arduous and almost incredible labors which for more than nine years he had sustained. Among his characteristics it is mentioned that "his ample fortune absolutely sank under the benevolence of his nature;" and, so far from having enriched himself in the appointment of governor-general, he returned to England in circumstances which obliged him still to seek public employment. In 1824 he received the comparatively small post of governor of Malta, in which island he introduced many reforms and endeared himself to the inhabitants. He died in 1826, leaving a request that his right hand should be cut off and preserved till the death of the marchioness of Hastings, and then interred in her coffin.

[1] For the interesting details of this campaign, as well as of the war in Nepaul, see Prinsep's *History of the Political and Military Transactions in India, during the administration of the Marquis of Hastings.*

[2] Meadows Taylor's *Student's Manual of the History of India*, p. 595.

[3] Reply to Address of Inhabitants of Calcutta; see *Asiatic Journal*, February, 1819.

No "Life" of the marquis of Hastings has appeared, but a diary of his first tours in India, written for his children, has been published, and affords interesting indications of his character. For further particulars of his career see the *Asiatic Journal* for November, 1823, and the *Annual Biography and Obituary* for 1828; and for details of his Indian administration see Prinsep's work cited above, Wilson's continuation of Mill's *History of India*, and other Indian histories. (A. GR.)

HAT, a covering for the head worn by both sexes, and distinguished from the cap or bonnet by the possession of a brim. The modern hat can be traced back to the *petasus* worn by the ancient Romans when on a journey; and hats with brims were also used, probably on like occasions, by the earlier Greeks. It was not till after the Norman conquest that the use of hats began in England. A "hatte of biever" about the middle of the 12th century was worn by some one of the "nobels of the lande, mett at Clarendom;" and Froissart describes hats and plumes which were worn at Edward's court in 1340, when the Garter order was instituted. In the 13th century the use of the scarlet hat which distinguishes cardinals was sanctioned by Pope Innocent IV. The merchant in Chaucer's *Canterbury Tales* had

"On his head a Flaundrish bever hat;"

and from that period onwards there is frequent mention of "felt hattes," "beever hattes," and other like names. Throughout mediæval times the wearing of a hat was regarded as a mark of rank and distinction. The caprices of fashion in hats during the reign of Elizabeth may be understood from an extract from Stubbs's *Anatomie of Abuses*, published about 1585:—

"Sometimes they use them sharpe on the crowne pearking up like the spire or shaft of a steeple, standing a quarter of a yard above the crowne of theire heads; some more, some lesse, as please the fantasies of their inconstant mindes. Othersome be flat, and broade on the crowne, like the battlements of a house. Another sorte have rounde crownes, sometimes with one kind of bande, sometimes with another; now black, now white, now russed, now redde, now grene, now yellow; now this, now that; never content with one colour or fashion two daies to an end."

During the reign of Charles I. the Puritans affected a steeple crown and broad-brimmed hat, while the Cavaliers adopted a lower crown and a broader brim ornamented with feathers. Still greater breadth of brim and a profusion of feathers were fashionable characteristics of the hats in the time of Charles II., and the gradual expansion of brim led to the device of looping or tying up that portion. Hence arose various fashionable "cocks" in hats, such as the "Monmouth cock," etc.; and ultimately, by the looping up equally of three sides of the low-crowned hat, the cocked hat which prevailed throughout the 18th century was elaborated. Since the beginning of the present century the cocked hat as an ordinary article of dress has disappeared. The Quaker hat, plain, low in crown, and broad in brim, which originated with the sect in the middle of the 17th century, is also now becoming uncommon. See COSTUME.

HAT MANUFACTURE.—Until recent times hats were principally made by the process of felting, and as tradition ascribed the discovery of that very ancient operation to St. Clement, he was assumed as the patron saint of the craft, and the annual festival of the trade continues to be held on St. Clement's day, the 23d November. At the present day the trade is divided into two distinct classes. The first and most ancient is concerned with the manufacture of felt hats, and the second has to do with the recent but now most extensive and important manufacture of silk or dress hats. In addition to these there is the equally

important manufacture of straw or plaited hats, which does not fall within the scope of this article; and hats are occasionally manufactured of materials and by processes not included under any of these heads, but such manufactures do not take a large or permanent position in the industry.

Felt Hats.—As now made, felt hats are of three different kinds, plain soft, plain hard, and "napped" or "ruffed" felts. There is a great range in the quality of felt hats, the finer and more expensive qualities being made entirely of fur; for commoner qualities a mixture of fur and Saxony wool is used; and for the lowest kinds wool alone is employed. The processes and apparatus necessary for making hats of fur differ also from those required in the case of woollen bodies; and in large manufactories machinery is now generally employed for operations which at no distant date were entirely manual. In the smaller factories, and for special objects, the old hand processes are still in operation. An outline of the operations by which the old beaver hat was and to some extent yet is made will give an idea of the manual processes in making a fur napped hat, and the apparatus and mechanical processes employed in making ordinary hard and soft felts will afterwards be noticed.

Hatters' fur consists principally of the hair of rabbits (technically called coneys) and hares, with some proportion of nutria, musquash, and beavers' hair; and generally any parings and cuttings from furriers are also used. Furs intended for felting are deprived of their long coarse hairs, after which they are treated with a solution of nitrate of mercury, an operation called carroting or *secretage*, whereby the felting properties of the fur are greatly increased. The fur is then cut by hand or machine from the skin, and in this state it is delivered to the hat maker. Rabbits' fur for hat-making now comes in large quantities from the Australian colonies; and it is also largely collected in the United Kingdom and in northern Europe. A considerable trade in rabbit fur for hat-making is maintained between Great Britain and the United States.

The old process of making a beaver hat is as follows. The materials of a proper beaver consist, for the body or foundation, of rabbits' fur, and for the nap, of beaver fur, although the beaver is often mixed with or supplanted by a more common fur. Such a hat may be regarded as the highest achievement of the hatter. In preparing the fur plate, the hatter weighs out a sufficient quantity of rabbit fur for a single hat, which is spread out and combined by the operation of bowing. The bow or stang ABC (fig. 1) is about 7 feet long, and it

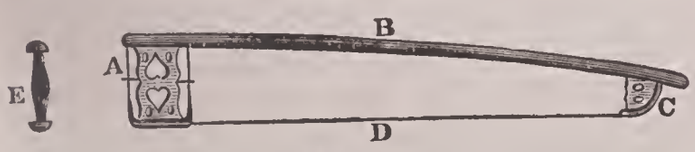


Fig. 1.

stretches a single cord of catgut D, which the workman vibrates by means of a wooden pin E, furnished with a half knob at each end. Holding the bow in his left hand, and the pin in his right, he causes the vibrating string to come in contact with the heap of tangled fur, which does not cover a space greater than that of the hand. At each vibration some of the filaments start up to the height of a few inches, and fall away from the mass, a little to the right of the bow, their excursions being restrained by a concave frame of wicker work called the basket. One half of the material is first operated on, and by bowing and gathering, or a patting use of the basket, the stuff is loosely matted into a triangular figure, about 50 by 36 inches, called a bat. In this formation care is taken to work about two-thirds of the fur down towards what is intended for the brim, which being effected, greater density is induced by gentle pressure with the basket. It is then covered with a wettish linen cloth, upon which is laid the hardening skin, a piece of dry half-tanned horse hide. On this the workman presses or bakes until the stuff adheres closely to the damp cloth, in which it is then doubled up, freely pressed with the hand, and laid aside. By this process, called basoning, the bat has become compactly felted and thinned toward the sides and point. The other half of the fur is next subjected to precisely the same processes, after which a cone-shaped slip of stiff paper is laid on its surface, and the sides of the bat are folded over its edges to its form and size. It is then laid paper-side downward upon the first bat, which is now replaced on the hurdle, and its edges are transversely doubled over the introverted side-lays of the second bat, thus giving equal thickness to the whole body. In this condition it is reintroduced between folds of damp linen cloth, and again hardened, so as to unite the two halves, the knitting together of which is quickly effected. The paper is now withdrawn; and the body in the form of a large cone is removed to the plank or battery room.

The battery consists of an open iron boiler or kettle A (fig. 2), filled with scalding hot water, with shelves, B, C, partly of mahogany and partly of lead, sloping down to it. Here the body is first dipped in the water, and then withdrawn to the plank to partly cool and drain, when it is unfolded, rolled gently with a pin tapering towards the ends, turned and worked in every direction, to toughen and shrink it, and at the same

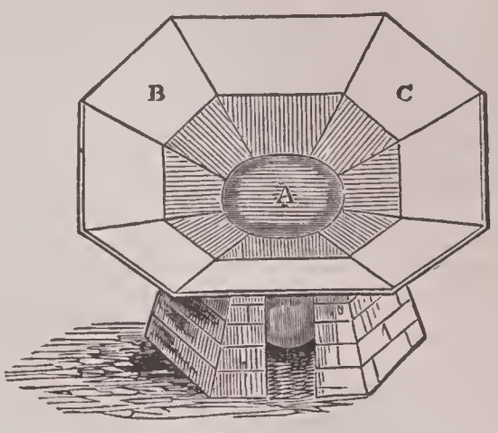


Fig. 2.

time prevent adhesion of its sides. Stopping or thickening the thin spots which now appear, on looking through the body, is carefully performed by dabbing on additional stuff in successive supplies from the hot liquor with a brush frequently dipped into the kettle, until the body be shrunk sufficiently (about one half) and thoroughly equalized. When quite dried, stiffening is performed with a brush dipped into a thin varnish of shellac, and rubbed into the body, the surface intended for the inside having much more laid on it than the outer, while the brim is made to absorb many times the quantity applied to any other part.

On being again dried, the body is ready to be covered with a nap of beaver hair. For this, in inferior qualities, the hair of the otter, nutria, or other fine fur is sometimes substituted. The requisite quantity of one or other of these is taken and mixed with a proportion of cotton, and the whole is bowed up into a thin uniform lap. The cotton merely serves to give sufficient body to the material to enable the workman to handle the lap. The body of the hat being damped, the workman spreads over it a covering of this lap, and by moistening and gentle patting with a brush the cut ends of the hair penetrate and fix themselves in the felt body. The hat is now put into a coarse hair cloth, dipped and rolled in the hot liquor until the fur is quite worked in, the cotton being left on the surface loose and ready for removal. The blocking, dyeing, and finishing processes in the case of beaver hats are similar to those employed for ordinary felts, except that greater care and dexterity are required on the part of the workmen, and further that the coarse hairs or kemps which may be in the fur are cut off by shaving the surface with a razor. The nap also must be laid in one direction, smoothed, and rendered glossy by repeated wettings, ironings, and brushings. A hat so finished is very durable, and it is much more light, cool, and easy-fitting to the head than the silk hat which has now so largely superseded it.

Till a comparatively recent date all attempts to apply machinery to the principal processes in felt hat-making resulted in failure. As is the case with many other labor-saving appliances of recent introduction, the first efficient machinery for felt hat-making was devised in America, and from the United States the machine-making processes were introduced into England about the year 1858; and now in all large establishments machinery such as that alluded to below is employed. For the forming of hat bodies two kinds of machine are used, according as the material employed is fur or wool. In the case of fur, the essential portion of the apparatus used consists of a cone of copper of the size and form of the body or bat to be made, perforated all over with small holes. The cone is made to revolve on its axis slowly over an orifice under which there is a powerful fan, which maintains a strong inward draught of air through the holes in the cone. At the side of the cone, and with an opening towards it, is a trunk or box from which the fur to be made into a hat is thrown out by the rapid revolution of a brush-like cylinder, and as the cloud of separate hairs is expelled from the trunk, the current of air being sucked through the cone carries the fibres to it and causes them to cling closely to its surface. Thus a coating of loose fibres is accumulated on the copper cone, and these are kept in position only by the exhaust at work under it. When sufficient for a hat body has been deposited, a wet cloth is wrapped round it, over which an outer

cone is slipped and the whole is removed for felting, while another copper cone is placed in position for continuing the work. The felting of fur bodies is principally done by hand-labor, although machinery has recently been introduced by which it is partly done. The bat or body of wool hats is prepared by first carding in a modified form of carding machine. The wool is divided into two separate slivers as delivered from the cards, and these are wound simultaneously on a double conical block of wood mounted and geared to revolve slowly with a reciprocating horizontal motion, so that there is a continual crossing and recrossing of the wool as the sliver is wound around the cone. This diagonal arrangement of the sliver is an essential feature in the apparatus, as thereby the strength of the finished felt is made equal in every direction; and when strained in the blocking the texture yields in a uniform manner without rupture. The wool wound on the double block forms the material of two hats, which are separated by cutting around the median or base line, and slipping each half off at its own end. Into each cone of wool or bat an "inlayer" is now placed to prevent the inside from matting, after which they are folded in cloths, and placed over a perforated iron plate, through which steam is blown. When well moistened and heated, they are placed between boards, and subjected to a rubbing action sufficient to harden them for bearing the subsequent strong planking or felting operations. The planking of wool hats is generally done by machine, in some cases a form of fulling mill being used; but in all forms the agency is heat, moisture, pressure, rubbing, and turning.

When by thorough felting the hat bodies of any kind have been reduced to dense leathery cones about one half the size of the original bat, they are dried, and, if hard felts are to be made, the bodies are at this stage hardened or stiffened with a varnish of shellac. Next follows the operation of blocking, in which the felt for the first time assumes approximately the form it is ultimately to possess. For this purpose the conical body is softened in boiling water, and forcibly drawn over a hat-shaped wooden block. A string is passed round where the band is to be, and the brim is then flattened out from the string. Next follows the dyeing of the hat in a bath of suitable dyeing materials, according to the color desired. In dealing with fine hats, each hat is separately dyed while on the block, but with commoner qualities it is the practice to dye before blocking. The finishing processes include shaping on a block, over which crown and brim receive accurately their ultimate form, and pouncing or pumicing, which consists of smoothing the whole surface with emery or glass paper while the hat is still stretched on the block. The trimmer finally binds the outer brim and inserts the lining, after which the brim may get more or less of a curl or turn over according to prevailing fashion. Machines of American invention for blocking and pouncing have to some extent been introduced.

Silk Hats.—The silk hat, which has now become coextensive with civilization, is an article of recent introduction. It was known in Florence about a century ago; but its manufacture was not introduced into France till about 1825, and its development has taken place entirely since that period. A silk hat consists of a light stiff body covered with a plush of silk, the manufacture of which in a brilliant glossy condition is the most important element in the industry; and in that manufacture the French are without equals. Originally the bodies were made of felt and various other materials, but now calico is almost exclusively used.

The calico is first stiffened with a varnish of shellac, and then cut into pieces sufficient for crown, side, and brim. The side-piece is wound round a wooden hat block, and its edges are joined by hot ironing, and the crown-piece is put on and similarly attached to the side. The brim, consisting of three thicknesses of calico cemented together, is now slipped over and brought to its position, and thereafter a second side-piece and another crown are cemented on. The whole of the body, thus prepared, now receives a coat of size, and subsequently it is varnished over, and thus it is ready for the operation of covering. In covering this body, the under brim, generally of merino, is first attached, then the upper brim, and lastly the crown and side sewed together are drawn over. All these by hot ironing and stretching are drawn smooth and tight, and as the varnish of the body softens with the heat, body and cover adhere all over to each other without wrinkle or pucker. Dressing and polishing by means of damping, brushing, and ironing, come next, after which the hat is "velured" in a revolving machine by the application of haircloth and velvet velures, which cleans the nap and gives it a smooth and glossy surface. The brim has only then to be bound, the linings inserted, and the brim finally curled, when the hat is ready for use.

In all kinds of hat-making the French excel, and in such centres as Anduze, Lyons, and Paris the trade is very extensive and important. In the United Kingdom the felt hat trade is principally centred at Denton and other localities in the neighborhood of Manchester, and in America the States of New York and New Jersey enjoy the greater part of the industry. The value of the hats annually exported from the United Kingdom somewhat exceeds £1,000,000 sterling. (J. PA.)

HATFIELD, or BISHOP'S HATFIELD, a quiet, old-fashioned market-town of England, in the county of Hertford, is prettily situated on the side of a hill, 17¾ miles N. N. W. of London by railway. The church of St. Ethelreda dates its foundation from Norman times, though only a small portion of the original building is now standing. Hatfield is the seat of a poor-law union embracing four parishes. The population of parish in 1901 was 7,551. In the vicinity is Hatfield House, on the site of a palace of the bishops of Ely, which was erected about the beginning of the 12th century. In 1538 the manor was resigned to Henry VIII. by Bishop Goodrich, in exchange for certain lands in Cambridge, Essex, and Norfolk; and after that monarch the palace was successively the residence of Edward VI. immediately before his accession, of Queen Elizabeth during the reign of her sister Mary, and of James I. The last-named exchanged it in 1607 for Theobalds, near Cheshunt, in the same county, an estate of Sir Robert Cecil, afterwards earl of Salisbury, in whose family Hatfield House has since remained. The west wing of the present mansion, built for Cecil in 1608–11, was destroyed by fire in November, 1835, the dowager-marchioness of Salisbury perishing in the flames. The grounds surrounding the house are extensive and beautifully laid out.

HÁTHRAS, or HATRAS, a town in the Alígarh district, North-Western Provinces, India, in 27° 35′ 31″ N. lat., 78° 6′ 9″ E. long. It is well built, with numerous brick and stone houses, and is a prosperous trading centre. At the end of last century it was held by the Ját Thákur, Dáya Rám, whose ruined fort still stands at the east end of the town, and was annexed by the British in 1803. A municipal hall and school-house stand upon the brink of a new tank; and the town also contains a post-office and Government charitable dispensary. Since it came under British rule Háthras has rapidly risen to commercial importance, and now ranks second to Cawnpore among the trading centres of the Doáb. The exports include coarse sugar, grain of all sorts, oil-seeds, cotton, and *ghí*; and the imports embrace iron, metal vessels, European and native cloth, drugs, spices, and miscellaneous wares. Population (1872), 23,589, comprising 21,121 Hindus and 2468 Mahometans.

HATTINGEN, a town of Westphalia, Prussia, in the government district of Arnsberg and the circle of Bochum, is situated on the river Ruhr, about 21 miles N. E. of Düsseldorf. It is the seat of a commission of justice, and possesses a good school. The manufactures comprise cloth, woollen and silk goods, tobacco, iron, and steel. In the town are large iron-works, a brewery, and a brandy distillery. There are iron-stone and coal mines in the neighborhood, and the scanty remains of the Iscuburg, demolished in 1226. Hattingen was one of the Hanse towns of the Middle Ages. Its population in 1905 was 10,345.

HATTO I. (*c.* 850–913), tenth archbishop of Mainz, was born of a Swabian family about the middle of the 9th century. Educated at the monastery of Ellwangen or at Fulda, he attracted the attention of the emperor Arnulf, who in 888 made him abbot of Reichenau, in 889 abbot of Ellwangen, and in 891 archbishop of Mainz. During his reign Hatto acquired much ecclesiastical as well as political power. He presided over the council at Tribur or Teuver (895), at which the emperor and twenty-six or twenty-seven bishops attended, and was employed as ambassador to Charles the Simple and the king of Lorraine at their conference at Saint Goar in 899. Twice he accompanied Arnulf to Italy, in 894 and 896. On the death of Arnulf in 900, Hatto became regent and guardian of Louis, and in the contest with the dukes of Babenberg treacherously betrayed into the emperor's hands Count Adalbert, who was one of their partisans. Under Louis's successor, Conrad I., Hatto retained his influence, but he died in 913, two years after Conrad's accession. Another but less probable account has it that he was killed at the battle of Heresburg in 912. Hatto was a zealous churchman and a bold and energetic statesman. By his influence the crown and the church combined to check the growing power of the great nobles. In a letter to Pope John IX., still extant, he defends the German bishops from certain charges made to the pope.

There is a tradition, due probably to his ambition and violence, that his corpse was seized by the devil and thrown into the crater of Mount Etna. The tradition of the Mouse Tower on the Rhine at Bingen is connected with another Hatto, also archbishop of Mainz (968–970).

HATVAN, a market-town in the county of Heves, Hungary, is situated on the left bank of the Zagyva, at the junction of the Pest-Miskolcz, Hatvan-Rutka, and Hatvan-Szolnok lines of railway, about 30 miles E.N.E. of Budapest, 47° 40′ N. lat., 19° 41′ E. long. Hatvan possesses a handsome church and an elegant castle. There are two large cloth factories, and a court of assize is held there. Many of the inhabitants of the town and neighborhood are employed in raising fruit and melons, in improving the breed of sheep, and in tending large herds of horses, which graze wild on the spacious communal pasture-lands. Cattle fairs are frequently held in the town, and the trade in horses is considerable. In 1900 the population amounted to 9,707, for the most part Magyars by nationality and Roman Catholics by creed.

As a fortified place Hatvan rose to some importance in the Middle Ages. In July, 1525, a diet of Magyar nobles was held there. Subsequent to the catastrophe at Mohács (1526), Hatvan, along with many other Hungarian towns, fell into the hands of the Turks. After being besieged by the imperialists in 1594 and 1595, it was taken by them on the 3d September, 1596. In 1678 it was almost completely destroyed by the Ottoman forces. On the 2d April, 1849, the Austrians were defeated by the Hungarians in a sanguinary engagement near the town.

HATZFELD (Hungarian *Zsombolya*), a market-town in the county of Torontál, Hungary, on the Austrian state line of railway, about 22 miles W. of Temesvár, 45° 48′ N. lat., 20° 44′ E. long. The most important buildings are the Roman Catholic church, the château of Count Csekonics, a district court-house, and the usual Government offices. The communal lands are large and very productive, more especially in wheat, barley, oats, Indian corn, and rape seed. The rearing of horses is extensively carried on. In 1900 the population amounted to 10,152, for the most part Germans by nationality and Roman Catholics by creed.

HAUCH, Johannes Carsten (1790–1872), Danish poet, was born of Danish parents residing at Frederikshald in Norway, on the 12th of May, 1790. In 1802 he lost his mother, and in 1803 returned with his father to Denmark. In 1807 he fought as a volunteer against the English invasion. He entered the University of Copenhagen in 1808, and in 1821 took his doctor's degree. He became the friend and associate of Steffens and Oehlenschläger, warmly adopting the new views about poetry and philosophy. His first dramas, *The Journey to Ginistan* and *The Power of Fancy*, appeared in 1816 and 1817, and were followed by *Flosaura*; but these works attracted little or no attention. Hauch therefore gave up all hope of fame as a poet, and resigned himself entirely to the study of science, to pursue which he went abroad. At Nice he had an accident which obliged him to submit to the amputation of one foot. He returned to dramatic production, and published *The Hamadryad, Bajazet, Tiberius, Gregory VII., The Death of Charles V.* (1831), and *The Siege of Maestricht* (1832). These plays were violently attacked by the best critical organs, and enjoyed no success. Hauch then turned to novel-writing, and published in succession four romances—*Vilhelm Zabern*, 1834; *Guldmageren*, 1836; *A Polish Family*, 1829; and *The Castle on the Rhine*, 1845. In 1842 he collected his shorter *Poems*. In 1846 he was appointed professor of the Scandinavian languages in Kiel, but returned to Copenhagen when the war broke out in 1848. About this time his dramatic talent was at its height, and he produced one admirable tragedy after another; among these may be mentioned *Svend Grathe*, 1841; *The Sisters at Kinnekullen*, 1849; *Marsk Stig*, 1850; *Honor Lost and Won*, 1851; and *Tycho Brahe's Youth*, 1852. From 1858 to 1860 Hauch was director of the Danish National Theatre; he produced three more tragedies—*The King's Favorite*, 1859; *Henry of Navarre*, 1863; and *Julian the Apostate*, 1868. In 1861 he published another collection of *Poems*, and in 1862 the historical epic of *Valdemar Atterdag*. From 1851, when he succeeded Oehlenschläger, to his death, he held the honorary post of professor of æsthetics at the university of Copenhagen. He died in Rome in 1872. Hauch was one of the most prolific of the Danish poets, and his writings are unequal in value. His lyrics and romances in verse are always fine in form and often strongly imaginative. In all his writings, but especially in his tragedies, he displays a strong bias in favor of what is mystical and supernatural. Of his dramas *Marsk Stig* is perhaps the best, and of his novels *Vilhelm Zabern* is admired the most.

HAUFF, Wilhelm (1802–1827), a popular German novelist, was born at Stuttgart, 29th November, 1802. Having lost his father, who was a Government official, at the age of seven, he repaired with his mother to Tübingen, where he frequented the *Schola anatolica*. In 1818 he was sent to the *Klosterschule* at Blaubeuren, and two years later he entered the seminary of Tübingen. After having completed, in 1824, his philosophical and theological studies and taken his degree, he acted for two years as private tutor, and assumed in January, 1827, the editorship of the *Morgenblatt*. In the following month he married, and led a happy and quiet life, which was ended by a fatal illness on 18th November of the same year. Hauff's literary activity is comprised within the short space of about two years. In his *Märchenalmanach* for 1826 he published the *Fairy Tales* he used to relate to his pupils during his tutorship. They were distinguished by an originality of conception, a playful though somewhat fantastic humor, and an elegance of style, not usually met with in similar productions. Those fanciful tales founded his fame as a narrator, and form, together with his subsequent novels, several of which belong to the same species, the basis of his permanent reputation as an author. His next publication, *Mittheilungen aus den Memoiren des Satans*, "Extracts from the Memoirs of Satan" (2 vols. 1826–27), was of a fragmentary kind, but gave additional proof of his talent as a humorist. In 1826 he wrote a novel—*Der Mann im Monde*, "The Man in the Moon"—with the intention of satirizing and parodying the sentimental sensualism of Clauren; but in the course of composition the projected parody became a regular imitation, and as he issued the novel under the name of that romancer, the latter brought an action against him for the abuse of his name, and gained his lawsuit. Hauff succeeded, however, in morally annihilating that maudlin narrator by his witty *Controverspredigt*, "Controversial Sermon" (1826). Animated by the genius of Sir Walter Scott, Hauff wrote a historical romance called *Lichtenstein* (1826), which illustrated the most interesting period in the history of Würtemberg, and, being one of the first historical German novels, acquired, in spite of its weakness as a literary composition, great popularity throughout Germany. His fanciful work, *Phantasien im Bremer Rathskeller* (1827), is pervaded, especially in the first portion of the book, by an exuberant spirit of conviviality, which exercises a cheering effect on the reader; but his most perfect fiction is the *Bettlerin vom Pont-des-Arts*. Hauff's works have gone, collectively and separately, through many editions, and some of his shorter poems have become regular "Volkslieder."

HAUG, Johann Christoph Friedrich (1761–1829), a German epigrammatist, was born March 19, 1761, at Niederstotzingen in Würtemberg, and received his early training from his father, who was afterwards professor and preacher at Stuttgart. From the gymnasium in this city Haug passed in 1776 to the Prince Charles academy, where he had Schiller as a fellow scholar, and, after finishing the philosophical and philological course, he devoted himself to the study of legal science with so much success that he attracted the attention of the duke. In 1784 he was appointed secretary of the private closet to his patron, in 1791 received the title of curial and palatine count, in 1794 became the duke's private secretary, and in 1817 was made *Hofrath* or aulic councillor and librarian of the public library at Stuttgart. In 1827 he travelled through northern Germany, and on 30th January, 1829, he died. Haug began his career as an author by publishing *Sinngedichte von Friedrich Hophthalmos* (Frankfort, 1791), the pseudonym Hophthalmos being a jocular Greek equivalent of his own name (*Aug*, the eye, equal to *Ophthalmos*, and therefore Haug equal to Hophthalmos).

Among his later works, which are as often characterized by a love of fun as by power of wit, it is enough to mention *Epigramme und vermischte Gedichte*, Berlin, 1805; *Hundert Epigramme auf Aerzte die Keine sind*, Zurich, 1806; *Epigrammatische Spiele*, 1807; *Taschenbuch dem Bacchus und Jocus geweiht*, Stuttgart, n. d.; *Magische Laterne*, Brünn, 1820; *Panorama der Laune und des Witzes*, Tübingen, 1826; and, perhaps more famous than any, *Zweihundert Hyperbeln auf Herrn Wahls*

ungeheure Nase, Stuttgart, 1804, new edition, Brünn, 1822. Along with Weisses, Ha published *Epigrammatische Anthologie*, Stuttgart, 1807–1 9, 10 vols. A selection from his poems appeared at Hamburg, 1827, 2 vols.

HAUG, Martin (1827–1876), Orientalist, was born at Ostdorf near Balingen, Würtemberg, January 30, 1827. As a self-taught lad he became a pupil in the gymnasium at Stuttgart at a comparatively late age; and in 1848 he entered the university of Tübingen, where he devoted himself to the study of the Oriental languages, and especially of Sanskrit under Roth. He afterwards for some time attended the lectures of Ewald and Benfey in Göttingen, and finally "habilitated" as a privat-docent at Bonn. In 1856 he removed to Heidelberg as collaborateur in the preparation of Bunsen's *Bibelwerk;* and in 1859 he accepted an invitation to India, where he became superintendent of Sanskrit studies and professor of Sanskrit in Poona. There his previous acquaintance with the Zend language and literature enabled him to associate with the Parsees on such terms as afforded the best opportunities for perfecting his knowledge in this department. The result of his researches was the volume of *Essays on the Sacred Language, Writings, and Religion of the Parsees* (Bombay, 1862). After a residence of six years in India, he was compelled by domestic circumstances to return to Würtemberg in 1865; from Stuttgart he was called to Munich as first professor ordinarius of Sanskrit and comparative grammar in 1868. He died at Ragatz in Switzerland on the 3d of June, 1876.

Besides the *Essays on the Parsees*, of which a new edition, by West, greatly enriched from the posthumous papers of the author, appeared in 1878, Haug published a number of works of considerable importance to the student of the literatures of ancient India and Persia. They include *Die Pehlewisprache u. der Bundehesch* (1854); *Die Schrift u. Sprache der zweiten Keilschriftgattung* (1855); *Die fünf Gathas*, edited, translated, and expounded (1858–60); an edition with translation and explanation of *The Aitareya Brahmana of the Rigveda* (1863); *A Lecture on an original Speech of Zoroaster* (1865); *An old Zend-Pahlavi Glossary* (1867); *Ueber den Charakter der Pehlewisprache* (1869); *Das 18te Capitel des Wendidad* (1869); *Ueber das Ardai-Viraf-nameh* (1870); *An old Pahlavi-Pazand Glossary* (1870); *Vedische Räthselfragen u. Räthselsprüche* (1875).

HAUGE, Hans Nielsen (1771–1824), founder of a religious sect within the Lutheran Church of Norway and Denmark, was born in the former country, in the parish of Thunö, April 3, 1771. With the aid of various religious works which he found in his father's house, he labored to supplement the scanty education which he had received as a peasant's son. In his twenty-sixth year, believing himself divinely commissioned, he began to preach in his native parish and afterwards throughout Norway. In 1800 he passed to Denmark, where, as at home, he gained many followers and assistants, chiefly among the lower orders. Proceeding to Christiansand in 1804, Hauge set up a printing-press to disseminate his views more widely, but was almost immediately arrested for holding illegal religious meetings, and for insulting the regular clergy in his books, all of which were confiscated. After being in confinement for ten years, he was released in 1814 on payment of a fine, and retiring to an estate at Bredwill, near Christiania, he died there, March 29, 1824. His adherents, called *Haugianer* or *Leser* (*i. e.*, Readers), are still to be found in the south of Norway. By his writing and preaching he unquestionably did much to revive the spiritual life of the northern Lutheran Church. Though he cannot be said to have rejected any article of the Lutheran creed, the peculiar emphasis which he laid upon the evangelical doctrines of faith and grace involved considerable antagonism to the rationalistic or sacerdotal views commonly held by the established clergy.

Hauge's principal writings are *Forsög til Afhandeling om Guds Visdom*, 1796; *Anvisning til nogle mörkelige Sprog i Bibelen*, 1798; *Forklaring over Loven og Evangelium*, 1803. For an account of his life and doctrines, see Chr. Bang's *Hans Nielsen Hauge og hans Samtid*, Christiania, 1875.

HAUPT, Moritz or Moriz (1808–1874), one of the principal representatives at once of classical and of vernacular philology in Germany, was born at Zittau, in Lusatia, July 27, 1808. His early education was mainly conducted by his father, Ernst Friedrich Haupt, burgomaster of Zittau, a man of good scholarly attainment, who used to take pleasure in turning German hymns or Goethe's poems into Latin, and whose memoranda have been employed by Freytag in the 4th volume of his *Bilder aus der deutschen Vergangenheit*. From the Zittau gymnasium, where he spent the five years 1821–1826, partly under the tuition of Lindemann, Haupt removed to the university of Leipsic with the intention of prosecuting theology; but the natural bent of his mind and the influence of Professor G. Hermann soon turned all his energies in the direction of what were to be his life-studies. On the close of his university course (1830) he returned to his father's house, and the next seven years were devoted to quiet work not only at Greek, Latin, and German, but at Old French, Provençal, and Bohemian. In 1834 he became acquainted with Endlicher, Karajan, and F. Wolff at Vienna, and formed with Lachmann at Berlin a friendship which had great effect on his intellectual development. In September, 1837, he "habilitated" at Leipsic as privat-docent, and his first lectures, dealing with such diverse subjects as Catullus and the Nibelungenlied, indicated the two-fold direction of his labors. A new chair of German language and literature being founded in his behoof, the new teacher received in succession the title of professor extraordinarius (September, 1841), and professor ordinarius (November, 1843); and in 1842 he married Louise Hermann, the daughter of his master and colleague. But the peaceful and prosperous course opening out before him at the university of Leipsic was brought to a sudden close. Having taken part in 1849 with Otto Jahn and Theodor Mommsen in a political agitation for the maintenance of the imperial constitution, Haupt was deprived of his professorship by a decree of the 22d April, 1851. Two years later, however, he was called to succeed Lachmann at the university of Berlin; and at the same time the Berlin academy, which had made him a corresponding member in 1841, elected him an ordinary member. For one and twenty years he continued to hold a prominent place among the scholars of the Prussian capital, making his presence felt, not only by the prestige of his erudition and the clearness of his intellect, but by the tirelessness of his energy and the ardent fearlessness of his temperament. His death, which took place with very little warning, February 5, 1874, was the result of heart disease.

Haupt's critical work is distinguished by a happy union of the most painstaking investigation with intrepidity of conjecture, and while in his lectures and addresses he was frequently carried away by the excitement of the moment, and made sharp and questionable attacks on his opponents, in his writings he exhibits great self-control. The results of many of his researches are altogether lost, because he could not be prevailed upon to publish what fell much short of his own high ideal of excellence. To the progress of classical scholarship he contributed by *Quæstiones Catullianæ* (1837), *Observationes Criticæ* (1841), and editions of Ovid's *Halieutica* and the *Cynegetica* of Gratius and Nemesianus (1838), of Catullus, Tibullus, and Propertius (3d ed., 1868), of Horace (3d ed., 1871), and of Virgil (2d ed., 1873). As early as 1836 he with Hoffmann von Fallersleben started the *Altdeutsche Blätter*, which in 1841 gave place to the *Zeitschrift für deutsches Alterthum*, of which he continued editor till his death. Hartmann von Aue's *Erec* (1839) and his *Lieder, Büchlein*, and *Der arme Heinrich* (1842), Rudolf von Ems's *Guter Gerhard* (1840), and Conrad von Würzburg's *Englehard* (1844) are the principal German works which he edited. To form a collection of the French songs of the 16th century was one of his favorite schemes, but a little volume published since his death, *Französische Volkslieder* (1877), is the only monument of his labors in that direction. Three volumes of his *Opuscula* have appeared (Leipsic, 1875–1877). See Kirchhoff, "Gedächtnissrede," in *Abhandl. der Königl. Akad. der Wissenschaften zu Berlin*, 1875; and Otto Belger, *Moriz Haupt als Lehrer*, 1879.

HAUPTMANN, Moritz (1792–1868), although a composer of ability, was of infinitely greater importance as a writer on the theory of music. He was born at Dresden, October 13, 1792, and studied music under Scholz, Lanska, Grosse, and Morlacchi, the rival of Weber. Afterwards he completed his education as a violinist and composer under Spohr, and till 1820 held various appointments in private families, varying his musical occupations with mathematical and other studies bearing chiefly on acoustics and kindred subjects. For a time also Hauptmann was employed as an architect, but all other pursuits gave place to music, and a grand tragic opera, *Mathilde*, belongs to the period just referred to. In 1822 he entered the orchestra of Cassel, again under Spohr's direction, and it was then that he first taught composition

aud musical theory to such men as Ferdinand David, Burgmüller, Kiel, and others. His compositions at this time chiefly consisted of motets, masses, cantatas, and songs. His opera *Mathilde* was performed at Cassel with great success. In 1842 Hauptmann obtained the position of cantor at the Thomas-school of Leipsic (long previously occupied by the great Johann Sebastian Bach) together with that of professor at the conservatoire, and it was in this capacity that his unique gift as a teacher developed itself and was acknowledged by a crowd of enthusiastic and more or less distinguished pupils. He died on January 3, 1868, and the universal regret felt at his death at Leipsic is said to have been all but equal to that caused by the loss of his friend Mendelssohn many years before. Hauptmann's compositions are marked by symmetry and perfection of workmanship rather than by spontaneous invention.

Amongst his vocal compositions—by far the most important portion of his work—may be mentioned two masses, choral songs for mixed voices (*Op.* 32, 47), and numerous part songs. The results of his scientific research were embodied in his book *Die Natur der Harmonik und Metrik* (1853), a standard work of its kind, in which a philosophic explanation of the forms of music is attempted.

HAURAN. See BASHAN.

HAUSER, KASPAR, a German youth whose life was remarkable from the circumstances of apparently inexplicable mystery in which it was involved. He appeared on May 20, 1828, in the streets of Nuremberg, dressed in the garb of a peasant, and with such a helpless and bewildered air that he attracted the attention of the passers-by. In his possession was found a letter purporting to be written by a poor laborer, stating that the boy was given into his custody on the 7th October, 1812, and that according to agreement he had instructed him in reading, writing, and the Christian religion, but that up to the time fixed for relinquishing his custody he had kept him in close confinement. Along with this letter was enclosed another purporting to be written by the boy's mother, stating that he was born on the 30th April, 1812, that his name was Kaspar, and that his father, formerly a cavalry officer in the 6th regiment at Nuremberg, was dead. The appearance, bearing, and professions of the youth corresponded closely with these credentials. He showed a repugnance to all nourishment except bread and water, was seemingly ignorant of outward objects, wrote his name as Kaspar Hauser, and said that he wished to be a cavalry officer like his father. For some time he was detained in prison at Nuremberg as a vagrant, but on July 18, 1828, he was delivered over to the care of Professor Daumer, who undertook to be his guardian and to take the charge of his education. On October 17, 1829, he was found to have received a wound in the forehead, which according to his own statement had been inflicted on him by a man with a blackened face. Having on this account been removed to the house of a magistrate and placed under close surveillance, he was visited by Earl Stanhope, who became so interested in his history that he sent him to Ansbach to be educated. After this he became clerk in the office of Feuerbach, president of the court of appeal, and his strange history was almost forgotten by the public when the interest in it was suddenly revived by his death on the 14th December, 1833, from a deep wound on his left breast. He affirmed that the wound was inflicted by a stranger, but many believed it to be the work of his own hand, and that he did not intend it to be fatal, but only so severe as to give a sufficient coloring of truth to his story.

In 1830 a pamphlet was published at Berlin, entitled *Kaspar Hauser nicht unwahrscheinlich ein Betrüger;* but the truthfulness of his statements was defended by Daumer, who published *Mittheilungen über Kaspar Hauser* (Nuremberg, 1832) and *Enthüllungen über Kaspar Hauser* (Frankfort, 1859); as well as *Kaspar Hauser, sein Wesen, seine Unschuld,* etc. (Regensburg, 1873), in answer to Meyer's, *Authentische Mittheilungen über Kaspar Hauser* (Ansbach, 1872). Feuerbach awakened considerable psychological interest in the case by his pamphlet *Kaspar Hauser, Beispiel eines Verbrechens am Seelenleben* (Ansbach, 1832), and Earl Stanhope also took part in the discussion by publishing *Materialien zur Geschichte K. Hausers* (Heidelberg, 1836). The theory of Daumer and Feuerbach was that the youth was the son of the grand-duke Charles of Baden, and that he had been kidnapped by the countess of Hochberg in order to secure the succession to the children of the grand-duke Charles Frederick; but this theory was set aside in 1875 by the publication in the Augsburg *Allgemeine Zeitung* of the official record of the baptism, post-mortem examination and burial of the heir supposed to have been kidnapped. See *Kaspar Hauser und sein badisches Prinzenthum* (Heidelberg, 1876).

HAÜY, RENÉ JUST (1743–1822), an eminent French mineralogist, commonly styled the Abbé Haüy, from being an honorary canon of Notre Dame, was born at St. Just, in the department of Oise, February 28, 1743. His parents were in a humble rank of life, and were only enabled by the kindness of friends to educate their son. He was sent to Paris to the college of Navarre, and afterwards to that of Lemoine, where he finished his course amid incredible privations and difficulties. He escaped from these when, in 1764, he was himself appointed one of the teachers in the first of the above-named colleges. He began to devote his leisure hours to the study of botany; but an accident directed his attention to another field in natural history. Happening to let fall a beautiful specimen of calcareous spar belonging to a friend, he discovered, by examining the fragments, the geometrical law of crystallization. By experimenting on a hexahedral crystal of this substance, he found that it could be so dissected, by dividing it by planes parallel to certain edges, as to exhibit a rhombohedral nucleus, and, by extending his experiments, he farther showed that the same result could be obtained from mechanical division of every crystal of the same species. This led him to the theory that crystals are composed of what he called "integrant molecules," which he held had each the same shape as the respective nuclei got at by mechanical division. To obtain the different crystalline forms these molecules were supposed to be built up in layers round the nucleus, each layer diminishing regularly in the number of rows of molecules, and the rows at the same time diminishing in the number of molecules according to the nature of the crystal. A full account of his mathematical theory of this subject is given by Haüy in his *Traité de Minéralogie* (see CRYSTALLOGRAPHY). Daubenton and Laplace immediately recognized the scientific value of the discovery, which, when communicated to the Academy, secured for its author a place in that society. Besides the important service which he rendered to crystallography, Haüy also greatly increased our knowledge of pyro-electricity. He demonstrated by experiment in the case of tourmaline that the positive and negative charges of electricity at the respective ends of the crystal diminish rapidly as we approach the middle point, where they disappear. He showed also that each particle of a broken pyro-electric crystal itself exhibits polarity; and he was likewise the first to observe that, in all minerals, the pyro-electric state has an important connection with the want of symmetry of the crystals. In tourmaline, for instance, he found the vitreous charge always at the summit with six, and the resinous at the summit with three faces (see ELECTRICITY). When the Revolution broke out, Haüy was thrown into prison, and his life was even in danger, when he was saved by the intercession of Geoffroy Saint-Hilaire. Under Napoleon he became professor of mineralogy at the museum of natural history. He also obtained other scientific preferment, of which he was deprived by the feeble Government of the Restoration, though his royalism had been a serious bar to his promotion under the empire. His latter days were consequently clouded by the poverty which had threatened to blight his early career. But the courage and high moral qualities which had helped him forward in his youth did not desert him in his old age; and he lived cheerful and respected till his death, June 3, 1822.

The following are his principal works:—*Essai d'une Théorie sur la Structure des Cristaux,* 1784; *Exposition raisonnée de la Théorie de l'Électricité et du Magnétisme, d'après les Principes d'Æpinus,* 1787; *De la Structure considérée comme Caractère Distinctif des Minéraux,* 1793; *Exposition abrégée de la Théorie de la Structure des Cristaux,* 1793; *Extrait d'un Traité Élémentaire de Minéralogie,* 1797; *Traité de Minéralogie,* 1802, 4 vols., 2d ed.; *Traité Élémentaire de Physique,* 1803, 1806, 2 vols.; *Tableau Comparatif des Résultats de la Cristallographie, et de l'Analyse Chimique relativement à la Classification des Minéraux; Traité des Pierres Précieuses,* 1817; *Traité de Cristallographie,* 1822, 2 vols. He also contributed papers to various scientific journals, particularly the *Journal d'Histoire Naturelle, Annales de Chimie Journal de Physique Magasin Encyclopédique, Annales du Muséum d'Histoire Naturelle,* and *Journal des Mines.*

HAVANA, HAVANNAH, or HABANA, more fully San Cristobal de la Havana, the capital of Cuba, and one of the principal seats of commerce in the New World, is situated on the northern coast of the island in 23° 9′ 24″ N. lat.

and 82° 22′ 35″ W. long. From the sea it presents a picturesque appearance. The background is indeed tame; but the long lines of fortifications, the church-towers, and the shipping relieve the somewhat tawdry effect of the gayly colored houses. Though the walls, completed in 1702, have been almost entirely demolished since 1863, it is still usual to speak of the intramural and the extramural city. The former, lying close to the harbor, has streets of the narrowest possible description consistent with the existence of wheel traffic. The latter has been laid out on a spacious plan, with wide thoroughfares frequently fringed with trees. Most of the houses are built of solid stone and have flat roofs, after the manner in vogue in southern Spain, and, as the erection of wooden buildings has been illegal since 1772, it is only in the suburban districts that they are at all common. The lavish use of white marble in the decoration both of shops and dwelling-houses is one of the peculiarities of the popular taste; and it is worthy of remark that, though the native quarries would supply what is wanted, the marble is brought from Genoa. Cafés, restaurants, clubs, and casinos are both exceedingly numerous and largely frequented, forming a good indication of that general absence of domestic life among the white population which surprises the European visitant. Havana is still, as of yore, a city of smells and noises. There is no satisfactory cleaning of the streets or draining of the subsoil, and the harbor is visibly rendered foul by the impurities of the town. Victorias, —of which it is the Cuban boast that there are 6000,— volantes, and other vehicles are driven through the thoroughfares with the utmost recklessness; and tramways and railways in the American fashion contribute to the confusion.

Plan of Havana.

1. Prison.
2. Circus.
3. Cathedral.
4. Exchange.
5. University.
6. Mathematical University.
7. Marine Post-office.
8. Public Library.
9. Military Hospital.
10. Theatres.
11. Lancers' Barracks.
12. Beneficencia.

The principal defences of Havana are the Castillo de la Punta, to the west of the harbor entrance, the Castillo del Morro and San Carlos de la Cabaña to the east, the Santo Domingo de Atares, which lies at the head of the western arm of the bay and commands both the city and the neighborhood, and the Castillo del Principe, situated on an eminence to the west, and forming the terminus of the great Paseo Militar. El Morro, as it is popularly called, was first erected in 1589, but additions have been frequently made. La Punta, a much smaller fort, is of the same period. The castle of Atares dates from about 1763, when the Conde de Ricla was governor of the island. Cabaña, which alone has accommodation for 4000 men, fronts the bay for a distance of 800 yards, and is defended on the land side by three bastions. To the east there lies a smaller fort, No. 4, or San Diego, on a hill about 100 feet high.

Of the churches in the city, which number more than a score, the most noteworthy is the cathedral erected in 1724 by the Jesuits. Externally it is plain though symmetrical; but within it has richly frescoed walls, a floor of variegated marble, and costly altars. In the wall of the chancel, a second-rate medallion and a sorrier inscription distinguish the tomb of Columbus, whose remains were removed thither in 1796. It is enough to mention the churches of San Juan de Dios, dating from 1573, Santa Catalina (1658), San Agostino (1608), and San Felipe, which possesses a large library. Of monasteries and nunneries there is of course no lack; and the same may be said of charitable institutions. The most important of the seven hospitals is the Real Casa de Beneficencia, founded about 1790, and containing an orphan asylum, a home for vagrants, a lunatic asylum, and an infirmary.

Besides the university established in 1728, the city possesses a theological seminary, a military school, and a school of art. The governor and the bishop have their respective palaces, the former a large yellow stone building in the Plaza de Armas; a large prison erected in 1771, capable of receiving 500 inmates, and with barracks for a regiment, forms a striking object in the general view of the city; and among the other public buildings are the exchange (El Muelle), the custom-house (formerly the church of San Francisco), and the maestranza or headquarters of the artillery. Of the theatres, which have still to compete with the bull-ring and the cock-pit, the most important is the Tacon, erected in 1838, and capable of accommodating about 3000 persons. The promenades, drives, and public gardens form a notable feature of Havana: it is sufficient to mention the Plaza de Armas, with a statue of Ferdinand VII.; the Prado or Paseo Isabel, a long and handsome boulevard laid out in the 18th century; the Campo del Marte or drill-park; the Parque Isabel, the Paseo Tacon, the botanical gardens, and the gardens of Los Molinos, the suburban residence of the captain-general. The palm-tree avenues of Los Molinos are unusually fine. Along the borders of the bay there are several fine embankments, of which the best is perhaps that called either the Salon O'Donnell or the Alamada de Paula. In the coral rock of the coast sea-baths have been excavated, so that the bathers may run no risk from the sharks; each apartment is about 12 feet square and 6 or 8 feet deep, and the water enters by two port-holes. The city is supplied with water from the river Chorrera by an aqueduct (Canal Isabel II.) constructed by Antonelli under Philip II., and the number of fountains is considerable. The markets—of which the most noteworthy are the Mercado de Cristina, erected in 1836, and the Mercado de Tacon or Plaza de Vapor—are abundantly stocked with fruits and vegetables. Several of the suburban villages (*e.g.*, Chorrera, Guanabacoua) are attractive places of resort.

The bay of Havana makes one of the finest harbors in the world, easy of access, spacious enough to contain about 1000 large vessels, deep enough to allow them to come close up to the wharves, and, except in the case of a hurricane, well protected on all sides. The entrance, encumbered by neither bar nor rock, is 980 feet wide and 4200 feet long. Within, the bay breaks up into three distinct arms, named respectively Marimaleña or Regla Bay, Guasabacoa Bay, and El Fondo or Bay of Atares. The wharves are well built, and a good floating dock is maintained by a private company. On the left hand of the entrance stands a lofty lighthouse tower.

In 1865 1950 vessels entered with a burthen of 686,644 tons; in 1873 2194 vessels with a burthen of 921,632 tons; and in the first six months of 1878 741 vessels with a burthen of 449,785 tons. The average number of vessels annually in the ten years from 1864 to 1873 was 1931 (771,196 tons), and of this average 647 (324,373 tons) were American, 689 (190,231 tons) Spanish, 384 (131,216 tons) British, 55 (45,218 tons) French, 55 (18,200 tons) Norwegian, and 32 (31,693 tons) German.

In spite of high tariffs and civil wars, and the competition of Matanzas, Cardenas, Cienfuego, and other Cuban ports opened to foreign trade in modern times, the commerce of Havana continues to increase. As indicated by the statistics just quoted, the chief foreign customers are Britain and the United States; but, while the latter are gradually taking a greater proportion of the trade, the British interest is gradually diminishing. The two staple articles of export are sugar and tobacco-wares. While the average export of sugar for the first ten years of the

century was only 177,998 boxes (61,199,200 lb), by 1855 it had reached 965,677 boxes (386,270,800 lb), and by 1878 145,601 boxes, 102,786 hogsheads, and 91,974 tons, or a grand total of nearly 408 millions of lb. In 1867 there were exported 7,716,802 lb of tobacco and 199,027 millions of cigars, and the corresponding numbers for 1878 were 13,864,800 lb and 174,638 millions. Other exports of importance are rum, wax, and honey. The nature and quantities of the imports on an average of the ten years 1868 to 1877 are 295,202 quintals (100 lb each) of jerked beef, 134,203 quintals of cod-fish (61,576 from Europe, and 41,019 from United States), 359,925 barrels of flour, 627,786 quintals of rice (mainly from the East Indies), 143,035 quintals of lard (from the United States), 85,503 pipes of wine, 145,539 tons of coal, 344,095 jars of olive oil, and 92,857 quintals of coal-oil.

The staple manufacturing industry of Havana is that of tobacco. Of the cigar factories, more than a hundred may be reckoned as of the first class. The Royal and Imperial Factory of La Honradez, which occupies a whole square, and is considered one of the great sights of the city, produces daily 2,532,000 cigarettes. Besides the making of boxes and barrels, and other articles necessarily involved in its sugar and tobacco trade, Havana also prosecutes to some extent the building of carriages and ships, and the manufacture of iron and machinery; but the weight of taxation is too great to allow the development of any business requiring great capital. There were six banks in the city in 1877, the most important being the Spanish Bank, through which all the Government paper is issued.

Havana has steam communication several times a week with New York; once a week with Baltimore, Philadelphia, and New Orleans; and about as frequently with several ports in England, Spain, and France. It is the terminus of a railway system which reaches Cardenas, Cienfuego, Matanzas, Batabano, etc.; and short lines run out to the Bay of Havana and Marianas. Telegraphs radiate to all parts of the island; and a submarine cable to Key West forms part of the line of communication between Aspinwall and New York.

The population of Havana and its suburbs was stated at 139,996 in 1817, at 196,994 in 1841, at 203,676 in 1863, and at 169,184 in 1871. Of this last number 108,754 were whites, 27,623 free negroes, mulattos, etc., and 22,807 slaves. By 1902 the total had reached, it is said, 262,395. None of these statistics can be received with much confidence as to their accuracy. Among the white population the proportion of males to females is extraordinarily high: according to the official returns, there die annually 3682 white males to 1204 white females. The average rate of mortality is 27 per thousand annually. Foreigners are subject to yellow fever, especially from June to September.

Havana, originally founded by Diego Velasquez in 1515 on an unhealthy site near the present harbor of Baracon on the south coast, was removed to its actual position about 1519, and soon began to be considered one of the most important places in the New World. In 1528 the buccaneers laid the settlement in ashes, but it was soon after restored by De Soto, who built the fortress of La Fuerza. The residence of the captain-general was transferred to Havana from Santiago de Cuba in 1551; and in 1589, to protect the city, which had been plundered by the pirate Jacob Sores in 1555 and threatened by Drake in 1585, Philip II. of Spain ordered the erection of the Bateria de la Punta and the castle of El Morro or Los Tres Reyes. In the course of the 17th century the port became the great rendezvous for the gold-ships of Spain, and the commercial centre of the Spanish possessions in America. The English under Admiral Pocock and the duke of Albemarle captured Havana in 1762, but it was restored to the Spaniards on 10th Feb., 1763, in exchange for the Floridas. The *Gaceta de la Habana*, the first paper published in Cuba, appeared in 1782. In 1771 the port, which had formerly been, like the rest of Cuba, monopolized by Seville and Cadiz, was declared open to all nations in regard to certain articles of trade; and this liberty was extended in 1818 to all goods whatsoever. During the despotico-paternal administration of Tacon many improvements were introduced at Havana; the railway from Havana to Guines was commenced in 1835; a ferry between the city and the suburb of Regla was set on foot in 1837; and night watchmen, a police-force, and a fire-brigade were established. The first line of steamships from Cadiz to Havana dates from 1850. Like the rest of Cuba the city has frequently suffered severely from hurricanes, the most violent being those of 1768 (St. Theresa's), 1810, and 1846.

See the works referred to under CUBA.

HAVELBERG, an ancient town of Brandenburg, Prussia, in the government district of Potsdam and the circle of Westpriegnitz, is situated on the Havel, about 6½ miles from its junction with the Elbe. The nearest station is Glöwen (6¼ miles), on the Berlin and Hamburg Railway. The town is built partly on an island in the Havel and partly on hills on the right bank of the river, on one of which stands the fine cathedral. The two parts, which are connected by a bridge, were incorporated as one town in 1875. Havelberg is the seat of a commission of justice The inhabitants are chiefly engaged in farming, tobacco and pin manufacturing, sugar-refining, and ship-building, and in the timber trade. Population in 1905, 5,988.

Otto I. founded a bishopric at Havelberg so early as 946; the bishop, however, generally resided at Plattenburg or Wittstock, a few miles to the north. In 1548 the bishopric was reduced, and the cathedral passed to the Protestant Church and retained its endowments till the edict of 1810, by which all former ecclesiastical possessions were assumed by the crown. The final secularization was delayed till 1819. Havelberg was formerly a strong fortress, but in the Thirty Years' War it was taken from the Danish by the imperial troops in 1627. Recaptured by the Swedes in 1631, and again in 1635 and 1636, it was in 1637 retaken by the Saxons under Klitzeng. It suffered severely from a conflagration in 1870.

HAVELOCK, SIR HENRY (1795–1857), an eminent British soldier, was the second of four brothers (all of whom entered the army), and was born at Ford Hall, Bishop-Wearmouth, Sunderland, on the 5th of April, 1795. His parents were William Havelock, a wealthy shipbuilder in Sunderland, and Jane, daughter of John Carter, solicitor at Stockton-on-Tees. When about five years old Henry accompanied his elder brother William to Mr. Bradley's school at Swanscombe, whence at the age of ten he removed for seven years to Charterhouse School. In accordance with the desire of his mother, who had died in 1811, he entered the Middle Temple in 1813, studying under Chitty the eminent special pleader. His legal studies having been abridged by a misunderstanding with his father, he in 1815 accepted a second lieutenancy in the Rifle Brigade (95th), procured for him by the interest of his brother William. During the following eight years of service in Britain he read extensively and acquired a good acquaintance with the theory of war. In 1823, having exchanged into the 21st and thence into the 13th Light Infantry, he followed his brothers William and Charles to India, first qualifying himself in Hindustani under Dr. Gilchrist, a celebrated Orientalist. At the close of twenty-three years' service he was still a lieutenant, and it was not until 1838 that, after three years' adjutancy of his regiment, he became captain. Before this, however, he had held several staff appointments, notably that of deputy assistant-adjutant-general of the forces in Burmah till the peace of Yandabo, of which he, with Lumsden and Knox, procured the ratifications at Ava from the "Golden Foot," who bestowed on him the "gold leaf" insignia of Burmese nobility. His first command had been at a stockade capture in the war, and he was present also at the battles of Napadec, Patanago, and Paghan. He had also held during his lieutenancy various interpreterships and the adjutancy of the king's troops at Chinsurah. In 1828 he published at Serampore *Campaigns in Ava*, and in 1829 he married Hannah Shepherd, daughter of Dr. Marshman, the eminent missionary. About the same time he became a Baptist, being baptized by Mr. John Mack at Serampore. During the first Afghan war he was present as aide-de-camp to Sir Willoughby Cotton at the capture of Ghazni, July 29, 1839, and at the occupation of Cabul. After a short absence in Bengal to secure the publication of his *Memoirs of the Afghan Campaign*, he returned to Cabul in charge of recruits, and became interpreter to General Elphinstone. In 1840, being attached to Sir Robert Sale's force, he took part in the Khurd-Cabul fight, in the celebrated passage of the defiles of the Ghilzees (1841), and in the fighting from Tezeen to Jellalabad. Here, after many months' siege, his column in a sortie *en masse* defeated Akbar Khan, April 7, 1842. He was now made deputy adjutant-general of the infantry division in Cabul, and in September he assisted at Jugdulluk, at Tezeen, and at the release of the British prisoners at Cabul, besides taking a prominent part at Istaliff. Having obtained a regimental majority he next went through the Mahratta campaign as Persian interpreter to Sir Hugh (Viscount) Gough, and distinguished himself at Maharajpúr in 1843, and also in the Sikh campaign at Mudki, Firozeshah, and Sobraon in 1845. For these services he was made deputy adjutant-general at Bombay. He exchanged from the 13th to the 39th, then as second major into the 53d at the beginning of 1849, and soon afterwards left for England, where he spent two years. In 1854 he became quartermaster-general, then full colonel, and lastly adjutant-general of the troops in India. In 1857 he was selected by Sir James Outram for the command of a divis-

ion in the Persian campaign, during which he was present at the actions of Mohummarah and Ahwaz. Peace with Persia set him free just as the mutiny broke out; and he was chosen to command a column "to quell disturbances in Allahabad, to support Lawrence at Lucknow and Wheeler at Cawnpore, to disperse and utterly destroy all mutineers and insurgents." At Futtehpúr, July 12th, at Aong and Pandoonudee on the 15th, at Cawnpur on the 16th, at Onao on the 29th, at Buseratgunge on the 29th, and again on August 5th, at Boorhiya on August 12th, and at Bithoor on the 16th, he defeated overwhelming forces. Twice he advanced for the relief of Lucknow, but twice prudence forbade a reckless exposure of troops wasted by battle and disease in the almost impracticable task. Reinforcements arriving at last under Outram, he was enabled by the generosity of his superior officer to crown his successes on the 25th of September, 1857, by the capture of Lucknow. There he died, November 24, 1857, of dysentery brought on by the anxieties and fatigues connected with his victorious march, and with the subsequent blockade of the British troops. He lived long enough to receive the intelligence that he had been created K. C. B. for the first three battles of the campaign; but of the major-generalship which was shortly afterwards conferred he never knew. On November 26, before tidings of his death had reached England, letters-patent were directed to create him a baronet, and a pension of £1000 a year was voted at the assembling of parliament. The baronetcy was afterwards bestowed upon his eldest son; while to his widow, by royal order, was given the rank to which she would have been entitled had her husband survived and been created a baronet. To both widow and son pensions of £1000 were awarded by parliament. See Marshman's *Life of Havelock*, 1860.

HAVERCAMP, Sigebert (1683–1742), classical editor and numismatist, was born at Utrecht in December, 1683. After studying at the university of his native town and at Leyden, he entered the church, and became minister of Stad-aan-'t Haringvliet, in the island of Overflakkee. There he remained till 1721, when he succeeded Gronovius in the Greek chair at Leyden, becoming shortly afterwards professor of history and rhetoric also. He died at Leyden, April 23, 1742.

His editions of Latin and Greek authors are useful and learned compilations, rather than original critical commentaries, and bear frequent traces of the rapidity with which they were produced. They are the following:—*Tertullian*, 1718; *Lucretius*, 1725; *Josephus*, 1726; *Eutropius*, 1729; *Orosius*, 1738; *Sallust*, 1742; and *Censorinus*, 1743. See Dibdin's *Classics* under these names. His principal numismatic works are *Dissertationes de Alexandri Magni Numismate*, 1722; *Thesaurus Morellianus*, 1734; *Universal History, illustrated from Medals* (in Dutch), 1736; *Nummophylacium reginæ Christinæ*, 1742. He was also the author of *Sylloge Scriptorum qui de linguæ Græcæ vera et recta Pronuntiatione commentarios reliquerunt*, 1740; *Introductio in Historiam Patriæ*, 1739; and *Introductio in Antiquitates Romanas*, 1740.

HAVERFORDWEST (in Welsh Hwlffordd), the chief town of Pembrokeshire, a seaport, market-town, parliamentary and municipal borough, and county by itself, is picturesquely situated on a hill overlooking the West Cleddau river, 8 miles N. N. E. of Milford, and 276 miles W. N. W. of London. The town is clean and well built, though somewhat irregular, owing to its position. Its principal buildings are the guildhall and the market-house, both modern, and the church of St. Mary, one of the finest churches in South Wales. The old church of St. Martin is close to the castle, of which, built on a rocky eminence overhanging the river, only a wall and the keep remain, the latter with considerable additions being till lately used as the county prison. It was built by Gilbert de Clare, first earl of Pembroke; and during the insurrection of Owen Glendower was defended by Henry IV. against the French allies of the Welsh. In the civil wars of the 17th century it was held by the royalists. The castle was visited in 1188 by Giraldus Cambrensis and Archbishop Baldwin. Below the end of the Parade, a public walk overlooking the river, are the ruins of a priory of Black Canons of the order of St. Augustine, dedicated to St. Mary and St. Thomas. Dating from the 12th century it was endowed though not founded by Robert de Hwlffordd, whose liberal grants were confirmed by Edward III. The old wall and fortifications that formerly surrounded the town have totally disappeared. On the north side of the river is the suburb of Prendergast, containing the remains of an ancient mansion, formerly occupied by a family of that name. Haverfordwest is the seat of an assize court and quarter sessions and with the contributory boroughs of Fishguard and Narberth returns one member to parliament. The river is navigable as high as the bridge for small craft. Timber, tea, and spirits are imported, and coal, cattle, butter, and grain are exported. In 1105, the Flemings, who had been driven from their own country by inundations, were settled in this locality by Henry I., and the Flemings who had served under Stephen afterwards increased the colony. Their influence is still to be traced in the non-use of the Welsh language among the townspeople, and in the peculiar shape of the cottages in the surrounding country. Population in 1901, 6,907; area, 1430 acres.

HAVERHILL, a city in Essex county, Massachusetts, United States, is situated on the north bank of the Merrimack river, 18 miles from its mouth, and opposite the towns of Bradford and Groveland, with which it is connected by two fine bridges. It has railway communication with Boston, which is 32 miles south, and with Portland, 78 miles north. The city contains a handsome soldiers' monument of white marble, erected in 1869, several public halls, including the city hall, the Freemasons' and the Oddfellows' halls, and a public library with 30,000 volumes. Haverhill derives its prosperity from the manufacture of boots and shoes, chiefly of the finer kinds, in which about 150 firms are engaged, employing from 6000 to 8000 hands, and turning out goods to the annual value of about £2,000,000. Besides these there are about forty manufactories of different articles used in this trade, as heels, lasts, shoe-nails, etc. The other manufactures include hats, paper-boxes, and woollen goods. The first settlement at Haverhill was made in 1640, and for 70 years as a frontier town it suffered much from savage attacks. A fine granite and bronze monument has been recently erected to commemorate the heroism of the early settlers. Haverhill was incorporated in 1645, and received its city charter in 1870. The population in 1870 amounted to 13,092, of whom 2003 were foreigners. In 1900 the number was estimated at 37,175.

HAVRE, Le (originally Havre de Grâce), a town of France, the second to Marseilles in importance as a seaport, capital of an arrondissement in the department of Seine-Inférieure, is situated on the north bank of the estuary of the Seine, 143 miles N. W. of Paris and 55 W. of Rouen by rail. The greater part of the town stands on a level plain, but from the heights on which Ingouville, since 1856 united to Havre, is situated, a charming and varied prospect is obtained. In the lower part of the town the streets run chiefly in straight lines, and they are grouped round the basins or docks, which communicate by lockgates and are placed so as to form a triangle entered from the Outer Port. The old fortifications surrounding the town were demolished in 1856, and it is now defended by forts erected on the heights of Ingouville and Sainte-Addresse. The principal street is the Rue de Paris, running from north to south in the centre of the town, and among the principal promenades may be mentioned the Boulevard de Strasbourg, the Place Louis XVI., and the Jetée du Nord, which terminates in a light-house. Havre possesses a tribunal of the first instance, a tribunal of commerce, an exchange and chamber of commerce, a chamber of agriculture, a hydrographic school, and a communal college. The principal buildings are the churches of Notre Dame and St. Francis, the new Hôtel de Ville, the Musée, containing apartments for a library, and for art, antiquities, and natural history, and with statues in front of Bernardin de St. Pierre and Casimir Delavigne, natives of Havre, by David Angers; the theatre, the clubhouse called the *Cercle du Commerce*, the new palace of justice, the marine arsenal, the town-house, the custom-house, and the Frascati bath-house. The docks are among the finest in the world, and consist of eight separate basins, which, with the late enlargement of the outer harbor, afford 150 acres of accommodation for vessels. The new entrance to the harbor has a width of 100 metres or 328 feet. Lines of rails have lately been laid along the docks. As these have absorbed much of the space on the quays, lading is frequently a slow and tedious process, but the completion of the lately projected harbor will afford all the facilities necessary in this respect. The completion of the proposed canal between Havre and the Seine near Tancarville would be a great commercial benefit

to the port whose prosperity has, notwithstanding its advantages as the port of Paris, and its unsurpassed facilities for dock accommodation, been much hampered by the system of centralization, which has both retarded improvements and led to the levying of exorbitant shipping rates. Partly on this account, not only has France been unable to maintain the transit of goods for Belgium, Switzerland, and Germany, but even much of the traffic of its own northern and eastern provinces has been directed to Antwerp. The latter port is served by an abundant network of railroads and canals, while Havre has only one convenient railroad (that to Paris by Rouen), and the river Seine with its dangers and high tariff. The completion of the scheme for a railway over Montivilliers to Dieppe will afford partial remedy for this state of matters. In the extensive ship-building yards of Havre the finest vessels of France are built, and many are also built for other countries. The construction of two new dry-docks has lately been proposed, one of which is to afford accommodation for the largest Atlantic steamers. Havre is now fortified as a fleet station and harbor of war. The port has regular steam communication with London, Liverpool, Southampton, Dublin, Glasgow, Hull, Swansea, Bristol, Dunkirk, Brest, Cherbourg, Rotterdam, Hamburg, Copenhagen, St. Petersburg, Constantinople, West Indies, San Francisco, Vancouver Island, and New York. The total number of vessels which entered the port in 1878 was 6491 with a tonnage of 2,192,778, while 6458 cleared with a tonnage of 2,148,517. For the 5 years ending 1878 the average number of vessels that entered was 6041 with a tonnage of 1,841,265, the number that cleared 6006 with a tonnage of 1,818,189. The average annual value of exports and imports is about 2800 million francs. The trade of Havre with the United States is very large, and it has always retained its superiority in the importation of cotton, one-third of which, however, it imports from other countries than America. It is also the chief port for the exportation of French goods to the United States, and an important point of emigration. Besides cotton its principal imports are petroleum, coals, wheat, woollen, silk, flax, mohair and jute tissues, spices, sugar, coffee, hides, dyewoods, and building timber. The principal exports are various French manufactured cloths, leather, jewelry, agricultural and dairy produce, wine, brandy, and oil. Fishing is extensively prosecuted. Besides the various industries connected with shipbuilding, Havre possesses sugar-refining works, tobacco manufactories, iron foundries, salt works, breweries, vitriol works, and manufactories of *faience*, lace, silk, and paper. It is also much frequented for sea-bathing. The population in 1872 was 85,538, and in 1901 it was 130,196.

Plan of Havre.

1. Prison.
2. Hôtel de Ville.
3. Exchange.
4. Tribunal of Commerce.
5. Theatre.
6. College.
7. Marine Arsenal.
8. Church of St. Francis.
9. Courthouse.
10. Church of Notre Dame.
11. Musée.
12. Custom House.
13. Frascati Bath House.

Until 1516 Havre was only a fishing village possessing a chapel dedicated to Notre Dame de Grâce, to which it owes its original name Havre (or harbor) de Grâce. The building of the harbor was begun by Francis I. who gave the town the name of Franciscopolis. At the entrance to the harbor he erected a tower which served as a lighthouse for ships until it was demolished in 1862. The town in 1562 was delivered over to the keeping of Queen Elizabeth by the Prince do Condé, leader of the Huguenots, and the command of it was entrusted to Ambrose Dudley, earl of Warwick; but the English were expelled within a year, after a most obstinate siege, the progress of which was pressed forward by Charles IX. and his mother, Catherine de' Medici, in person. The defences of the town were greatly strengthened by Henry II. and Louis XIII., and under Louis XIV. it became an important fortress. In the 17th century it was several times vainly besieged by the English, who also bombarded it in 1759, 1794, and 1795. It was a port of considerable importance as early as 1572, and despatched vessels to the whale and cod fishing at Spitzbergen and Newfoundland. In 1672 it became the entrepôt of the French East India Company, and afterwards of the Senegal and Guinea companies. Its development was greatly furthered by Louis XVI., and Napoleon I. raised it to a war harbor of the first rank. Havre is the birthplace of Bernardin de St. Pierre, author of *Paul and Virginia*, Casimir Delavigne, Mademoiselle Scudéry, and the naturalists Ancelot and Lesueur.

See Guilmeth, *Histoire de la ville et des environs du Havre*, 1842; *Mémoires de la fondation et origine de la ville françoise de Grâce, composez par maistre Guillaume de Marceilles*, first published by J. Morlent, 1847; *Le Havre, son passé, son présent, et son avenir*, by Frederick de Coninck, new edition 1862; Nerval, *Documents relatifs à la fondation de Havre*, 1875.

HAWAIIAN OR SANDWICH ISLANDS,[a] THE, a group of eight inhabited and four uninhabited islands in the North Pacific Ocean, lying between 18° 54′ and 22° 2′ N. lat. and 155° and 161° W. long. The group has a trend of about N. 64° W., which is nearly the trend of all the Pacific groups. From Honolulu, the capital, on Oahu, the distance to San Francisco is 2100 miles; to Auckland, New Zealand, 3810 miles; to Sydney, New South Wales, 4484 miles; to Yokohama, 3440 miles; to Hongkong, 4893 miles; to Tahiti, 2380 miles. The first of the names by which the group is designated above is taken from that of the largest island Hawaii, and is the name adopted by the inhabitants. The other name was given to it by Captain Cook the discoverer, in honor of the earl of Sandwich, first lord of the Admiralty at the time of the discovery. Plate XIII.

History.—These islands, the most important Polynesian group in the North Pacific, were discovered by Captain Cook in 1778.[1] He was received by the natives with many demonstrations of astonishment and delight; and offerings and prayers were presented to him by their priest in one of the temples; and though in the following year he was killed by a native when he landed in Kealakeakua bay in Hawaii, his bones were preserved by the priests and continued to receive offerings and homage from the people, until the abolition of idolatry. At the time of Cook's visit each island had its chief. On the death of the chief who ruled Hawaii at that time there succeeded one named Kamehameha, who appears to have been a man of quick perception and great force of character. When Vancouver visited the islands in 1792, this chief being desirous of possessing a vessel on the European model, the keel of one was laid down for him. Ten or twelve years later Mr. Turnbull found him with 20 vessels of from 25 to 50 tons which traded amongst the islands, and he afterwards purchased others from foreigners. Having encouraged a warlike spirit in his people and introduced firearms, Kamehameha attacked and overcame the chiefs of the other islands one after another, until he became undisputed master of the whole group. He encouraged trade with foreigners, and derived from its profits a large increase of revenue as well as the means of consolidating his power. He died in 1819, and was succeeded by his son, a mild and well-disposed prince, but destitute of his father's energy. One of the first acts of Kamehameha II. was to abolish *tabu* and idolatry throughout the islands. Some disturbances were caused thereby, but the insurgents were defeated and the peace of the islands has been scarcely broken since. In 1820 missionaries

1 According to the *Boletin de la Soc. Geogr. de Madrid*, 1877, there had been a previous discovery by the Spaniards

a See HAWAIIAN ISLANDS, Vol. XXVII.—A republic was established in 1894 with Sanford B. Dole as president. Annexation to the United States was desired and accomplished by the passage, 6th July 1898, of a joint resolution in Congress. President McKinley confirmed the same and sent a commission to visit the islands and recommend a form of government.

arrived from America and commenced their labors at Honolulu. A short time afterwards the British Government presented a small schooner to the king, and this afforded an opportunity for the Rev. William Ellis, the well-known English missionary, to visit Honolulu, along with a number of Christian natives from the Society Islands. Finding the language of the two groups nearly the same, Mr. Ellis, who had spent several years in the southern islands, was able to assist the American missionaries in reducing the Hawaiian language to a written form. In 1824 the king and queen of these islands paid a visit to England, and both died there of measles. For many years the Hawaiians have continued to advance steadily in intelligence, resources, and civilization, but their progress has been at times interrupted by the conduct of the officers of foreign powers. On one occasion a British officer went so far as to take possession of Oahu and establish a commission for its government; and French officers abrogated the laws, dictated treaties, and by force of arms established the Roman Catholic religion in the country. The act of the British officer was disavowed by his superiors as soon as known; and these outrages led to a representation on the part of the native sovereign to the Governments of Great Britain, France, and the United States of America, and the independence of the islands was guaranteed by these powers in 1844. Kalakaua,[a] the reigning monarch (1880), was elected king by ballot on Lunalilo's death without heirs in 1874. The heir to the throne is a sister of the king, Lelia Kamakacha,[a] and is married to an American.

Inhabitants.—By the census taken in December 1900, the population of the whole group amounted to 154,001 persons, instead of 56,897 as in 1873. In 1900 there were 25,762 Chinese and 61,115 Japanese. The British numbered 1,730; the Portuguese 15,675, and the total white population amounted to 28,533.

The natives belong to the Malayo-Polynesian race. Their reddish-brown skin has been compared to the hue of tarnished copper. The hair, usually raven black, is straight or at most wavy; the beard is thin, the face broad, the profile not prominent, the nose rather flattened, and the lips thick. The bulk of the population are of moderate stature, but the chiefs and the women of their families are remarkable for height.

"The inhabitants of these islands," says Mr. Ellis,[1] "are, considered physically, amongst the finest races in the Pacific, bearing the strongest resemblance to the New Zealanders in stature, and in their well-developed muscular limbs. The tattooing of their bodies is less artistic than that of the New Zealanders, and much more limited than among some of the other islanders. They are also more hardy and industrious than those living nearer the equator. This in all probability arises from their salubrious climate, and the comparative sterility of their soil, rendering them dependent upon the cultivation of the ground for the yam, the arum, and the sweet potato, their chief articles of food. Though, like all undisciplined races, the Sandwich Islanders have proved deficient in firm and steady perseverance, they manifest considerable intellectual capability. Their moral character, when first visited by Europeans, was not superior to that of other islanders; and, excepting when improved and preserved by the influences of Christianity, it has suffered much from the vices of intemperance and licentiousness introduced by foreigners. Polygamy prevailed among the chiefs and rulers, and women were subject to all the humiliations of the tabu system, which subjected them to many privations, and kept them socially in a condition of inferiority to the other sex. Infanticide was practised to some extent, the children destroyed being chiefly females. Though less superstitious than the Tahitians, the idolatry of the Sandwich Islanders was equally barbarous and sanguinary, as, in addition to the chief objects of worship included in the mythology of the other islands, the supernatural beings supposed to reside in the volcanoes and direct the action of subterranean fires rendered the gods objects of peculiar terror. Human sacrifices were slain on several occasions, and vast offerings presented to the spirits supposed to preside over the volcanoes, especially during the periods of actual eruptions. The requisitions of their idolatry were severe, and its rites cruel and bloody. Grotesque and repulsive wooden figures, animals, and the bones of chiefs were the objects of worship. Human sacrifices were offered whenever a temple was to be dedicated, or a chief was sick, or a war was to be undertaken; and these occasions were frequent. The apprehensions of the people with regard to a future state were undefined, but fearful. The lower orders expected to be slowly devoured by evil spirits, or to dwell with the gods in burning mountains. The several trades, such as that of the fisherman, the tiller of the ground, and the builder of canoes and houses, had each their presiding deities. Household gods were also kept, which the natives worshipped in their habitations. One merciful provision, however, had existed from time immemorial, and that was sacred inclosures, places of refuge into which those who fled in time of war, or from any violent pursuer, might enter and be safe. To violate their sanctity was one of the greatest crimes of which a man could be guilty."

In the former state of society the habits of the people were extremely licentious; men were living with several wives, and women with several husbands. Female virtue was an unknown thing, and there is no native word for it. This state of things has, however, been greatly altered by the exertions of the missionaries.

As regards cannibalism, it appears that the heart and liver of the human victims offered in the temples were eaten as a religious rite, and that the same parts of any prominent warrior slain in battle were devoured by the victor chiefs in the belief that they would thereby inherit the valor of the dead man. When, on the death of the great warrior Kamehameha I., the chiefs assembled to deliberate what should be done with his body, one suggested that they should eat it, but this did not find favor with the others.

The Hawaiians are a good-tempered, light-hearted, and pleasure-loving race. They have many games and sports, and the women spend much time in making flower garlands. Both sexes are passionately fond of riding, almost every one being in possession of a horse. They delight to be in the water, and swim with remarkable skill and ease. In the exciting sport of surf swimming, which always astonishes strangers, they balance themselves while standing or sitting on a small board which is carried landwards on the curling crest of a great roller.

In spite of moral and material progress — better food, better clothing, improved dwellings, and many other advantages of civilization—the race is dying out, and, indeed is threatened with extinction in the course of a few years. Captain Cook estimated the number of natives at 400,000; in 1823 the American missionaries calculated them to be only 142,000; the census of 1832 showed the population to be 130,313; and the census of 1878 proved that the number of natives was no more than 44,088. To account for this it is said that the blood of the race has become poisoned by the introduction of foreign diseases. The women are much less numerous than the men; and the married ones have few children at the most; two out of three have none. Moreover, the mothers appear to have little maternal instinct, and there is consequently a neglect of the offspring. Whilst the Hawaiians are decreasing, the Chinese are coming in large numbers, and threaten in time to take their place. To counteract this, as well as to supply the pressing need for laborers, the Government has considered many schemes for introducing other immigrants. Polynesians from other islands have been brought over, and a considerable number of Portuguese have come from Madeira.

The language is a branch of the widely-diffused Malayo-Polynesian tongue; and Hawaiians and New-Zealanders, although occupying the most remote regions north and south at which any of their race have been found, can understand each other without much difficulty. This language is soft and harmonious, being highly vocalic in structure. The only consonants are *k*, *l*, *m*, *n*, and *p*, which with the gently aspirated *h*, the five vowels, and the vocalic *w*, make up all the letters in use. The letters *r* and *t* have been suppressed of late years in favor of *l* and *k*, so that, for example, *taro*, the former name of the *Colocasia* plant, is now *kalo*. The language was not reduced to a written form until after the arrival of the missionaries.[2]

In the days of idolatry the only dress worn by the men was a narrow strip of cloth wound round the loins and passed between the legs. Women wore a short petticoat made of *tapa* (cloth prepared from the inner bark of the paper mulberry), which reached from the waist to the knee. But now the common class of men wear a shirt and trousers, whilst the better class are attired in the European fashion. The women are clad universally in the *holoka*, a loose white

[1] Mr. Ellis was the writer of the article POLYNESIA, which included an account of the Hawaiian Islands, in the last edition of this work.

[2] See Chamisso, *Ueber die Hawaiische Sprache* (Leipsic, 1837); and Andrews, *Grammar of the Hawaiian Language* (Honolulu, 1854), and *Dictionary* (Honolulu, 1865).

[a] [Kalakaua (1836–91), son of a native chief, quarrelled with Emma, widow of Kamehameha IV., gave a new constitution in 1887. Died January 20, 1891, in San Francisco. His elder sister, called now Liliuokalani, succeeded, her husband being J. O. Dominis of Boston, governor of Oahu. In 1893 she was deposed, and in 1895 abdicated the throne. See HAWAIIAN ISLANDS, Vol. xxvii.

Map of
HAWAII.
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SCALE OF STATUTE MILES.
0 5 10 20 30 40 50 60
47 MILES TO THE INCH
Longitude West from Greenwich
160° 159° 158° 157° 156° 155°
22° 21° 20°
PACIFIC OCEAN
KAUAI
NIIHAU
OAHU
MOLOKAI
LANAI
MAUI
HAWAII
Waimea
Hanalei
Waialeale
Nawiliwili Harbor
Lihue
Koloa
Hanapepe
Waimea Bay
Waialua
Punaluu
Kaena Pt.
Mauna Kaala
Waianae
Waipio
Pali
Kaneohe Harbor
Ewa Mill
Barbers Pt.
HONOLULU
Pearl Harbor
Waimanalo Anchorage
Makapuu Head
Kalaupapa
Leper Settlement
Mauna Loa
Olokui
Halawa Pt.
Kaunakakai Harbor
Honolua
Nakalele
Kahakuloa Pt.
Pailoio Channel
Kaiwi Channel
Kauai Channel
Kealaikahiki Channel
Alenuihaha Channel
Lahaina
Kahului
Haiku
Huelo
Keanae
Ulaino
Kapueokahi Bay
Mt. Haleakala
Kauiki Head
Kamaole
Makena
Ka Lae o Ka Ilio
Molokini I.
Kahoolawe
Kealaikahiki Pt.
Honolulu Landing
Niuli
Mahukona Harbor
Kawaihae
Waimea
Ookala
Puako Bay
Laupahoehoe
Nahaku Pt.
Hakalau Bay
Kiholo Bay
Mauna Kea
Hualalai
Table Land
Lava flow of 1855
Lava flow of 1880
HILO
Kailua
Keauhou
Holualoa
Mauna Loa
Kilauea
Puu Huluhulu
Kau
Kapoho
Poholki
Kalapana
Okoe Landing
Punaluu
Honuapo
Kaalualu
Ka Lae
Lava flow of 1868
Lava flow of 1881
Kauai Channel
To Yokohama, 3,445 miles, and Hongkong, 4,217 miles
To Vancouver, 2,410
To San Francisco, 2,097
To Sydney, 4,534
To Auckland, 3,806
HONOLULU
and
Vicinity.
SCALE OF MILES.
0 1 3
THE PEARL LOCHS
Middle Loch
East Loch
Pearl City
French Mission
Waiawa
Waiau
Kalauao
Halawa
Halawa Mill
Waipio
Moku o Mumu or Ford I.
Kuahua
Keanapuaa
Salt Lake
Moanalua
Leper Asylum
Nuuanu Valley
Puu Ohia Tantalus
Punch Bowl Hill
Makiki
Punahu
Kewalo
Telegraph Hill
Waikiki
Kapiolani Park
Diamond Hill
Leahi or Diamond Head
Puuloa Sta.
Bishop Pt.
Coral Rock Plateau
Hammer Point
Puuloa
Pearl R.
Puuloa or Pearl River Entrance
Ahua Pt.
Mokulo
Quarantine I.
Breakers
Kuwili St.
Oahu College
Immigration Depot
Race Course
Kapua Entrance
Insane Asylum
Royal Mausoleum
Kalihi Plain
Oahu Prison
Slaughterhouses Pt.
Kamehameha School
Honolulu Landing
North Kohala
South Kohala
Hamakua
North Kona
South Kona
Kau
Puna
Cook Monument
Kealakekua (Napoopoo)
Kauhako Bay
Honaunau Bay
Okoe Landing
Kaunu Pt.

or colored garment with sleeves reaching from the neck to the feet. A colored handkerchief is twisted round the head or a straw hat is worn. Both sexes delight in adorning themselves with garlands (*leis*) of flowers and necklaces of colored seeds.

The natives derive their sustenance chiefly from pork and fish both fresh and dried, and from the *kalo* (*Colocasia esculenta*), the banana, sweet potato, yam, bread fruit, and cocoa-nut. The root of the *kalo* affords the national dish called *poi;* after having been baked and well beaten on a board with a stone pestle it is made into a paste with water and then allowed to ferment for a few days, when it is fit to eat. There was formerly a particular breed of dog, which, after being fed exclusively on *poi*, was considered a great delicacy. The filthy liquor called *awa* or *kawa* is still relished by the natives, and though it is only allowed to be made under license, it is often prepared clandestinely.

The native dwellings are constructed of wood, or more frequently are huts thatched with grass at the sides and top. What little cooking is undertaken is done outside. The oven consists of a hole in the ground in which a fire is lighted and stones made hot; and the fire having been removed, the food is wrapped up in leaves and placed in the hole beside the hot stones and covered up until ready.

Leprosy is prevalent amongst the natives, and the Government has established a settlement on the island of Molokai[1] where all persons found to be affected with the disease are kept entirely isolated from the healthy part of the community. The lepers number about 800.

Agriculture and Commerce.—Large capital has been embarked, chiefly by Americans, in the production of sugar, the soil and climate being well suited to the cane in those localities where the water supply is ample. There are between 60 and 70 sugar estates, and more are being planted. The principal difficulty is the want of labor. The average yield of sugar per acre is 2½ tons, whilst in some favored spots as much as 7 tons has been obtained. In 1878 the exports of sugar amounted to 17,187 tons. Rice is also largely cultivated, 2455 tons having been exported in the same year. Coffee is produced only to a small extent. Arrow-root is prepared from the root of the *Tacca pinnatifida*. The *kalo* plant (*Colocasia esculenta*) is extensively grown in wet places. It is said that a patch of *kalo* measuring 40 feet square yields sufficient food for a native for a whole year; a square mile of it would therefore support 17,000 persons. Maize and wheat are raised, and flour is manufactured. Pine apples, oranges, mangoes, custard apples, guavas, and many other fruits have been introduced, and flourish in gardens. A silky fibre called *pulu*, growing on the crown of tree-fern stems belonging to the genus *Cibotium*, is exported in large quantities to America, where it is used for stuffing cushions.

The owners of sheep are few, but they have large flocks, and the wool exported in 1878 amounted to 523,000 lb. Some districts are well suited for cattle raising. The wild cattle on the mountains—a very inferior breed, descended from some left by Captain Vancouver—are shot or taken with the lasso for the sake of their hides, which are exported in large quantities. In one island 11,000 were killed in a single year. The natives used to entrap them by digging pits near pools of water, and it was through falling into one of these pits that Douglas, the botanical collector, met his death by being gored by a bull.

Owing to their geographical position the commercial development of the islands has advanced even more rapidly than the material improvement in the circumstances of the people. A treaty of commerce was concluded in 1876 between the United States and the Hawaiian Islands, under which the manufactures of the former and the chief productions of the latter are reciprocally allowed to enter duty free. This treaty has been of great benefit to the islands, more especially by stimulating the cultivation of the sugar cane. The principal exports are sugar, rice, coffee, hides, skins, tallow, and wool. In 1878 the total amount of exports reached the value of about 3,500,000 dollars, whilst the value of imports amounted to about 3,000,000 dollars. The United States are by far the largest customers for the articles exported, and supply the great bulk of the imported goods. In 1878 there were 54 vessels registered under the Hawaiian flag, of which 11 were engaged in whaling and foreign trades, whilst 43 were coasters, making a total of 8000 tons. In 1878, besides the mail steamers, 216 merchant vessels of various foreign nations entered Hawaiian ports.

Many good roads have been made, and railways have been projected; a telegraph line was opened in 1878 between Wailuka and Lahaina in Maui (40 miles), and has since been extended; considerable capital has been brought in by foreigners; and the price of land is rising. A Government survey of the islands is in progress.

Climate and Meteorology.—The climate in general is warm but very salubrious. The temperature is equable and the sky usually cloudless. The N. E. trades blow for nine months; and the leeward coast, being protected by high mountains, is refreshed by regular land and sea breezes. During January, February, and March the wind blows strongly from the S. W.; and at this season an unpleasant hot damp wind from the equatorial region occasionally makes itself felt. Very much more rain falls on the windward side of the principal islands than on the leeward. Thus at Hilo, on the east coast of Hawaii, the usual rainfall is said to amount to 80 inches, and in some years to more than twice that quantity, whilst at Honolulu on the south coast of Oahu, out of the reach of the windward rains, the mean annual rainfall for the five years ending 1877 varied from 32·30 to 46·40 inches, the average being about 38. The mean annual temperature at the same place for the same period was 75° Fahr. The mean temperature of the coldest month during the five years was 62° Fahr., and that of the hottest month 81° Fahr. Strong gales blow once or twice during the winter, but destructive hurricanes are entirely unknown.

Zoology.—When Cook arrived at the islands he found only hogs, dogs, and rats. There is a day-flying bat; a small lizard is found, but no other reptiles. Cattle, goats, and hogs at the present day run wild upon the mountains in the larger islands, and do much damage to the woods. As to the birds, fifty-three species have been enumerated by Mr. Sanford Dole in *Proceedings of Boston Soc. of Natural History* (*cf.* Sclater's paper in *Ibis*, 1871), but it is thought that many more species remain to be discovered in the mountain districts. In former times the chiefs exacted as a tax from the people the gay feathers of certain species (*Drepanus* and *Mobo*), and employed them to ornament their state robes, only one of which is now in existence, and that is kept with the greatest care for the king's use on state occasions. Mr. Dole's list includes of *Falconidæ* 2 species, *Strigidæ* 1, *Promeropidæ* 10, *Meliphagidæ* 4, *Turdidæ* 2, *Ampelidæ* 1, *Corvidæ* 1, *Fringillidæ* 5, *Charadridæ* 2, *Scolopacidæ* 3, *Ardeidæ* 2, *Rallidæ* 5, *Anatidæ* 3, *Procellaridæ* 2, *Laridæ* 5, and *Pelicanidæ* 3. One of the *Rallidæ*, now nearly extinct, is remarkable for having rudimentary wings, like the moa of New Zealand, hidden in long, loose, hairy feathers. Dr. Otto Finsch, who visited Honolulu in 1879, says that the native birds, as well as the native plants, are being ousted by introduced species. The house sparrow from Europe and the maina (*Acridotheres tristis?*) and the turtle-dove (*Turtur chinensis*) from China are almost the only birds to be seen in and about the town; and in order to obtain specimens of indigenous species he had to go far inland. (See *Proceed. Roy. Geog. Soc.*, Jan., 1880.)

Botany.—The ravines and mountain slopes on the windward side of the larger islands contain much forest growth, whilst the leeward uplands and plains are comparatively bare. Amongst the more remarkable forms are a *Pandanus*, or screw pine, and the *Aleurites*, or candle-nut tree, so named from the natives stringing together the kernels, which are very oily, and so making a candle. Sandal-wood, formerly plentiful, has been exhausted. The cocoa-nut palm grows in abundance on the coast. For the following valuable notes on the flora, we are indebted to Dr. William Hillebrand, who for many years studied the subject on the spot with the view of publishing a complete work upon it:—

"The flora of these islands, according to my researches, comprises 829 species of phanerogams and 147 species of vascular cryptogams. These 976 species are distributed amongst 358 genera. There are 144 species of monocotyledons, of which 45 belong to the *Cyperaceæ* and 63 to the *Gramineæ*. Only 3 species of orchids have been found. Of the 829 species of phanerogamous plants 94 are known to have been introduced since the advent of the white man, whilst 597 species are peculiar to the islands, leaving only 138 species which are found elsewhere. With few exceptions the peculiar genera are the richest in species, but some of the genera not entirely Hawaiian are also remarkable for the number of their species; for example, *Cyrtandra* has 29 species, *Peperomia* 21, *Pittosporum* 12, and *Euphorbia* 10. Amongst the peculiar dicotyledonous plants there is not a single annual; and by far the greater number are arborescent or frutescent. There are only two native species of palm, both belonging to the genus *Pritchardia*. Of ferns there are 130 species, including 35 of *Asplenium*, 16 of *Aspidium*, 16 of *Polypodium*, and 8 of *Phegopteris*. The tree ferns number 5 species, 3 belonging to the genus *Cibotium*, and 2 to *Sadleria*. As to the derivation of the flora a distinction must be made between the lower and middle regions and the upper mountainous region. The two former are manifestly connected with the south-western Polynesian and Malaysian flora, so far as the latter is represented by the Moluccas and New Guinea, and connected by Wallace with the Australian continent. Some of the prevailing forest trees of

[1] [Father Damien (1841–89) (Joseph de Veuster), a Louvain Catholic, spent sixteen years in this settlement, and died there of leprosy. See his *Life*, by E. Clifford, New York, 1889.—Am. Ed.]

the lower region are identical with the species found in the localities just mentioned, *e. g., Aleurites moluccana, Jambosa malaccensis, Alphidoxia excelsa, Dodonæa viscosa, Thespesia populnea, Cordia subcordata, Artocarpus incisa, Paritium tiliaceum, Broussonetia papyrifera,* and *Cordyline terminalis.* Most of the forest trees of the middle belt, although peculiar as species, have very near congeners in the same direction, as *Metrosideros polymorpha, Acacia Koa* (with phyllodia), the *Peleas, Pseudopanax, Gouldia, Sophora, Elæocarpus, Pittosporum, Bobea, Straussia, Caprosma, Maba, Sapota, Myrsine, Olea, Pisonia, Santalum, Charpentiera,* etc. But with regard to the flora of the highest region in the Hawaiian Islands, there are many plants and some entire orders which point to the American continent as the land of their nearest allies—for instance, the *Compositæ* with few exceptions, the *Rosaceæ, Geraniaceæ,* and most of the *Labiatæ.*"

Geology and Mineralogy.—Though the islands are mountainous, none of the eminences reach the limit of perpetual snow. All the islands are of volcanic origin and are entirely composed of the products of eruption. On one of them (Hawaii) the volcanic forces are still in operation; on all the others they have been quiescent for an indefinite period, and the superficial rocks are in a more or less advanced state of decay. Where volcanic action has long ceased deep ravines have been excavated on the sides of the mountains, and this is especially the case on the windward side of Hawaii, where the rainfall is very large. The headlands frequently terminate in lofty cliffs, sometimes overhanging the sea to a height of 2000 feet; and these afford additional evidence of a prolonged period of repose. The products of the Hawaiian volcanoes are rather scanty. According to Mr. Brigham they consist of hydrochloric, sulphuric, and sulphurous acids, native sulphur, pyrites, common salt, sal ammoniac, hæmatite, quartz, palagonite, felspar, chrysolite, thomsonite, gypsum, solfatarite, copperas, nitre, arragonite, labradorite, and limonite. Evidence of slight upheaval is furnished by those parts of the shore where old coral reefs are found, sometimes as high as 100 feet above the sea.

Government and Laws.—The form of government is a constitutional monarchy, with a legislature composed of 20 nobles appointed by the king for life, and 28 representatives elected every two years by the people—the two classes sitting together. An annual income of 75 dollars is the qualification of an elector. The king has a cabinet of ministers and a privy council. The Government is regularly organized, its departments are efficiently managed, and the laws are justly administered. Many of the principal offices are filled by foreigners, chiefly Americans, who have become Hawaiian subjects. It is somewhat of a burlesque of the proceedings of royalty in Europe that here, where the whole body of subjects is less than the population of a small English county, we find in full display the titles of majesty, royal highness, prince, excellency, etc., as well as knights grand cross and other grades of two royal orders! A governor is appointed by the king for each of the larger islands. Diplomatic representatives of Great Britain, France, and the United States of America are resident at Honolulu, and also consuls of these and other foreign powers. At London, Paris, New York, and several other foreign cities there are Hawaiian diplomatic and consular agents. An efficient postal system has been established, and there is a standing army of about 70 men. The laws are modelled on those of the United States. There is a supreme court of justice, as well as circuit judges and district justices, assisted by a police force.

Religion and Education.—The ancient idolatrous religion has been abandoned since 1819, and the whole population has embraced Christianity. All forms are tolerated, and at Honolulu there are six churches belonging to the Roman Catholic, Protestant Episcopal, and Congregational communions. The bishop of the Church of England is styled the bishop of Honolulu, and the Roman Catholics have also a bishop. The Congregationalists are most numerous. Originally started by the foreign missionaries, the question of education has been taken up by the Government, who have established a board to superintend the affairs connected with this subject. Nearly every native can read and write. In 1878 there were 222 schools, attended by 3991 boys and 3000 girls. In the majority of these schools the instruction is communicated in Hawaiian; but in some of a higher grade English is employed, and, as the people themselves desire it, that language is more and more introduced.

Revenue and Currency.—The annual revenue of the Government amounts to about 600,000 dollars derived chiefly from custom duties (284,000 dollars in 1878), taxes on real and personal property, and a poll tax. It does not equal the expenditure, and there is a funded debt of from 400,000 to 500,000 dollars. Accounts are kept in dollars, and the coins in circulation are those of American States.

The Capital.—Honolulu (population 14,114), the capital of the island group, stands on the S. W. coast of Oahu, in 157° 51′ 48″ W. long. and 21° 17′ 56″ N. lat., at the mouth of the valley of Nuuanu, which runs back between tall cliffs to two peaks about 3000 feet high in the great eastern range of mountains. It is the seat of the central government and the residence of the king. Although consisting largely of one-story wooden houses, mingled with grass huts half smothered by foliage, Honolulu is said to present to approaching vessels more of the appearance of a civilized place with its churches and public buildings than any other town in Polynesia. The streets, laid out in the American style, are straight, neat, and tidy. Water-works supply the town from a neighboring valley. Among the stone erections are the king's house, a hospital, a large hotel built by the Government, and the Government buildings, in which are a fair library of English books and a museum containing corals, shells, and other natural curiosities, as well as specimens of ancient weapons and other native articles. Amongst the brick buildings are large iron works, a brass foundry, an establishment for working up wood, and rice mills. All the necessaries and most of the luxuries of civilized life can be obtained in Honolulu. There are several hotels for the accommodation of strangers, and numerous agencies of both British and American insurance offices; American and English medical men and lawyers have settled in the town; two weekly newspapers in English and two in the Hawaiian language are published. Honolulu has a good natural harbor, with wharves, a custom house, and warehouses. It is connected by regular lines of mail steamers with San Francisco, Sydney, and New Zealand. There are also lines of steamers to Liverpool and Glasgow, New York and Boston, Bremen, China, and Peru. Small steamers ply between the islands. Business is almost entirely carried on by foreigners, and chiefly by Americans, British, Germans, and Chinese. The last are the most numerous; they are acquiring property rapidly, and some of them are wealthy. The foreigners are very sociable, and have established numerous clubs, benevolent societies, etc. American influence and customs are said to be dominant. In the neighborhood of the town is a college, where for a small sum boys and girls receive a good English education.

The Separate Islands.—The following description of the separate islands begins with the largest and most easterly, giving the others in the order of their position.

Islands.	Length in Miles.	Width in Miles.	Estimated Area in Acres.	Population. Census 1878.
Hawaii..	100	90	2,500,000	17,034
Maui.....	54	25	400,000	12,109
Kahulawi.....	12	5	30,000	60
Lanai.....	20	9	100,000	214
Molokai.....	35	7	200,000	2,581
Oahu.....	35	21	350,000	20,236
Kauai.....	30	28	350,000	5,634
Niihau.....	20	5	70,000	117
			4,000,000	57,985

In older English works Hawaii is called Owhyhee and Maui Mowee. The four uninhabited islets are named Nihoa, Kaula, Lehua, and Molokini.

Hawaii has an area nearly double that of all the other islands put together. In shape it is a rude triangle, with sides of 85, 75, and 65 geographical miles in length. Almost the whole of its surface is occupied by the gentle slopes of four volcanic mountains, Mauna Kea on the N., 13,805 feet in height (the highest peak in the Pacific Ocean); Mauna Loa on the S., 13,600 feet; Mauna Hualalai on the W., 8275 feet; and Mauna Kohala on the N. W., 5505 feet. Pop. 46,843.

The highest points of Mauna Kea are truncated cones with craters rising from plains of clinkers and gravel, ashes and sand; but no modern streams of lava are visible, nor is there record of any eruption of this mountain. The slopes on the west side are so gentle that the base of the terminal cones may be reached on horseback. On the windward side cryptogamic vegetation reaches as high as 12,000 feet, but the forest ceases at 6000 feet.

Mauna Loa is the most interesting mountain of the whole group from its being still an active volcano. The circular terminal crater, 8000 feet in diameter, is quite perfect, with nearly vertical walls from 500 to 600 feet high on the inner side; and the bottom between the numerous cones is usually covered with solid lava, from the fissures of which issue steam and sulphurous vapors; but its features change with every eruption. There is no record of any eruption from Mauna Loa before 1832, when lava flowed from the summit crater on several sides. In 1843 a vast flood of lava was discharged, which formed three streams 5 or 6 miles wide and between 20 and 30 miles long. There were eruptions in 1851, 1852, 1855, and 1859, but in none of these did the lava reach the sea except on the last occasion, when the eruption continued for two months, and a winding current 50 miles long, from 1 to 5 miles wide, and from 10 to some hundreds of feet thick, arrived at the west coast in eight days. Its surface is now black, shining, brittle, and very porous. In 1868 occurred another eruption attended by many

earthquakes. One of these caused a huge sea wave 40 feet high to break on the shore, occasioning the loss of many lives and the destruction of much property. The wave crossed the Pacific to the Californian coast. Later in the same year, at a time when earthquakes were taking place on the coast of South America and the town of Iquique in Peru was destroyed, a great wave came across the Pacific, struck the Hawaiian Islands, and made itself felt in New Zealand. The last eruption took place in February, 1877, when a stream of lava flowed for six hours.

Sixteen miles to the S. E. of Mauna Loa is a hill called Kilauea, with a crater which is the largest active one in the world. The earliest recorded eruption was in 1789, and there was another in 1832. This volcano was first made known to the civilized world in 1823, when Mr. Ellis and a party of American missionaries visited it. At an elevation of 4400 feet above the sea they found in the midst of a plain an oval crater 9 miles in circumference with vertical sides 1000 feet deep, covered at the bottom with a lake of liquid lava at one end red and boiling. Around the edge or from the midst of this fiery lake, 51 conical craters sent forth jets of lava or smoke and flame. A stony ledge round the inside of the crater, and 300 or 400 feet above the lake, indicated that the lava had risen to that height and had then run off by a subterraneau channel to the sea, where some miles of coast had been filled up with liquid lava a few weeks previously. Since that time many travellers have ascended to the craters of both Mauna Loa and Kilauea, and have given vivid descriptions of the very grand and wonderful phenomena they witnessed.[1] In 1840 the commander and officers of the United States Exploring Expedition spent three weeks on the summit of Mauna Loa and made an accurate survey of the crater. In that year there was a great outburst from a crater 8 miles from the summit of Kilauea, when a stream of lava half a mile broad and 40 miles long reached the sea.

Over the whole summit of Hualalai, another of the four mountains of Hawaii, are scattered many pit craters from 300 to 500 feet deep and from 700 to 1000 feet in diameter, their solid walls being nearly vertical. On the edge of one of the deepest craters there is a mound about 50 feet high, composed of drops of lava and fragments of all sizes, colored yellow, orange, red, blue, and black. They seem to have been ejected in a viscid state, for they are slightly agglutinated together. In the centre of the mound is a blow-hole 25 feet in diameter and about 1800 feet deep. The inside of this hole is grooved horizontally, but otherwise smooth as if turned. More than 150 cones have been counted on the sides of Hualalai. The last eruption took place in 1801, when a copious flow of lava reached the coast, where it filled up a deep bay.

The lavas of Hawaii are distinguishable according to the aspect of their surface into three classes. 1. The *pahoehoe* of the natives, or velvety lava, is folded and twisted in a manner that shows it was once a viscid fluid. This is the common form when the flow has passed over rocks or dry ground on a gentle slope. 2. The clinkers or scoriaceous lava is rough and covered with fragments. This is found wherever the stream has passed through woods or has been impeded by inequalities of the ground, or where its heat has caused the explosion of caverns beneath the floor of older beds. 3. The *a-a*, or spongy lava, which, on account of its extreme roughness and hardness, is carefully avoided by all travellers. This form is thought to owe its origin to the fact that, just as the lava was granulating, impediments that stood in its course gave way, when the spongy mass rolled over and built up piles from which the liquid portion drained off. The natives are in the habit of making holes in the *a-a*, and planting in them banana shoots or sweet potato cuttings, and though the holes are simply filled with stones or fern leaves the plants grow and in due time are productive.

The plain lying between the mountains of Hawaii is many square miles in extent, and is intersected by lava streams which have issued from the three nearest volcanoes. The rocks forming the north point of Kealakeakua bay, where Captain Cook was killed, are part of a flow which may be traced up the steep ascent and over a precipice where it must have fallen like a cascade, the surface being curiously marked with waves and curves as if the molten stone had been solidified instantaneously. A sheet of copper with an inscription, attached to the stump of a cocoa-nut palm, for many years served as the only memorial of Captain Cook's death; but in 1874 a monument was erected at the spot by the residents of Honolulu. The east coast of Hawaii from Hilo to Laupahoehoe, a distance of 30 miles, is very remarkable for the streams, 85 in number, running at the bottom of ravines 1800 or 2000 feet in depth which are cut into the side of Mauna Kea, and render travelling along this coast a work of extreme labor. The ridges between the ravines terminate at the sea in precipices from 100 to 500 feet high, so that the road is obliged to run inland into and across the ravines.

At a point midway between the three southern mountains, and at a height of 5000 feet, are the ruins of the ancient temple of Kaili, 92 feet long, which formerly contained many idols.

Hilo (population 4200), the residence of the governor, is a straggling village half hidden in sugar-cane and other vegetation on the east coast. It lies in a bay that is little more than an open roadstead, but is partly protected from heavy seas by a sunken coral reef.

Maui, lying 25 miles N. W. of Hawaii, is composed of two mountains connected by a sandy isthmus 7 or 8 miles long by 6 miles across, and so low that the depression of a few feet would convert Maui into two islands. Haleakala, the mountain to the N. W., has a height of 10,032 feet, and forms a great dome-like mass with a circumference at the base of 90 miles, and with regular slopes of only 8° or 9°, so that travellers may ride to the top on horseback. The extinct crater on its summit, the largest in the world, has a length from E. to W of 7½ miles, and a width of 2¼ miles, with an area of about 16 square miles. The circuit of the walls, which are composed of a hard gray clinkstone much fissured, is from 18 to 20 miles. The depth, measured from the highest point of the rim, is 2720 feet. At the bottom are 16 cones 500 or 600 feet high, formed long after the top of the great crater had been destroyed, perhaps by explosions. On the east and north are two great gaps in the walls from 1 to 3 miles wide, through each of which has poured a copious flood of lava which nearly reached the sea. These streams, though of unknown date, are comparatively modern, for they have blocked up several ravines in their progress. A little impure sulphur is found in the crater, but there is not the least sign of igneous activity at present on the island. Eeka, the mountain at the south-east of Maui, is 5820 feet high. Volcanic action appears to have ceased here at a much earlier period than on Haleakala, there being no craters on the summit or sides, whilst the slopes have been denuded into deep valleys separated by narrow sharp ridges. Pop. 24,797.

Lahaina (population 3000), on the north-west shore, is the residence of the governor. It is a decaying place situated in a grove of cocoa-nut and other tropical trees. The roadstead is roomy and sheltered, and there is regular steam communication with Honolulu, about 72 miles distant. A native Hawaiian college in the neighborhood is supported by Government. Foreigners reside at Lahaina, as well as at *Wailuku* (population 4000), a town on the east shore of the island. They are principally employed in the cultivation of sugar.

Kahulawi is a small island 6 miles west of Maui. Though the vegetation is scanty and there are no streams, it has been leased by the Government for sheep pasture. The highest point is only about 1130 feet above the sea, and there are no ravines.

Lanai is another small island on the west of Maui, from which it is 9 miles distant. At the south-east end there is a mountain 3000 feet high without a crater. Vegetation is stunted on the exposed slopes, but the ravines contain a rich growth of trees and shrubs. Sheep in large numbers are pastured here. Lanai and Kahulawi are remarkable for presenting high cliffs to the leeward and gentle slopes to the windward, the reverse being the case in all the other islands. Pop. 619,

Molokai is a long narrow island 9 miles distant from the northwest end of Maui. A ridge of hill forms its backbone and throws off lateral spurs enclosing ravines. At the west end are some lofty broken peaks, the highest of which is about 3500 feet above the sea. Deer are wild on the hills, the descendants of tame animals that belonged to a former king. The leper settlement of Molokai has been already mentioned. Pop. 2,504.

Oahu, 23 miles N. W of Molokai and 67 miles S. E. of Kauai, has an irregular quadrangular form. It is traversed from S. E. to N. W. by two parallel ranges of hills separated by a low plain. The highest point in the island is Kaula, 4060 feet, in the western range; but the eastern range is much longer than the other, and its ridge is very broken; on the land side there are many ravines formed by lateral spurs, but for 30 miles on the other side it presents to the sea a nearly vertical wall without a break. The valleys are remarkable for beautiful scenery, —peaks, cliffs, lateral ravines, cascades, and tropical vegetation combining to charm the eye. There are few craters on the loftier heights, volcanic activity appearing to have long ceased, but on the coast there are several groups of small cones with craters, some of lava, others of tuff. The greater part of the coast is surrounded by a coral reef, often half a mile wide. In several localities an old reef has been upheaved, sometimes to the height of 100 feet, and now forms part of the land. By such an upheaval a bay of the sea a mile wide and two miles long has been converted into a plain some 25 feet above the level of the ocean, and upon this plain stands Honolulu, the capital of the kingdom, noticed above. Pop. 58,504.

Kauai, 67 miles N. W. of Maui and 23 miles from Molokai, has an irregularly circular form; and at the centre is the basaltic mountain Waialealo, 5000 feet high, which has a

[1] Amongst the minor phenomena they speak of the delicate glassy fibres called Pele's hair by the Hawaiians, which are spun by the wind from the rising and falling drops of liquid lava, and blown over the edge or into the crevices of the crater. Pele in idolatrous times was the dreaded goddess of the volcano. It is noteworthy that a substance resembling Pele's hair is made from the slag of iron furnaces, by driving steam or air against a thin current of the melted slag. The filamentous material thus made has been termed mineral or slag wool; it can be woven into sheets which are useful for coating steam boilers, etc., as the substance is a very bad conductor of heat.

swampy top and sides deeply furrowed by ravines, showing that volcanic action has been long extinct. To the west of the mountain is a tableland with an elevation of 4000 feet and an area of 40 square miles, terminating at the sea in a precipice of 2000 feet. The valleys are numerous, deep, and very picturesque with wood and waterfalls. The soil is fertile, the lavas of nearly the whole island being much decomposed. In some places, however, are cones which have preserved their craters. Numerous dykes are exposed in the valleys, and there are large caverns in several localities which are thought to have been great bubbles in the lava. In one place near the shore is a bank of calcareous sand which on being set in motion gives out a curious noise. When the grains were examined with the microscope they were found to contain cavities, and it is supposed that these minute hollows are the cause of the resonance, for when the sand is wet the noise is not heard. A district on the north side of the island is considered to be the best watered and most fertile in the entire group; it contains several sugar plantations. In this part the rainy season extends over nine months. The chief town is *Waimea* (population 1200), which affords the best anchorage in Kauai; it is situated at the mouth of a stream navigable by boats for three-quarters of a mile.

Niihau, the most westerly island of the group, is 15 miles west of Kauai. Two-thirds of it consist of a low plain composed of an uplifted coral reef and matter washed down from the mountains. The hilly portion is destitute of cones, craters, peaks, and ridges. The coast on the side towards Kauai is formed of high cliffs, and from the similarity of the structure of the rocks on the two sides of the strait it is thought that the islands were once united. The soil of Niihau is dry, yet fertile. The island is the property of a foreigner who pastures about 75,000 sheep upon it. The uninhabited islets of Kaula and Lehua, close to Niihau, have each of them a tufa cone.

See G. Mortimer, *Observations during a Voyage to the . . . Sandwich Islands*, etc., Lond., 1791; G. F. Mathison, *Narr. of a Visit to the Sandwich Islands*, 1825; W. Ellis, *Narrative . . . with Remarks on the Sandwich Islands*, 1826; *Voy. of H. M. S. Blonde to the Sandwich Islands*, 1824–25, Lond., 1826; J. Jarves, *Hist. of the Sandwich Islands*, Boston, U. S., 1843; H. T. Cheever, *Life on the Sandwich Islands*, 1851; W. Ellis, *Polynesian Researches*, 1853; S. S. Hill, *Travels in the Sandwich Islands*, 1856; Ch. Wilkes, U. S. N., *Narrative of Exploring Exped. round the World, 1838–42*, New York, 1856; T. Williams, *The Sandwich Islands*, Lond., 1858; Hopkins, *Hawaii Past, Present, and Future*, Lond., 1866; Jules Remy, *Récits d'un vieux sauvage, pour servir à l'histoire ancienne du Hawaii*, Châlons sur Marne, 1859; Id., *Ka Mooolelo Hawaii, histoire de l'archipel hawaiien* (text and translation), Paris, 1862; H. Mann, *Flora of the Hawaiian Islands* (Boston, 1868), and his papers in *Mem. Boston Soc.*, 1869, and in *Proc. of Amer. Acad.*, vol. vii., 1868; Brigham, "Notes on Hawaiian Volcanoes," in *Mem. Bost. Soc. Nat. Hist.* (Boston, 1868–69), and his papers in the *Globus*, 1876, and the *Ausland*, 1876; Hann, "Klima der Sandwich Inseln," in *Zeitschrift der Oesterr. Ges. für Meteor.*, viii., 1873; W. R. Bliss, *Paradise in the Pacific*, New York, 1873; Nordhoff, *Northern California, Oregon, and the Sandwich Islands*, London, 1874; C. de Varigny, *Quatorze ans aux îles Sandwich*, Paris, 1874; H. M. Whitney, *The Hawaiian Guidebook*, Honolulu, 1875; Thrum, *Hawaiian Almanac for 1875*, Honolulu, 1875; Ferreiro, "Las islas do Sandwich descubiertas por los Españoles," in *Boletin de la Soc. Geogr. de Madrid*, 1877. For further bibliographical details see *Hawaiian Club Papers*, Boston, 1868, and W. Martin, *Cat. d'ouvrages relatifs aux îles Hawaii*, Paris, 1867. A map of Hawaii is given in Petermann's *Mittheil.*, 1876, and one of the other islands, *ibid.*, 1878.

(J. Y. J.)

HAWARDEN, a market-town of Flintshire, North Wales, 8 miles S. W. of Chester, is a clean and tolerably well-built place, situated on an eminence commanding an extensive prospect. It lies in the midst of a coal district, and near it are valuable clay-beds. Coarse earthenware, draining-tiles, and fire-clay bricks form the chief manufactures of the district. The family of Maude derive the title of viscount from the town. Population in 1901 of the township (including Saltney), 18,271. In the neighborhood is Hawarden Castle, built in 1752, and added to and altered in the Gothic style in 1814; it stands near the ruins of the old castle of that name which was granted by the Conqueror to his nephew Hugh Lupus, and which after many vicissitudes came into the possession of Serjeant Glynne, lord chief-justice of England under Cromwell. On the death in 1874 of Sir Stephen R. Glynne, the last of a line of baronets, the castle passed to his brother-in-law the eminent statesman Mr. W. E. Gladstone.

HAWES, Stephen, a minor English poet of the 16th century. Neither the date of his birth nor that of his death has been ascertained, and all the known facts of his life may be stated in a few lines. He was probably a member of a Suffolkshire family, studied at Oxford, with what success we can only conjecture, travelled in England, Scotland, and France, and having acquired the reputation of a man of culture was appointed groom of the chamber to King Henry VII. He was still alive in January, 1520–21, as appears by an entry, *Item to Mr. Hawse for his play vj* li. *xiii* s. *iiij* d. Of the play thus mentioned nothing further is known. The writer's chief work was *The Historie of Graunde Amour and la Bell Pucell, called the Pastime of Pleasure, conteyning the Knowledge of the Seven Sciences and the Course of Man's Life*, a long allegorical poem in the style of Lydgate. Its general method may be guessed from such a heading as *How Science first sent him to Gramer where he was receyved by Dame Congruitie;* and, though it must be confessed that portions of the poem are better both in matter and in workmanship than might be expected, it is now of interest almost exclusively because, in Warton's words, it is "almost the only effort of imagination and invention which had appeared in our poetry since Chaucer." Probably written about 1506, and first printed, it is said, by Wynkyn de Worde, it afterwards went through several editions (J. Wayland, 1554; Richard Tottel, 1555; J. Waley, 1559); a reprint of Tottel's was made for the Percy Society in 1842. Among the minor poems attributed to Hawes it is sufficient to mention his *Conversyon of Swerers* and his *Joyful Medytacyon to all Englonde of Kynge Henry the Eight.* The former, a dry didactic production, was printed by Wynkyn de Worde (1509?) and William Copland (1551). Of the latter the only copy preserved is among Bishop More's books in the public library of the university of Cambridge. Both were edited for the Abbotsford Club by David Laing (1854). For further details see Hazlitt's edition of Warton's *History of English Poetry* (1874), and the Percy and Abbotsford reprints.

HAWES, William (1785–1846), an English musician of some merit, is remembered chiefly by the fact that through his instrumentality Weber's *Der Freischütz* was for the first time performed in England. This event took place July 24, 1824, and led eventually to Weber's removal to London. Hawes was born in London in 1785, and was for eight years (1793–1801) a chorister of the Chapel Royal, where he studied music chiefly under Dr. Ayrton. He subsequently held various musical posts, being in 1817 appointed master of the children of the Chapel Royal. He also, in conjunction with Welsh, carried on the business of a music publisher, and was for many years musical director of the Lyceum Theatre, then devoted to English opera. It was in the last-named capacity that he introduced Weber's masterpiece, at first slightly curtailed, but soon afterwards in its entirety. Winter's *Interrupted Sacrifice*, Mozart's *Così fan Tutte*, Marschner's *Vampyre*, and other important works were also brought out under his auspices. Hawes also wrote or compiled the music for numerous pieces, none of which however has survived or deserves mention. Better were his glees and madrigals, of which he published several collections. He also superintended a new edition of the celebrated *Triumph of Oriana*. Hawes died February 18, 1846.

HAWFINCH, a bird so called from the belief that the fruit of the hawthorn (*Cratægus Oxyacantha*) forms its chief food, the *Loxia coccothraustes* of Linnæus, and the *Coccothraustes vulgaris* of modern ornithologists, one of the largest of the Finch family (*Fringillidæ*), and found over nearly the whole of Europe, in Africa north of the Atlas, and in Asia from Palestine to Japan. It was formerly thought to be only an autumnal or winter visitor to Britain, but later experience has proved that, though there may very likely be an immigration in the fall of the year, it breeds in nearly all the English counties to Yorkshire, and abundantly in those nearest to London. There seems also to be good reason for supposing that it is yearly extending its range in the British Islands. In coloration it bears some resemblance to a Chaffinch, but its much larger size and enormous beak make it easily recognizable, while on closer inspection the singular bill-hook form of some of its wing feathers will be found to be very remarkable. Though not uncommonly frequenting gardens and orchards, in which as well as in woods it builds its nest, it is exceedingly shy in its habits, so as seldom to afford opportunities for observation. As the genus *Coccothraustes* is now commonly restricted, it includes but this single species,—the Japanese form, at one time regarded as distinct, being considered by the latest authorities to be inseparable. (A. N.)

HAWICK, a municipal and parliamentary borough of Roxburghshire in Scotland, 10 miles S. W. of Jedburgh, and 53 miles S. S. E. of Edinburgh by rail, is situated on the south bank of the Teviot at its junction with the Slitrig, a wild and irregular stream that flows through the town. A handsome bridge, spanning the Teviot, connects Hawick with the manufacturing village of Wilton, which is practically a suburb. The town is fairly well built, the main

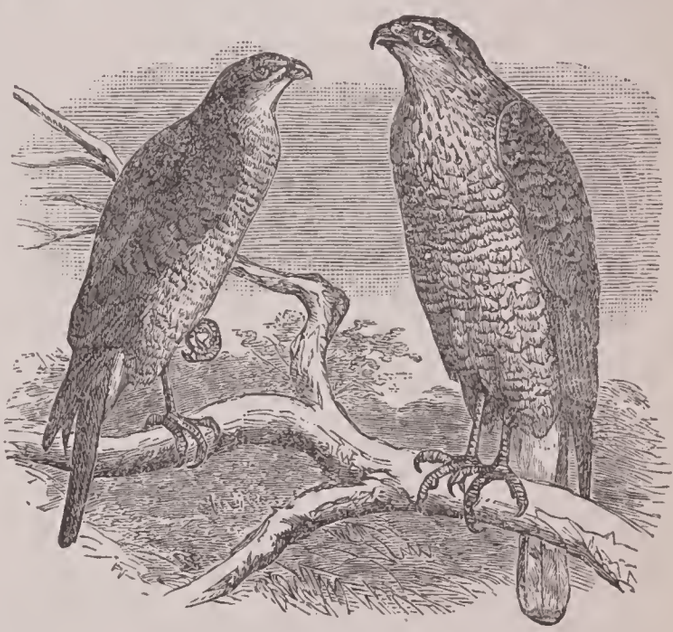
street being broad and well paved. The ancient tower of the barons of Drumlanrig is now occupied as an inn; and many of the older houses testify by their massive proportions to the former dangers of Hawick's position as a border town. The tower was the only building not burned down in 1570 by the earl of Sussex. The parish church of St. Mary has succeeded one mentioned in the *Chronicle of Melrose* as having been consecrated in 1214,—a fact which speaks for the antiquity of the town. Additional testimony is afforded by the Moathill at one end of the town, an earthen mound of great antiquity, about 30 feet high. The present town-charter, granted in 1537 by a baron of Drumlanrig, was confirmed in 1545 by Queen Mary during a residence in the town. Hawick, with Wilton, was in 1868 erected into a parliamentary burgh, uniting with Galashiels and Selkirk in sending a member to parliament. The municipal government is vested in a town council, consisting of a provost, four magistrates, and ten councillors. The exchange, built in 1865, contains a free public library. Hawick possesses a very complete system of underground drainage, in connection with purification works,—this being the first experiment of the kind on a large scale in Scotland.

The manufactures of Hawick are mentioned in the burgh records so far back as 1640, but they must have been flourishing for some time before that, as the weavers already formed an important part of the population. The weavers then worked each for himself, executing his private orders; and it is not till the middle of the following century that a number of looms under one employer are heard of. Linen was at first the chief article of manufacture, but woollen plaidings were also made. Wool was also spun and sold to be manufactured elsewhere. A carpet factory was begun in 1752, and the manufacture of linen tapes or inkle started a few years afterwards, but both industries became extinct towards the beginning of the present century. The manufacture of tweeds is the most important industry of Hawick. In this branch the annual turn-over is about £800,000; while in the whole woollen trade it is about £2,000,000. The manufacture of hosiery, to which the town owes so much of its prosperity, was introduced in 1771, when four looms, employing six men and five women, produced annually about 2400 pairs of coarse stockings. Hawick has gradually become the chief seat of this trade in Scotland. Some of the yarn spun at Hawick is sent to England and to other parts of Scotland to be woven; while the merino yarn used for the finer goods is chiefly obtained from Pleasley and Nottingham. Besides the staples, tweeds, and hosiery, Hawick manufactures shawls, plaids, blankets, gloves, and leather. There are also an oil-work, for extracting oil from the soapy refuse of the fulling-mills, an iron-foundry, and a factory-engineering establishment. The population of the burgh in 1871 was 11,356; in 1901 it was estimated at about 17,303.

HAWK (Anglo-Saxon, *Hafoc*), a word of somewhat indefinite meaning, being often used to signify all diurnal Birds-of-prey which are neither Vultures nor Eagles, and again more exclusively for those of the remainder which are not Buzzards, Falcons, Harriers, or Kites. Even with this restriction it is comprehensive enough, and will include more than a hundred species, which have been arrayed in genera varying in number from a dozen to above a score, according to the fancy of the systematizer. Speaking generally, Hawks may be characterized by possessing comparatively short wings and long legs, a bill which begins to decurve directly from the cere (or soft bare skin that covers its base), and has the cutting edges of its maxilla (or upper mandible) sinuated[1] but never notched. To these may be added as characters, structurally perhaps of less value, but in other respects quite as important, that the sexes differ very greatly in size, that in most species the irides are yellow, deepening with age into orange or even red, and that the immature plumage is almost invariably more or less striped or mottled with heart-shaped spots beneath, while that of the adults is generally much barred, though the old males have in many instances the breast and belly quite free from markings. Nearly all are of small or moderate size—the largest among them being the Gos-Hawk (vol. x. p. 701), and its immediate allies, and the male of the smallest, *Accipiter tinus*, is not bigger than a Song-Thrush. They are all birds of great boldness in attacking a quarry, but if foiled in the first attempt they are apt to leave the pursuit. Thoroughly arboreal in their habits, they seek their prey, chiefly consisting of birds (though reptiles and small mammals are also taken), among trees or bushes, patiently waiting for a victim to show itself, and gliding upon it when it appears to be unwary with a rapid swoop, clutching it in their talons, and bearing it away to eat it in some convenient spot.

[1] In one form, *Nisoides*, which on that account has been generically separated, they are said to be perfectly straight.

It is of course impossible here to enter into details of the numerous forms which, notwithstanding the limitation above adopted, are to be called hawks, or to describe the distinguishing characters, so far as any have been given, of the different groups or sections into which it has pleased systematic ornithologists to break them up, since hardly any two are agreed in the latter respect. There is at the outset a difference of opinion as to the scientific name which the largest and best known of these sections should bear—some authors terming it *Nisus*, and others, who seem to have the most justice on their side, *Accipiter*. In Europe there are two species—first, *A. nisus*, the common Sparrow-Hawk, which has a wide distribution from Ireland to Japan, extending also to northern India, Egypt, and Algeria, and secondly, *A. brevipes* (by some placed in the group *Micronisus* and by others called an *Astur*), which only appears



European Sparrow-Hawk (Male and Female).

in the south-east, and the adjoining parts of Asia Minor and Persia. In North America the place of the former is taken by two very distinct species, a small one, *A. fuscus*, usually known in Canada and the United States as the Sharp-shinned Hawk, and Stanley's or Cooper's Hawk, *A. cooperi* (by some placed in another genus, *Cooperastur*), which is larger and has not so northerly a range. In South America there are four or five more, including *A. tinus*, before mentioned as the smallest of all, while a species not much larger, *A. minullus*, together with several others of greater size, inhabits South Africa. Madagascar and its neighboring islands have three or four species sufficiently distinct, and India has *A. badius*. A good many more forms are found in South-eastern Asia, in the Indo-Malay Archipelago, and in Australia three or four species, of which *A. cirrhocephalus* most nearly represents the Sparrow-Hawk of Europe and Northern Asia, while *A. radiatus* and *A. approximans* show some affinity to the Gos-Hawks (*Astur*) with which they are often classed. The differences between all the forms above named and the much larger number here unnamed are such as can be only appreciated by the specialist, and could not possibly be pointed out within the limits of this article. It may be observed in conclusion that the so-called "Sparrow-Hawk" of New Zealand (*Hieracidea*) does not belong to this group of birds at all, and by many authors has been deemed akin to the Falcons. For Hawking, see Falconry. (A. N.)

HAWKE, Edward Hawke, Baron (1705–1781), an English admiral, was the son of a barrister and was born in 1705. He entered the navy at an early age, and in 1733 became commander of the "Wolf." In the engagement off Toulon in 1744, he broke from the line of battle in order to

engage the "Poder," and although he succeeded in causing her to strike her colors, his breach of discipline was punished by dismissal from the service. He was, however, almost immediately restored by the king's commands, and in 1747 was promoted to the rank of rear-admiral of the white. In October of the same year he was sent in command of a squadron intended to intercept a fleet of merchant vessels bound for the West Indies under a convoy of nine men-of-war, and coming up with them on the 14th of the month near the isle of Aix, he succeeded after a severe struggle in capturing six of the men-of-war, but darkness coming on before the close of the contest the whole of the merchant vessels escaped. For his victory Hawke was created a knight companion of the Bath. In December of the same year he was chosen member of parliament for Bristol. In May, 1748, he became vice-admiral of the blue, and in January, 1755, admiral of the white. In the following year he succeeded Admiral Byng as commander of the fleet in the Mediterranean, but arrived too late to succor Minorca; and in none of the commands which he subsequently held did he have an opportunity of distinguishing himself till 1759, when he took charge of a squadron sent to cruise off Brest. On the morning of the 20th November he sighted the French fleet under Admiral Conflans off Belleisle, and notwithstanding that the French, trusting to their knowledge of the rocks and shallows, retired towards the shore, he determined to engage them, which he did with such impetuosity that their fleet was only saved from total destruction by the approach of nightfall. As it was, more than half their vessels were either disabled, captured, or driven on shore. For this brilliant victory, gained in such circumstances of difficulty and danger, with the loss of only two vessels, Hawke received the thanks of the House of Commons and a pension of £2000 per annum. In 1765 he was appointed vice-admiral of Great Britain and first lord of the admiralty. In 1776 he was raised to the peerage by the title of Baron Hawke of Towton. He died at Shepperton, Middlesex, 17th October, 1781.

HAWKESWORTH, John (*c.* 1715–1773), an author of the last century, was born in London, according to one account in 1715, but according to another in 1719. He is said to have been apprenticed first to a clockmaker and afterwards to an attorney, but at any rate he was indebted for the education requisite for the prosecution of a literary career chiefly to his own perseverance. In 1744 he succeeded Dr. Johnson as compiler of the parliamentary debates for the *Gentleman's Magazine*. Eight years later he started in company with Johnson, Bathurst, and Warton a periodical called the *Adventurer*. This journal had a great success, and ran to 140 numbers, of which 70 were from the pen of Hawkesworth himself. On account of what was regarded as its powerful defence of morality and religion, Hawkesworth was rewarded by the archbishop of Canterbury with the degree of LL.D. In 1761 he published a volume of fairy tales, and an edition of Swift's works and letters, with a life prefixed which Johnson has referred to in highly laudatory terms in his *Lives of the Poets*. The reputation he obtained by these and other works was such that he was commissioned by Captain Cook to edit his papers relative to his first voyage. The work appeared in 1773 in three volumes, and as a reward of his labors Hawkesworth received from the Government the sum of £6000. His descriptions of the manners and customs of the New World were, however, regarded by many critics as hurtful to the interests of morality, and the severity of their strictures is said to have hastened his death, which took place November 17, 1773. He was buried at Bromley in Kent, where a monument has been erected to his memory. Hawkesworth was a close imitator of Johnson both in style and thought, but his independent literary talent is considerable.

HAWKINS, Sir John (*c.* 1532–1595), was born in Plymouth about 1532, and was bred a sailor. Learning that negroes from the coast of Guinea were good merchandise for traffic in the West Indies, he made trial of this in three voyages, the first in 1562, the second in 1564. The third, made in company with young Drake in 1567, ended in disaster, the story of which is related by Hawkins himself. He was returned M. P. for Plymouth in 1572; and the next year he was made treasurer and comptroller of the navy. In the expedition against the Armada he was appointed vice-admiral, hoisting his flag on board the "Victory," and for his services on that occasion he was afterwards knighted. His last expedition (1595) was undertaken, once more with Drake, mainly with a view to rescue his son Richard, who three years before had fallen into the hands of the Spaniards off the coast of Quito. It was unsuccessful; and, worn out with fatigue and broken-hearted, he died off Puerto Rico on the 12th of November, 1595. Hawkins was the first to use chain pumps and fighting nettings for ships. Stow speaks of him as a very wise, vigilant, and true-hearted man. Along with Sir Francis Drake, he founded in 1588 the "Chest at Chatham," the forerunner of Greenwich Hospital, where it is now preserved. A portrait of Hawkins once adorned the Armada tapestry in the House of Lords.

HAWKINS, Sir John (1719–1789), will be permanently remembered as the author of an important work on the history of music. He was born March 30, 1719, in London, the son of an architect who destined his son for his own profession. Ultimately, however, Hawkins took to the law, devoting his leisure hours to his favorite study of music. A wealthy marriage in 1753 enabled him to indulge his passion for acquiring rare works of music, and he bought, for example, the collection formed by Dr. Pepusit, and subsequently presented by Hawkins to the British Museum. It was on such materials that Hawkins founded his celebrated work on the *General History of the Science and Practice of Music*, in 5 vols. (republished in 2 vols., 1879). It was brought out in 1776, the same year which witnessed the appearance of the first volume of Burney's work on the same subject. The relative merits of the two works were eagerly discussed by contemporary critics. Burney no doubt is infinitely superior as a literary man, and his work accordingly comes much nearer the idea of a systematic treatise on the subject than Hawkins's, which is essentially a collection of rare and valuable pieces of music with a more or less continuous commentary. But by rescuing these from oblivion Hawkins has given a permanent value to his work. Of Hawkins's literary efforts apart from music it will be sufficient to mention his occasional contributions to the *Gentleman's Magazine*, his edition of the *Complete Angler*, and his biography of Dr. Johnson, with whom he was intimately acquainted. He was one of the original members of the Ivy Lane Club, and ultimately became one of Dr. Johnson's executors. If there were any doubt as to his intimacy with Johnson, it would be settled by the slighting way in which Boswell refers to him. Speaking of the Ivy Lane Club, he mentions amongst the members "Mr. John Hawkins, an attorney," and adds the following footnote, which at the same time may serve as a summary of the remaining facts of Hawkins's life:—"He was for several years chairman of the Middlesex justices, and upon presenting an address to the king accepted the usual offer of knighthood (1772). He is the author of a *History of Music* in five volumes in quarto. By assiduous attendance upon Johnson in his last illness he obtained the office of one of his executors,—in consequence of which the booksellers of London employed him to publish an edition of Dr. Johnson's works and to write his life." Sir John Hawkins died on the 21st of May, 1789, and was buried in the cloisters of Westminster Abbey.

HAWKWOOD, Sir John, (*ob.* 1394), an English adventurer who attained great wealth and renown by his services as a condottiere in the Italian wars of the 14th century. According to the accepted if not the authenticated account of his life, he was the son of a tanner of Sible Hedingham in Essex, and was apprenticed to a tailor in London. Pressed into the army, he served with honor in France, obtained the favor of the Black Prince, and received knighthood from King Edward III. On the peace of Bretigny in 1360, he collected a band of men-at-arms, and moved southward to Italy, where we find him assisting the Pisans to defeat the Florentines in 1364. His services were sought in succession by Bernabo Visconti, by the legate of Bologna, and by Pope Gregory XI. In 1375 the Florentines entered into an agreement with him, by which they were to pay him and his companion 130,000 gold florins in three months on condition that he undertook no engagement against them, and in the same year the priors of the arts and the gonfalonier decided to give him a pension of 1200 florins per annum for as long as he should remain in Italy. His subsequent services to Florence as captain-general of the city were numerous and important. Hawkwood married Donnana, an illegitimate daughter of Bernabo Visconti, and one of his own daughters became the wife of

the count of Porzigha. His latter years were spent in a villa in the neighborhood of Florence. On his death in 1394 the republic gave him a public funeral of great magnificence and decreed the erection of a marble monument in the cathedral. This, however, was never executed; but Paolo Uccelli painted his portrait in terre-verte on the inner façade of the building, where it still remains, though damaged by removal from the plaster to canvas. Richard II. of England, probably at the instigation of Hawkwood's sons, who returned to their native country, requested the Florentines to let him remove the good knight's bones, and the Florentine Government signified its consent.

The fullest account of Sir John Hawkwood in English is in Nichol's *Bibliotheca topographica Britannica*, vol. vi. He is one of Richard Johnson's *Nine Worthies of London* (published in *Harleian Misc.*, 1808), and Fuller includes him in his *Worthies of England*. An elaborate life by Manni is given by Tartini in *Rerum Ital. Script.*; and Hawkwood is naturally treated of in Ammirato and the other Florentine chronicles. The compact with the Florentines is printed in *Archivio Storico*, 1868.

HAWTHORN (Anglo-Saxon, *haga-*, *hæg-*, or *hege-thorn*), *Cratægus*, L., a genus of plants of the natural order *Rosaceæ* and sub-order *Pomeæ*. The common hawthorn, termed also whitethorn, quickthorn, quickset, and May tree, May bush, or May (German, *Hagedorn* and *Christdorn*: French, *Aubépine*), *C. Oxyacantha*, L., is a shrub or small tree having a smooth blackish bark; numerous branches, beset usually with thorns, which represent aborted twigs; alternate, long-stalked, obovate-wedge-shaped, 3- or 5-lobed, incised or serrate smooth leaves; flowers sweet-scented, arranged in corymbs, and having caducous bracts, broad, white, pink, or scarlet petals, and 1 to 3 styles; and fruit or "haw" an oblong or nearly globular mealy pome, commonly dark red, but occasionally yellow, black, or even greenish-orange or dull white, and of 1 or 2 cells. The common hawthorn is a native of Europe as far north as 60½° in Sweden, and of North Africa, Western Asia, and Siberia, and has been naturalized in North America and Australia. It thrives best in dry soils, and in height varies from 4 or 5 to 12, 15, or, in exceptional cases, as much as between 20 and 30 feet. There are several varieties of the plant. It may be propagated from seed or from cuttings. The seeds must be from ripe fruit, and if fresh gathered should be freed from pulp by maceration in water. They germinate only in the second year after sowing; in the course of their first year the seedlings attain a height of 6 to 12 inches. In England the hawthorn has been employed for enclosure of land since the Roman occupation, but for ordinary field-hedges it is believed it was not generally in use till about the end of the 17th century. James I. of Scotland, in his *Quair*, ii. 14 (early 15th century), mentions the "hawthorn hedges knet" of Windsor Castle. The first hawthorn hedges in Scotland are said to have been planted by soldiers of Cromwell at Inch Buckling Brae in East Lothian, and Finlarig in Perthshire. On the planting and use of hawthorn fences, see AGRICULTURE, vol. i. pp. 263, 264, 276. The wood of the hawthorn is white in color, with a yellowish tinge. Fresh cut it weighs 68 lb 12 oz. per cubic foot, and dry 57 lb 3 oz. It can seldom be obtained in large portions, and has the disadvantage of being apt to warp; its great hardness, however, renders it valuable for the manufacture of various articles, such as the cogs of mill-wheels, flails and mallets, and handles of hammers. Both green and dry it forms excellent fuel. The bark possesses tanning properties, and in Scotland in past times yielded with ferrous sulphate a black dye for wool. The leaves are eaten by cattle, and have been employed as a substitute for tea. Birds and deer feed upon the haws, which are used in the preparation of a fermented and highly intoxicating liquor, and for their astringency are sometimes resorted to in dysentery. The hawthorn serves as a stock for grafting other trees. As an ornamental feature in landscapes, it is worthy of notice; and the pleasing shelter it affords, and the beauty of its blossoms, have frequently been alluded to by poets. The custom of employing the flowering branches for decorative purposes on the first of May is of very early origin; but since the alteration in the calendar (see vol. iv. p. 601) the tree has rarely been in full bloom in England before the second week of that month. In Cornwall, however, in 1846, the flowers, though scarce, were gathered on the 18th April; and in the Scotch Highlands they may be seen as late as the middle of June. The hawthorn has been regarded as the emblem of hope, and its branches are stated to have been carried by the ancient Greeks in wedding processions, and to have been used by them to deck the altar of Hymen. The supposition that the tree was the source of Christ's crown of thorns gave rise doubtless to the tradition current among the French peasantry that it utters groans and cries on Good Friday, and probably also to the old popular superstition in Great Britain and Ireland that ill-luck attended the uprooting of hawthorns. Branches of the Glastonbury thorn, *C. Oxyacantha*, var. *præcox*, which flowers both in December and in spring, were formerly highly valued in England, on account of the legend that the tree was originally the staff of Joseph of Arimathea (see GLASTONBURY, vol. x. pp. 601, 602). Sub-species of *C. Oxyacantha* are *C. monogyna*, Jacquin, and *C. oxyacanthoides*, Thuill. *C. Pyracantha* and *C. Crus-galli* are among the cultivated species of *Cratægus*.

See Lauder, *Gilpin's For. Scenery*, i., 1834; Loudon, *Arboretum*, ii., 834; Selby, *Hist. of Brit. For. Trees*, 1842; Bentham, *Illustr. Handb. of Brit. Flora*, i., 270, 1865; C. A. Johns, *The Forest Trees of Britain*, p. 83.

NATHANIEL HAWTHORNE.

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THE ancestry of Nathaniel Hawthorne has been described by himself with a graphic power which no biographer may hope to surpass, in a passage which may well form the introduction to every sketch of his life. Writing in "The Scarlet Letter" of his native city of Salem, Massachusetts, and of his forefathers, he said: "It is now nearly two centuries and a quarter since the original Briton, the earliest emigrant of my name, made his appearance in the wild and forest bordered settlement which has since become a city. . . . The figure of that first ancestor, invested by family tradition with dim and dusky grandeur, was present to my boyish imagination as far back as I can remember. It still haunts me, and induces a sort of home feeling with the past. . . . I seem to have a stronger claim to residence here on account of this grave, bearded, sable-cloaked and steeple-crowned progenitor, who came so early, with his Bible and his sword, and trod the unworn street with such a stately port. . . . He was a soldier, legislator, judge. He was a ruler in the Church. He had all the Puritanic traits, both good and evil. He was likewise a bitter persecutor, as witness the Quakers, who relate an incident of his hard severity which will last longer, it is to be feared, than any record of his better deeds, although these were many. His son, too, inherited the persecuting spirit, and made himself so conspicuous in the martyrdom of the witches that their blood may fairly be said to have left a stain upon him. . . . From father to son, for above a hundred years, they followed the sea; a gray-headed shipmaster in each generation retiring from the quarter-deck to the homestead, while a boy of fourteen took the hereditary place before the mast."

The Hawthornes, whose name was also spelled Hathorn, came from Wiltshire, England, and William Hawthorne, the founder of the family in America, reach Boston with Winthrop in 1630. Seven years later he removed from Dorchester to Salem. His son John Hawthorne was the justice who tried the "witches." In the next generation came Joseph Hawthorne, and after him his son Daniel, who was a notable privateer captain in the Revolution. Daniel Hawthorne married Rachel Phelps, and had a son named Nathaniel, who married Elizabeth Clarke Manning, was a sea-captain, and died of yellow fever in the West Indies in 1813. Elizabeth Manning was a descendant of Richard Manning, who came from Dartmouth, England, to Massachusetts in 1679. The only son of Nathaniel and Elizabeth Manning Hawthorne was Nathaniel Hawthorne, the subject of this sketch, who was born at Salem, Massachusetts, on July 4, 1804. He scarcely knew his father, but was the constant companion of his mother,

who was a woman of great beauty and of a peculiarly sensitive disposition, both of which traits were inherited by her son. After the death of the husband and father the family — there were two daughters — removed for a time to Maine and lived in seclusion on a farm on the margin of Sebago Lake, in which lovely and romantic region Nathaniel, then ten years old, literally "ran wild." He was not fond of school, and did little systematic studying, but was a diligent reader of the Bible, Bunyan's works, Shakespeare, and similar books. Returning to Salem he was prepared for college, and in 1821 was entered at Bowdoin. He afterward described himself as an idle, almost lawless student, paying little attention to his books and less to college rules. Nevertheless he got through his course, and was graduated in 1825. Among his classmates were Henry W. Longfellow, George B. Cheever, and John S. C. Abbot, while Franklin Pierce, of the class of 1824, was one of his closest friends. For some years after leaving college he lived the life of a recluse at Salem. He had a small income, just enough to supply his needs, and so was not compelled to work or engage in business. He had no love but a positive dislike for society. So he shut himself up in the old house, with his books and his dreams and fancies, reading, musing, and scribbling, seldom going out of the house save at night, and so secluding himself that he himself said scarcely twenty persons in Salem even knew of his existence.

Most of the tales and other products of his pen at this time were destroyed by him as soon as written, but a number of them were published in magazines and elsewhere. Samuel C. Goodrich published several of them in his literary annuals, and encouraged him to write more. One of his earliest novels was "Fanshawe," which he printed at his own cost, and afterward tried, though vainly, to suppress. Another novel was published by him anonymously, and was permitted by him to fall into oblivion. His first important appearance in literature was made in 1837, when he collected a number of his sketches from Goodrich's annuals and elsewhere and republished them under the now famous title of "Twice Told Tales." Longfellow reviewed the volume favorably in *The North American Review*, pronouncing it the work of a man of genius, and it gradually won general recognition as an auspicious contribution to American literature. Five years later a second edition of it appeared, with a number of new tales collected from *The Democratic Review* and other magazines. Meantime Hawthorne was wooed out of his seclusion. He became editor of Goodrich's *American Magazine*, and also wrote for Goodrich a "Universal History" which formed the beginning of "Peter Parley's" famous series of popular histories. In 1838 George Bancroft, who was then Collector of Customs at the Port of Boston, secured for Hawthorne an appointment as a weigher in the Boston customhouse. The place was accepted and, strange to say, proved congenial and enjoyable to the shy, poetic recluse. The seafaring spirit of his ancestors had so descended upon him that he loved the contact with the ships and association with sailors. He showed himself, too, a sufficiently practical man of affairs to transact acceptably the business of the office. There he remained until the spring of 1841, when, at the accession of President Harrison, a Whig, he with the other Democratic office holders were retired to private life. Forthwith he joined the famous *coterie* of intellectual men and women, mostly from Boston, who founded the community known as "Brook Farm" at West Roxbury, Massachusetts. In that place, with its strange mixture of agriculture and philosophy, he remained only a few months, and then he returned to Boston, where he lived until 1843. In 1842 he was married to Miss Sophia Amelia Peabody, of Salem, to whom he had been engaged for several years — a woman, he wrote, "lent from Heaven to show the possibilities of the human soul." With her he went to Concord, Mass., in 1843, and established himself in "the Old Manse." This was a house which had been built for the minister of the village church, from the windows of which the Rev. William Emerson (grandfather of Ralph Waldo Emerson) had watched the battle of Concord, and which had never before been occupied by a layman. There Hawthorne led a happy life, as he himself has told us in his "Mosses from an Old Manse" — "wild, free days on the Assabeth, indulging fantastic speculations beside our fire of fallen boughs, with Ellery Channing, or talking with Thoreau about pine trees and Indian relics in his hermitage at Walden." The "Mosses" were written there, in the study in which Emerson wrote his "Nature."

There Hawthorne remained for three years. Then Polk, a Democrat, became President, George Bancroft became Secretary of the Navy, and Hawthorne was recalled to the customs service as Surveyor of the Port of Salem. Thither he went with his family, and for three years performed the duties of his place in the musty old Salem customhouse; when, upon the return of the Whigs to power, he was once more removed from office. Then he went up into the Berkshire Hills, occupied a cottage in the woods at Lenox, and produced his masterpiece and one of the glories of American literature in "The Scarlet Letter." This work had been begun at Salem, its opening chapter containing a notable description of the old customhouse, but it was finished at Lenox and was published in 1850. It is not too much to say that its appearance marked an epoch in American literature. Its success was instantaneous, in England as well as in America, and the passage of more than half a century has only served strongly to confirm the favorable opinions at first expressed of it. Its materials are commonplace, its theme is sombre and repellant, its narrative is a chain of horrors, yet the perfect art of it stamps it forever as an indisputable classic. The next year he brought out "The House of the Seven Gables," also a masterpiece, and also marked with gloom and horror. A third work was produced at Lenox, "The Blithedale Romance," published in 1852; in which, in a lighter vein than before, and with fine touches of humor, he made free with his experiences at Brook Farm, "certainly," he said, "the most romantic episode of his own life." This charming work may be accepted as a lifelike portrayal of the spirit and general conduct of affairs at Brook Farm, though we are assured that not one of the characters is in any sense a portrait. "The self-conceited philanthropist; the high-spirited woman bruising herself against the narrow limitations of her sex; the weakly maiden whose tremulous nerves endow her with sybilline attributes; the minor poet, beginning life with strenuous aspirations; all these might have been looked for at Brook Farm, but never made their appearance there."

The final removal of home was made in 1852, when Hawthorne left Lenox and established himself permanently at "The Wayside," at Concord. In that year he wrote a "campaign life" of his old friend Franklin Pierce, who was a candidate for the Presidency. Hawthorne earnestly desired his friend's success, but resolved that if Pierce did become President he would not accept any official favors from him, lest it should seem that they were bestowed for friendship's sake and not for merit or for the public good. Happily he was prevailed upon to renounce this vow, and to accept, in 1853, the appointment as Consul at Liverpool, one of the most lucrative places in the public service. He held that office until the end of Pierce's administration, in 1857, and then spent several years in France, Switzerland, and Italy, where he gleaned rich material for further literary work. He returned to Concord in 1860, and lived in retirement there, though taking an earnest interest in public affairs. At the outbreak of the Civil War he gave his hearty support to the Union, regretting that he himself was too old and his son was too young to shoulder a musket and go to the front. His health began to fail, and though he continued to write it was with much effort. In 1862 he visited Washington, but was much depressed by the political and military situation as he saw it there, which almost made him despair of the Union. In 1864 he started southward with a friend, but turned back at Philadelphia because of the sudden death of his companion. From Concord, in company with Franklin Pierce, he set out in leisurely fashion for the

White Mountains, and got as far as Plymouth, N. H., where, during the night of May 18, 1864, he quietly died in his sleep. His funeral was held at Concord, Mass., on May 23, the services being conducted by James Freeman Clarke, who had performed his wedding ceremony, and the followers of the bier including Emerson, Holmes, Lowell, Whittier, Longfellow, and Pierce. His wife survived him until 1871.

In addition to the works already named Hawthorne wrote "The Wonder Book" for children (1851), "True Stories from History and Biography" (1851), "The Snow Image" (1852), "Tanglewood Tales," a sequel to "The Wonder Book" (1853), "French and Italian Note Books" (1859), "The Romance of Monte Beni" (1859), "The Marble Faun," the most elaborate and one of the greatest of all his works (1860), and "Our Old Home" (1860). He edited in 1845 the "Journal of an African Cruiser" from the manuscript of his college classmate Lieutenant Horatio Bridge, and also "Papers of an Old Dartmoor Prisoner." At his death he left an unfinished manuscript, which was published in 1864 as "The Dolliver Romance," and afterward appeared in a different form as "Dr. Grimshawe's Secret" and also as "Septimius Felton," the one being edited and completed by his daughter and the other by his son. His works have run through many editions, and their popularity increases year by year, while the critical esteem in which they are held is constantly being enhanced. As a master of style, Hawthorne is unsurpassed among American writers of fiction, if indeed he has been surpassed by any in any land or time. His vocabulary was not extraordinarily copious, but he had the rare gift of being able to use it with unerring accuracy and with unfailing felicity. A peculiarity of his writing was that he seldom quoted even a phrase from another author, contemporary or classic. It may also be observed that he himself is little quoted, and indeed is little quotable. There are innumerable passages which may be quoted with pleasure and profit, but phrases and single sentences which may thus be used are few. His books are complete and harmonious works of art, from which epigrammatic bits are no more to be quoted than snips of color are to be taken from a painting by Raphael or Turner. His influence upon American literature has been great and wholly good. No such thing as a "Hawthorne school" has been possible, imitation of his style being out of the question. But his style has served as an inspiration to many, and his works have served to dignify American literature, to prove the worth of native American themes, and to refute the sneer implied in the question — asked while Hawthorne was yet an undergraduate — "Who reads an American book?" W. Fletcher Johnson.

June, 1904.

HAXTHAUSEN, August Franz Ludwig Maria von (1792–1867), baron of Haxthausen-Abbenburg, was born on his father's estate near Paderborn in Westphalia, February 3, 1792. Educated at first at home, he proceeded in 1811 to the school of mining at Klausthal in the Harz, and after serving in the Hanoverian army in 1813–15, entered the university of Göttingen. On finishing his course there in 1818, he occupied himself with the management of his estates, and the study of the land laws and the legal rights of the peasantry. The result of his studies appeared in 1829 in *Die Agrarverfassung und ihre Conflicte*, a work which attracted much attention, and procured for him an official commission to investigate and report upon the land laws of the Prussian provinces with a view to a new code. After nine years spent in laborious collation, he published in 1839 an exhaustive treatise, *Die ländliche Verfassung in den Provinzen Ost- und West-Preussen*. In 1843–44, at the request of the emperor Nicholas, he undertook a similar labor for Russia. The fruits of his investigations in that country are contained in *Studien über die inneren Zustände, das Volksleben, und insbesondere die ländlichen Einrichtungen Russlands* (3 vols. 1847–52), in *Die Kriegsmacht Russlands* (1852), and in *Die ländliche Verfassung Russlands* (1866). In 1836 he received the honorary title of privy state-councillor, and afterwards of hereditary chamberlain of the principality of Paderborn. In 1847–48 he sat as a member of the combined diet at Berlin, and afterwards of the first Prussian chamber. After travelling through a large part of Europe, Baron Haxthausen retired to his estate. He died at Hanover, January 1, 1867.

Besides the foregoing works, Haxthausen was the author of *The Algerian Slave*, a novel; and *Transcaucasia, Sketches of the Nations and Races between the Black Sea and the Caspian*, in English, 1854, German, 1856; in 1864 he edited *Das Constitutionelle Princip*, a collection of political writings by various authors.

HAYDN, Joseph (1732–1809), one of the most celebrated composers of the 18th century, was born at Rohrau, a village in Lower Austria, March 31, 1732. Schindler relates that when Beethoven, not long before his death, received a picture of Haydn's birth-place, he exclaimed—"How wonderful that so great a man should have been born in a peasant's cottage." This cottage, which is still standing, had been built by Haydn's father, a worthy wheelwright, of whose twelve children the composer was the second. At an early age the child evinced so decided a talent for music that one Johann Mathias Frankh, a distant relation of the family, proposed to undertake his musical and general education, and for that purpose invited him to Hainburg, a neighboring town where Frankh kept a school. To Hainburg accordingly young Haydn went in 1738, and there he received instruction in the elementary knowledge of his art, including a practical acquaintance with most instruments, at the hands of the musical schoolmaster. Having developed an agreeable soprano voice, young Haydn was by the intercession of the dean of Hainburg promoted to a post amongst the choir boys of St Stephen's cathedral, Vienna, where he remained from 1740–50, doing duty in the church services, and at the same time enlarging his musical knowledge and experience. His artistic education was, however, all but exclusively practical, and it is said that he received only two theoretical lessons from Reuter the chapel-master. As a composer, therefore, Haydn was in every sense self-taught. Of his zeal in acquiring information he was in the habit of talking with pride in later years, and several works of sacred music were the first fruit of his early studies. In 1749 or 1750 his beautiful boyish voice changed, and he lost his position accordingly. Being now thrown on his own resources, he had to undergo various forms of musical drudgery, such as giving lessons (at the moderate stipend of two florins per month) and even playing in the orchestra at dances and the like. His condition was somewhat improved by his acquaintance with Metastasio, the celebrated operatic poet, in fact the Scribe of the 18th century, who introduced him to Señor Martinez, a Spaniard living in Vienna, whose daughter Haydn instructed for several years. It was through Metastasio also that Haydn came into contact with Porpora the composer, best known as the singing-master of the great Farinelli. For a considerable time Haydn remained in constant intercourse with him, acting as his accompanist, and occasionally it is said as his valet. In return he obtained a perfect acquaintance with Porpora's method, besides his knowledge of the Italian language, both invaluable to a composer in those days. The works of Emmanuel Bach, son of the great Sebastian, at the same time became his model for chamber music. Fux's excellent work *Gradus ad Parnassum* was his guide in his studies of counterpoint. A mass in F, and a farce *Der neue krumme Teufel*, both written in or about 1752, were Haydn's first important attempts at composition. The former is still in existence, but of the latter the libretto by Kurz only remains. It was produced early in 1752, and seems to have met with considerable success. Haydn's acquaintance with Gluck also dates from this period. An important event in Haydn's life was his acquaintance with Baron Fürnberg, an accomplished amateur, for whose private concerts he wrote his first string quartet, a form of composition in which he earned some of his greatest and most permanent triumphs. It is in the key of B flat, and was followed in rapid succession by seventeen other works of the same class, written during the years 1755 and 1756. To his new protector Haydn also owed his still more important acquaintance with Count Ferdinand Morzin. Count Morzin in 1759 appointed him conductor of his small but excellent band. The opportunities of hearing his own works performed by competent musicians Haydn did not neglect, and his first symphony in D belongs to the year 1759. Soon afterwards Count Morzin was compelled to dissolve his band, but Haydn's position was by this time sufficiently established, and very soon afterwards he found employment as second chapel-master to Prince Paul Esterhazy, one of the richest Austrian nobles, whose love of art was as great as his wealth. The Esterhazy family have been amongst the foremost patrons of music in Vienna from the days of Haydn to those of Beethoven and Schubert. Prince Paul died in 1762, and left his title and fortune to his brother Nicholas, surnamed the Magnificent. He immediately enlarged his orchestra, and also increased the salaries of its members, including that of Haydn (from 400 to 600 florins), and on the death of his colleague Werner, a scholarly but dry musician, appointed him first conductor. This position, or at least its title and emoluments, Haydn retained till his death, and his attachment to the Esterhazy family remained unchanged by his

subsequent fame and fortunes. The events just referred to determined Haydn's career for the next twenty-eight years. During this period he was in the active service of his protector, residing at Esterház, the splendid country seat of the family, described as a second Versailles, or in Vienna, conducting the orchestra of the prince, and writing for his concerts and theatre a number of works, including symphonies, cassationes, quartets, sonatas, and numerous vocal compositions, including several operas, none of which, however, had any permanent success. Thus the opera *La vera Constanza*, written for the court theatre of Vienna in 1776, was withdrawn by the composer owing to intrigues against him, it is said; and we are not told that it met with a much better fate on its revival fourteen years later. Another dramatic work, *L'isola disabitata* (1779), procured for the composer the membership of the Accademia Filarmonica at Modena, and a gold snuff-box from the king of Spain. But with its companions it has not escaped oblivion. The truth is that Haydn was without the true dramatic spirit, and of this he was himself well aware. According to his own confession his operas were fitted only for the small stage at Esterház; in a large theatre, and before a miscellaneous audience, they lost their effect. The scores of most of the operas are preserved in the archives of Eisenstadt, another seat of the Esterhazy family. Of his life during this period little need be said. It was eventless and to a certain extent monotonous, but free from care and exclusively devoted to art. His own words, quoted by Herr Pohl, sum up all that it is necessary to relate. "My prince was always satisfied with my work; I not only had the encouragement of constant approval, but as conductor of an orchestra I could make experiments, observe what produced an effect and what weakened it, and was thus in a position to improve, alter, make additions or omissions, and be as bold as I pleased. I was cut off from the world; there was no one to confuse or torment me, and I was forced to become original." The only person that could have wished to "confuse or torment" the harmless composer was fortunately kept at a distance by the strict order of the prince's household, that none of his musicians was to be accompanied by his wife. Haydn at an early age became attached to the daughter of a hairdresser, Keller by name, and after her death was persuaded to marry her sister three years older than himself. The marriage was an unhappy one, and the pair separated soon after their union, Haydn's inflammable heart subsequently causing him more or less serious trouble on more than one occasion. In the mean time the composer's fame had begun to spread from an early period of his career. As early as 1766 a journal speaks of him as the "favorite of the nation," and foreign countries were not slow in acknowledging his merits. Thus one of his works, *The Seven Words of our Saviour on the Cross*, a series of orchestral interludes for the church service on Good Friday, was written by special invitation for the cathedral of Cadiz. In Paris his works were performed with immense success at the Concert Spirituel, and a single English firm bought the copyright of no less than 129 of his works, including 82 symphonies. The appreciation of Haydn's work in England led to important results in his later years. Several pressing invitations to visit that country had been declined by the composer on account of his services being required at Esterház. But when in 1790 Prince Nicholas died, and his successor dissolved the orchestra, allowing Haydn a considerable pension, the latter was at last at liberty to accept a munificent offer from Salomon, the violinist and entrepreneur, in whose company he started for London, where Salomon occupied a leading position in the musical world. They left Vienna in December, 1790, and travelled by way of Bonn, where Salomon had been born. There, accordingly, a halt was made, and Haydn was received by the elector with every honor due to his fame. The amusing description of a dinner given during his stay at Bonn may be read in Thayer's biography of Beethoven, who at that time was a member of the electoral chapel, and not unlikely made on this occasion Haydn's acquaintance. On the latter's return journey the young man submitted a cantata to the celebrated composer, whom he soon afterwards followed to Vienna to become his pupil. It is well known that the relations between the great master and his greater pupil were not altogether what might have been desired. Beethoven's genius was of too individual a type to bear the impress of a nature so different as Haydn's, and the latter may not always have taken sufficient trouble to enter into the ways of his wilful pupil. Certain it is that, at one time of his career, Beethoven delighted in speaking slightingly of "Papa Haydn," and, for instance, refused to call himself Haydn's pupil, because, as he bluntly said, he never learnt anything under his tuition. He even went so far as to suspect Haydn of wilfully trying to keep him back in his studies. It was only in his later years that this animosity gave way to the more genial appreciation of his great predecessor, an expression of which is quoted at the beginning of this notice.

Haydn's visit to London was a succession of triumphs Dr. Burney welcomed him with a laudatory poem; the various musical societies of the metropolis vied for his presence, and on July 8, 1791, he was created doctor of music by the university of Oxford. At court also he was received with every distinction, and the aristocracy followed the royal example. Neither were more substantial rewards wanting. Haydn's engagement with Salomon was to write and conduct at the concerts in the Hanover Square Rooms six symphonies, and the success of these may be judged from the fact that at Haydn's benefit concert, for which £200 had been guaranteed to him, the receipts rose to £350. He also appeared at other concerts (one given by himself at Hanover Square Rooms, where amongst other works the *Seven Words* already referred to was performed), always with equal success. The same events were repeated in the following year, when the Salomon concerts began in February, and concluded with an extra concert in June. The symphonies known as the "Salomon Set," comprising some of Haydn's finest instrumental works, are the permanent record of the connection of the two artists. In 1792 Haydn also went to hear the charity children at St. Paul's, whose singing produced on him as deep an impression as it did on Berlioz many years later. "I was more touched by this innocent and reverent music," he wrote in his diary, "than by any I ever heard in my life." Haydn left London in June, 1792, but only to return in January, 1794. In addition to his earlier works six new symphonies were played at the concerts of Salomon, which in the following year were given at the King's Concert-room and terminated on June 1, 1795, when Haydn appeared for the last time in England. In addition to valuable presents from royalty and other persons, he realized £1200 by his second English visit, from which he returned to Vienna in the autumn of 1795, to resume once more his functions in the newly organized chapel of Prince Esterhazy. He was now well stricken in years, and might have rested on his laurels. But so far from this being the case, the two works on which—apart from his symphonies and sonatas—his immortality must mainly rest, belong to this last epoch of his life. These were the oratorio *The Creation*, and the cantata *The Seasons*. They were both written to German translations of English libretti, the former being compiled from *Paradise Lost*, the latter from Thomson's *Seasons*. *The Creation* was first performed in public on March 19, 1799, when its success was as immediate as it has since proved permanent. *The Seasons* was begun soon after the completion of *The Creation*, and finished in very little time. No one, delighted by the charm and spontaneity of its melodies, would suspect it to be the work of a feeble old man. Such, however, Haydn had now become. He wrote little after *The Seasons*, and his public appearances were few and far between. His old age was surrounded by the love of his friends and the esteem of the musical world, but his failing health did not admit of much active enjoyment. He was seen in public for the last time at a performance of *The Creation* in 1808. But his own music made so overpowering an impression on him that he had to be carried out of the hall. He died on May 31, 1809, during the occupation of Vienna by Napoleon's army, and many French officers followed his body to the grave.

Haydn's compositions comprise almost every form of vocal and instrumental music. Of his dramatic works the operas are of infinitely less importance than *The Creation* and *The Seasons*. In the former there are points of grand and truly epical conception, surpassed by few masters except Handel, and the idyllic charm of the latter is as fresh to-day as it was eighty years ago. At the same time the great importance of Haydn in the history of music lies elsewhere. It was as an instrumental composer that he opened a new epoch of musical development. That amongst his 125 orchestral symphonies there are many extremely slight efforts is a matter of course. Even his finest symphonies, such as the celebrated *Surprise*, or the

one in E flat surnamed in Germany "mit dem Paukenwirbel," on account of the characteristic drum-roll occurring in it, are pigmies if compared with Beethoven's colossal efforts. At the same time it is true that without Haydn's modest substruction Beethoven's mighty edifice would have been impossible. It was Haydn who first fixed the form of the symphony and gave it consistency of development. The lucid and harmonious treatment of his themes and the symmetrical structure of his symphonic movements remain still unsurpassed. And the same may be said in almost the same words of his string-quartets, of which he wrote no less than eighty-three. It is by such works as these that Haydn has earned the name of father of instrumental music, generally and justly applied to him. At the same time it cannot be denied that there is in his works a certain want of intensity and depth. He avoids the high places of thought and passion; his path lies mostly in the smiling plains of humor and agreeable sentiment. In the former especially he excels, and it ought to be noted that his humor is of that peculiarly Viennese type which is as harmless as it is charming, and to the genial influence of which even such serious composers as Beethoven and Brahms have had to submit. Some of Haydn's minuets especially seem to spring immediately from the consciousness of the people. How much he was at one with his nation is further proved by such a song as his "Gott erhalte Franz den Kaiser," which has become the Austrian national hymn, and is one of the rare instances in which a genuine volkslied can be traced to a celebrated composer,—for generally the songs of the people are produced by the people. To sum up, Haydn's place in the history of his art will remain unassailed by all the changes musical taste has undergone since his time, or may still undergo. His melodies, though simple, are genuinely inspired, and will never lose their charm; and his workmanship will remain an invaluable model of clearness and symmetry. Haydn's life has been written by many pens and in many languages, Stendhal, the celebrated novelist, being amongst his French biographers. But all these earlier attempts have been thrown into the shade by the excellent works of Herr C. F. Pohl (*Mozart and Haydn in London*, 1867; *Joseph Haydn*, vol. i., 1875; and the article "Haydn" in Grove's *Dictionary of Music and Musicians*), which are full of accurate and comprehensive research. To Herr Pohl all students of Haydn's life must confess themselves deeply indebted.

Two of Haydn's brothers acquired a certain amount of celebrity. JOHN MICHAEL HAYDN, born at Rohrau, September 14, 1737, and like his brother a choir-boy at St. Stephen's cathedral, became a prolific and able composer of masses and all kinds of church music. He lived during the greater part of his life at Salzburg, and his name is frequently mentioned in the biography of Mozart. Of his numerous compositions few have been printed. A mass in D is perhaps his masterpiece. He died August 10, 1806. The youngest brother, JOHANN HAYDN (born December 23, 1743, died May 20, 1805), had some reputation as a vocalist, and became, most probably by his brother's intercession, a singer in Prince Esterhazy's chapel. (F. H.)

HAYDON, BENJAMIN ROBERT (1786–1846), historical painter and writer, was born at Plymouth, January 26, 1786. His mother was the daughter of the Rev. Benjamin Cobley, rector of Dodbrook, Devon, whose son, General Sir Thomas Cobley, signalized himself in the Russian service at the siege of Ismail. His father, a prosperous printer, stationer, and publisher, was a man of literary taste, and was well known and esteemed amongst all classes in Plymouth. Haydon, an only son, at an early date gave evidence of his taste for study, which was carefully fostered and promoted by his mother. At the age of six he was placed in Plymouth grammar school, and at twelve in Plympton St. Mary school. He completed his education in this institution, where Sir Joshua Reynolds also had acquired all the scholastic training he ever received. On the ceiling of the school-room was a sketch by Reynolds in burnt cork, which it used to be Haydon's delight to sit and contemplate. Whilst at school he had some thought of adopting the medical profession, but he was so shocked at the sight of an operation that he gave up the idea. A perusal of Albinus, however, inspired him with a love for anatomy; and Reynolds's discourses aroused within him a smouldering taste for painting, which from childhood had been the absorbing idea of his mind. Sanguine of success, full of energy and vigor, he started from the parental roof, May 14, 1804, for London, and entered his name as a student of the Royal Academy. He began and prosecuted his studies with such unwearied ardor that Fuseli wondered when he ever found time to eat. At the age of twenty-one (1807) Haydon exhibited, for the first time, at the Royal Academy, The Repose in Egypt, which was bought by Mr. Thomas Hope the year after. This was a good start for the young artist, who shortly received a commission from Lord Mulgrave and an introduction to Sir George Beaumont. In 1809 he finished his well-known picture of Dentatus, which, though it brought him a great increase of fame, involved him in a life-long quarrel with the Royal Academy, whose committee had hung the picture in a small side-room instead of the great hall. In 1810 his difficulties began through the stoppage of an allowance of £200 a year he had received from his father. His disappointment was embittered by the controversies in which he now became involved with Sir George Beaumont, for whom he had painted his famous picture of Macbeth, and Mr. Payne Knight, who had denied the beauties as well as the value of the Elgin Marbles. The Judgment of Solomon, his next production, gained him £700, besides £100 voted to him by the directors of the British Institution, and the freedom of the borough of Plymouth. To recruit his health and escape for a time from the cares of London life, Haydon joined his intimate friend Wilkie in a trip to Paris; he studied at the Louvre; and on his return to England produced his Christ's Entry into Jerusalem, which afterwards formed the nucleus for the American Gallery of Painting, which was erected by his cousin John Havilland of Philadelphia. Whilst painting Lazarus his pecuniary difficulties increased, and for the first time he was arrested but not imprisoned, the sheriff-officer taking his word for his appearance. Amidst all these harassing cares he married in October, 1821, a beautiful young widow, Mrs. Hyman, to whom he was devotedly attached. In 1823 Haydon was lodged in the King's Bench, where he received consoling letters from the first men of the day. Whilst a prisoner he drew up a petition to parliament in favor of the appointment of "a committee to inquire into the state of encouragement of historical painting," which was presented by Mr. Brougham. He also, during a second imprisonment in 1827, produced the picture of the Mock Election, the idea of which had been suggested by an incident that happened in the prison. The king (George IV.) gave him £500 for this work. Among Haydon's other pictures were—1829, Eucles, and Punch; 1831, Napoleon at St. Helena, for Sir Robert Peel; Xenophon, on his Retreat with the "Ten Thousand," first seeing the Sea; and Waiting for the *Times*, purchased by the marquis of Stafford; 1832, Falstaff, and Achilles playing the Lyre. In 1834 he completed the Reform Banquet, for Lord Grey—this painting contained 197 portraits; in 1843, Curtius Leaping into the Gulf, and Uriel and Satan. When the competition took place at Westminster Hall, Haydon sent two cartoons, The Curse of Adam, and Edward the Black Prince, but had not the good fortune to gain a prize for either. He then painted The Banishment of Aristides, which was exhibited with other productions under the same roof where Tom Thumb was then making his début in London. The exhibition was unsuccessful; and the artist's difficulties increased to such an extent that, whilst employed on his last grand effort, Alfred and the Trial by Jury, overcome by debt, disappointment, and ingratitude, he wrote "Stretch me no longer on this rough world," and put an end to his existence with a pistol-shot, June 22, 1846, in the sixty-first year of his age. He left a widow and three children (various others had died), who, by the generosity of their father's friends, were rescued from their pecuniary difficulties and comfortably provided for; amongst the foremost of these friends were Sir Robert Peel, Count D'Orsay, Mr. Justice Talfourd, and Lord Carlisle.

Haydon began his first lecture on painting and design in 1835, and afterwards visited all the principal towns in England and Scotland. His delivery was energetic and imposing, his language powerful, flowing, and apt, and replete with wit and humor; and to look at the lecturer, excited by his subject, one could scarcely fancy him a man overwhelmed with difficulties and anxieties. The height of Haydon's ambition was to behold the first buildings of his country adorned with historical representations of her glory. He lived to see the acknowledgment of his principles by Government in the establishment

of schools of design, and the embellishment of the new houses of parliament; but in the competition of artists for the carrying out of this object, the commissioners (amongst whom was one of his former pupils) considered, or affected to consider, that he had failed. Haydon was well versed in all points of his profession; and his *Lectures*, which were published shortly after their delivery, showed that he was as bold a writer as painter. It may be mentioned in this connection that he was the author of the long and elaborate article, "Painting," in the 7th edition of the *Encyclopædia Britannica*.

To form a correct estimate of Haydon it is necessary to read his autobiography. This is one of the most natural books ever written, full of various and abundant power, and fascinating to the reader. The author seems to have daguerreotyped his feelings and sentiments without restraint as they rose in his mind, and his portrait stands in these volumes limned to the life by his own hand. His love for his art was both a passion and a principle. He found patrons difficult to manage; and, not having the tact to lead them gently, he tried to drive them fiercely. He failed, abused patrons and patronage, and intermingled talk of the noblest independence with acts not always dignified. He was self-willed to perversity, but his perseverance was such as is seldom associated with so much vehemence and passion. With a large fund of genuine self-reliance he combined a considerable measure of vanity. To the last he believed in his own powers and in the ultimate triumph of art. In taste he was deficient, at least as concerned himself. Hence the tone of self-assertion which he assumed in his advertisements, catalogues, and other appeals to the public. He proclaimed himself the apostle and martyr of high art, and believed himself to have on that account a claim on the sympathy and support of the nation. It must be confessed that he often tested severely those whom he called his friends. Every reader of his autobiography will be struck at the frequency and fervor of the short prayers interspersed throughout the work. Haydon had an overwhelming sense of a personal, overruling, and merciful providence, which influenced his relations with his family, and to some extent with the world. His conduct as a husband and father entitles him to the utmost sympathy. In art his powers and attainments were undoubtedly very great, although his actual performances mostly fall short of the faculty which was manifestly within him; his general range and force of mind were also most remarkable, and would have qualified him to shine in almost any path of intellectual exertion or of practical work. His eager and combative character was partly his enemy; but he had other enemies actuated by motives as unworthy as his own were always high-pitched and on abstract grounds laudable. Of his three great works—the Solomon, the Entry into Jerusalem, and the Lazarus—the second has generally been regarded as the finest. The Solomon is also a very admirable production, showing his executive power at its loftiest, and of itself enough to place Haydon at the head of British historical painting in his own time. The Lazarus, now in the National Gallery, is a more unequal performance, and in various respects open to criticism and censure; yet the head of Lazarus is so majestic and impressive that, if its author had done nothing else, we must still pronounce him a potent pictorial genius.

The chief authorities for the life of Haydon are *Life of B. R. Haydon, from his Autobiography and Journals*, edited and compiled by Tom Taylor, 3 vols., 1853; and *B. R. Haydon's Correspondence and Table Talk*, with a memoir by his son, F. W. Haydon, 2 vols., 1876. (W. M. R.)

HAY FEVER, Hay Asthma, or Summer Catarrh, a term applied to a catarrhal affection of the respiratory mucous membrane occurring in some individuals during the hay season, and generally believed to be due to the inhalation of the emanations from the spring grass (*Anthoxanthum odoratum*). It is an ailment of comparatively rare occurrence. The symptoms are those commonly experienced in the case of a severe cold or influenza, consisting of headache, violent sneezing, and watery discharge from the nostrils and eyes, together with dry hard cough, and occasionally severe asthmatic paroxysms. The attack usually runs a course of from two to six weeks, unless cut short by appropriate treatment, to which the complaint is in a considerable measure amenable. There is generally an annual recurrence of the disorder in those liable to it if they are exposed to its exciting cause, namely, the presence of hay. Symptoms of a similar character are produced in certain persons by the aroma of various flowers, by ipecacuan, and by the odor from cats, dogs, and rabbits. All such cases are examples of idiosyncrasy, and the individual is in general permanently susceptible to the influence of the excitant. In not a few instances an hereditary liability is traceable. The most effectual method of treatment in hay fever is to avoid the exciting cause, namely, the neighborhood of grass fields, during the particular season. Removal to the seaside often succeeds in putting an end to an attack, and many persons who are liable to the complaint make such a change annually before its expected onset, and thus escape. For those who are unable to accomplish this, and must remain exposed to the noxious emanation, the use of a respirator is recommended. Of medicinal agents for affording relief during an attack, the usual remedies for asthma may be advantageously resorted to (see Asthma), while the use of the nasal douche with a weak solution of quinine and the employment of creasote or carbolic acid inhalations have been suggested.

HAYLEY, William (1745–1820), the friend and biographer of Cowper, and grandson of William Hayley, dean of Chichester, was born in that city on the 9th November, 1745. On account of mismanagement during a fever which he had while in a boarding school at Kingston, he was reduced to such prostration that the preservation of his life appeared to present only the promise of hopeless lameness and idiocy, but by careful nursing his health was gradually completely restored, and after some years' private tuition he pursued his studies at Eton and at Trinity College, Cambridge. In 1766 he procured a certificate of admission to the Middle Temple, London, but a short trial of legal studies was sufficient to dissipate the unexperienced preference which he had cherished for the profession of law. After his marriage in 1769 he stayed for some years chiefly in London, but in 1774 he retired to his patrimonial estate of Eartham in Sussex, resolved to spend the remainder of his days in rural quiet, with only such an amount of literary activity as might defy ennui and give a zest to life. Hayley made more than one attempt to succeed as a dramatic author, but first won fame by his poetical *Essays on Painting, History, and Epic Poetry*, and by his poem the *Triumph of Temper*. The success of these poems was partly attributable to the general dearth of poetic talent at the time, but they had also certain external qualities fitted to secure for them at least a temporary popularity; and his notes to his poetical essays also displayed very extensive reading, and exerted considerable influence in directing attention in England to the literature of Italy and Spain. On the death of Warton, Hayley was offered the laureateship, but declined it. In 1792 he made the acquaintance of the poet Cowper; and this acquaintance ripened into a friendship which remained unbroken until Cowper's death in 1800. This bereavement was separated by only a week from that caused by the death of Hayley's natural son Thomas Alphonso, who had given great promise of excellence as a sculptor; and, shrinking from the associations now connected with Eartham, Hayley retired to what he called a "marine hermitage," which he had built at Feltham, and there resided till his death, November 20, 1820. Besides the *Life of Cowper*, published in 1803, Hayley was the author of a number of works in prose, which were not, however, so successful as his early poetical productions. Indeed the estimation in which he was held even during his lifetime depended perhaps more on his acquirements and widely-cultivated tastes and his position in society than on his achievements in literature. The *Memoirs of Hayley*, 2 vols., for writing which, to be published posthumously, he received a considerable allowance during the last twelve years of his life, appeared in 1823.

HAYNE, Robert Young (1791–1840), American statesman, was born in St. Paul's parish, Colleton district, South Carolina, on November 10, 1791. He studied law at Charleston, S. C., and in his twenty-first year was admitted to the bar there, but in the same year (1812) served for a short time as a soldier in the war with Great Britain. Returning to practice in Charleston, Hayne was elected a member of the State legislature in 1814, and four years later became speaker. Shortly afterwards he accepted the post of attorney-general for his native State, though he declined the same office for the United States. On being elected a senator of the United States, Hayne at once showed himself

an active foe to protective legislation, and vigorously combated the tariffs of 1824 and 1828. A bill having been passed in 1832 removing the duty from those imports only which were not in competition with home manufactures, the State of South Carolina passed an ordinance nullifying the bill, on the ground that it was unconstitutional. President Jackson denounced this proceeding, and South Carolina, appointing Hayne governor, was preparing to defend its position by arms, when Congress made the desired change in the tariff, and South Carolina repealed its act. Hayne, on retiring from the governorship in 1834, was elected mayor of Charleston, and continued to take an active interest in public affairs till his death at Asheville, North Carolina, September 24, 1840.[1] See *Life and Speeches of R. Y. Hayne*, 1845.

HAYTER, Sir George (1789–1871), principal painter in ordinary to the queen, was the son of a popular drawing-master and teacher of perspective who published a well-known introduction to perspective and other works. The son was born in London, and in his early youth went to sea. He afterwards studied in the Royal Academy, became a miniature-painter, and was appointed in 1815 miniature-painter to the Princess Charlotte. He passed some years in Italy, more especially in Rome, returned to London towards 1826, resumed portrait-painting, now chiefly in oil-color, executed many likenesses of the royal family, and attained such a reputation for finish and refinement in his work that he received the appointment of principal painter, and teacher of drawing to the princesses. In 1842 he was knighted. He painted various works on a large scale of a public and semi-historical character, but essentially works of portraiture; such as The Trial of Queen Caroline (189 likenesses), The Meeting of the First Reformed Parliament, now in the National Portrait Gallery, Queen Victoria taking the Coronation-oath (accounted his finest production), The Marriage of the Queen, and the Trial of Lord William Russell. The artistic merits of Hayter's works are not, however, such as to preserve to him with posterity an amount of *prestige* corresponding to that which court patronage procured him. He is not to be confounded with a contemporary artist, John Hayter, who produced illustrations for the *Book of Beauty*, etc.

HAYTI.

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HAYTI, also known as Haïti, and Santo or San Domingo, and named by Columbus Hispaniola, Espagnola, or Little Spain, is after Cuba, the largest of the West Indian islands, and historically and geographically one of the most interesting and important of the entire archipelago. It lies between the Caribbean Sea and the Atlantic Ocean, between the parallels of 17° 37′ and 20° north latitude, and the meridians of 68° 20′ and 74° 30′ longitude west from Greenwich. Its extreme length from east to west is a little more than 400 miles, and its width from north to south varies from 160 down to 17 miles, the former being the distance from Point Isabella to Cape Beate, and the latter the width of the long western peninsula. The perimeter of the island measures about 900 miles. Its area is 29,830 square miles. It lies about 1,400 miles south of New York, 450 miles from the Florida coast, 50 miles from Cuba, from which it is separated by the Windward Passage, 80 miles from Porto Rico, from which it is divided by the Mona Passage, 360 miles from the northern extremity of South America, Cape Gallinas, and 700 miles from Colon, on the Isthmus of Panama. It occupies the centre of the great chain of West Indian islands which stretches from near the mouth of the Orinoco River almost to the coast of Yucatan. Lying as it does between two of the chief passageways between the Atlantic Ocean and the Caribbean Sea, its strategic importance, both in commerce and in war, is very great.

Topography.—The name Hayti is derived from an old Carib Indian word, meaning "rough country," and the island fully deserves that description. Its geographical outline is irregular. At the east is the long, narrow Bay of Samaná, and at the west is the much larger Gulf of Gonaive, containing Gonaive Island. Tortue Island lies close to the northern coast, and Adamanay, Beata and Vaches islands are on the south coast respectively at the east, centre and west. The sky line of the island as seen from the sea is rugged in the extreme, a tumbled mass of mountains and cliffs, so that we might well credit the story that a British admiral, when asked by George III. what Hayti looked like, crumpled up a sheet of paper into a shapeless mass and threw it upon the table, with the words: "Your Majesty, Hayti looks like that!" There are in fact four mountain chains traversing the island and practically covering its area. Parallel with the north coast is the Monte Cristi range, rising to the height of 4,000 feet. Next there is a chain running diagonally across the island from southeast to northwest, chiefly known as the Cordilleras, the Desert Mountains, or the Sierra del Cibao (Rocky Mountains), the highest peak and the highest on the island being Loma Tina, 10,300 feet high. A third is formed by the Mathieux and Neiba mountains, running from Cape St. Mark, at the middle of the Gulf of Gonaive, eastward to the centre of the island; and the fourth, the Hotte and Selle mountains, occupies the great Southwestern peninsula. Besides these there are many minor ranges and groups and scattered peaks, so that nowhere in the whole island is there any considerable extent of level or even non-mountainous country. There are two large lakes, Assui and Enriquillo, at the south, and several smaller ones near the northern coast. Rivers are numerous, comprising four large ones and a multitude of smaller ones. The large ones are the Yaqui del Norte, at the north, flowing into Manzanillo Bay; the Yuna, at the east, flowing into the Bay of Samaná; the Maguana, or San Juan, at the south, emptying into the Gulf of Neiba, and the Artibonite, the largest of all, flowing westward into the Gulf of Gonaive. There are nearly fifty other streams large enough to be named upon the map, but they are chiefly mountain torrents, useless for navigation. It is interesting to observe that the large lakes mentioned, though lying a considerable distance inland, are filled with salt or brackish water, which rises and falls in accord with the tides, a subterranean connection with the sea being thus indicated.

Geology, Soil and Climate.—The geological formation of Hayti is much mixed. The whole island is of volcanic structure, and earthquakes are common, though there are no active craters. The rocks are chiefly of the secondary and tertiary eras, limestone, slate, conglomerate and syenite abounding. There are some deposits of lignite, too small to be of value, and gold, silver, platinum, copper, iron, quicksilver, tin, manganese, antimony, rock-crystal, jasper, porphyry, sulphur, marble, opal, chalcedony, lapis lazuli, rock salt and bitumen have been found. No systematic and thorough geological survey of the island has ever been made, however, and the value of its mineral resources remains a matter of speculation. The soil is generally fertile, and with proper irrigation could be made highly productive of cultivated crops. Lying entirely within the Torrid Zone, the island has a warm but not always oppressive climate. Some points on the coast are as hot as any in the West Indies. Thus at Port au Prince the temperature from April to November is seldom lower than 95° in the middle of the day, though it seldom rises more than two or three degrees higher. There and elsewhere, in fact, the heat is notably constant. On the other hand many places on the island, at considerable elevations among the hills, enjoy a moderate temperature. A few miles inland from Port au Prince a temperature of 45° at night may be found. Naturally, fevers abound. These are chiefly malarious and bilious in type, and are easily provoked or contracted. Yellow fever is less common and is said to be invariably imported. Enteric troubles are rare.

[1] [His nephew, Paul Hamilton Hayne (1831–86), the poet of the Confederacy, published *Temptation of Venus* and other verse. Complete works appeared in 1882. He died near Augusta, Ga.— Am. Ed.]

Pulmonary consumption is very prevalent among the natives, while to visitors suffering from that ailment the island is a sanatorium. Tetanus is one of the commonest and deadliest diseases, the slightest abrasion of the skin being liable to cause it. There have been widespread epidemics of smallpox, but Asiatic cholera has never invaded the island. The vital statistics are so ill kept that it is impossible to state accurately the death rate of the island.

Flora and Fauna.—The island is heavily wooded and provided with a profuse tropical vegetation. The trees include mahogany, Brazilwood, logwood, rosewood, lignum vitæ, cedar, lancewood, palms, india rubber, and many other valuable varieties. Other native plants are oranges, lemons, limes, bananas, pineapples, pomegranates, cocoanuts, cacao, tobacco and coffee. Animal life is equally abundant. Mosquitoes, fleas, chigres, roaches, ants, spiders, bees, centipedes, scorpions, and similar creatures are innumerable, and make the life of the visitor miserable. The common house fly is, however, comparatively rare. Poisonous snakes are said to be non-existent, and snakes of any kind are few. Turtles and crabs are plentiful and are valuable for food. Lizards of all kinds and sizes swarm everywhere, together with toads and frogs. Alligators, or caymans, are numerous in all the rivers. Birds of many kinds are abundant. Practically all wild animals of considerable size have now become extinct, excepting a few wild hogs and goats, and perhaps some horses and cattle that have escaped from domesticity and have become wild. All the ordinary domestic animals are plentiful, and it is said there are more cats and dogs on the island, proportionately, than in any other country in the world.

History.—The Island of Hayti was discovered by Columbus during his first voyage to America, in 1492, and his sixth landing upon American soil was made at Mole St. Nicholas. It was the site of the first permanent colony planted by Europeans in the New World. At the time of the discovery the island was densely populated by Caribs. Columbus estimated their numbers at 900,000, and others placed them as high as 1,000,000. They compared favorably with any American aborigines, and Columbus himself reported that nowhere in the world was there a better land or people. The Spanish invasion, however, resulted there as elsewhere in the destruction of the native race. Cruel exactions and wholesale slaughter reduced the population within fifteen years to less than 60,000, and within a quarter of a century the Caribs had entirely disappeared from the island, through either death or exile. To-day it is said not a trace of Indian blood is to be found upon the island. To take the place of the Caribs as workmen or slaves, African negroes were imported, beginning in 1502. This traffic was conducted chiefly by the Portuguese and Dutch, in such proportions that the overwhelming mass of the population soon became negro, as it remains to-day. Down to 1520 the island belonged exclusively to Spain, but about that year the French began to make incursions upon it, and by 1530 succeeded in establishing themselves immovably upon Tortue Island, off the northwest coast. Thence they irresistibly spread to the mainland of Hayti, and finally in 1697, at the peace of Ryswick, the western part of the island was formally assigned to France. The actual delimitation of boundaries between the French and Spanish portions did not occur until 1770, when the line was run which now divides the island into the two republics of Hayti and Santo Domingo. During the American Revolution the French authorities recruited a negro army in Hayti for service in the war, and some 800 blacks took part in the siege of Savannah, in aid of American independence.

With the outbreak of the French Revolution came a crisis in Haytian history. The island contained 30,000 French people, luxurious, oppressive, and disunited; as many more mulattoes, practically free, educated, and many of them rich, but bitterly smarting under social ostracism; and perhaps 500,000 negro slaves, half savage, and filled with hatred against their masters. It would be difficult to conceive a situation more ready for trouble. The trouble came. When news of the French revolution reached the island, the French population became divided into two hostile camps. Then the mulattoes rose with a fierce demand for political and social equality. Finally, both parties made appeal to the negroes. The latter responded with a general insurrection. The French government hastened to proclaim the abolition of slavery, in hope of thus quelling the storm. It was too late. The negroes freed themselves, and amid appalling scenes of rapine and slaughter, all the white people were driven from the island, or killed. In the midst of this storm arose the heroic figure of Toussaint l'Ouverture. He was a full-blooded negro slave, who secured his own emancipation by force, though he saved his former owner and his family from destruction. Upon the French emancipation proclamation he put himself at the head of the negroes, to help France in her war with Spain and England. He developed extraordinary military genius, drove out the English invaders from their strongholds in the north of the island, restored peace and order, and then showed himself as competent in civil administration as in war. He promulgated in May, 1801, a constitution for the government of the island, subject to the approval of France, and brought back the exiled French planters to their homes in security. (In 1795, it may be observed, Spain relinquished the entire island to France.) Such success, which should have made Toussaint an object of France's profoundest gratitude, provoked the animosity of Napoleon. Immediately after the Peace of Amiens, when for a time France was at peace with all the world, he resolved upon the reimposition of slavery in Hayti, in order that France might enjoy the same advantages of cheap labor in her chief tropical colony that England and Spain enjoyed in theirs. He tried to persuade Toussaint to agree to the plan, and himself to undertake the re-enslavement of his countrymen. He wrote letters to Toussaint with his own hand, making him all sorts of flattering promises, if only he would do this deed. At the same time he prepared for the forcible subjection of this negro community, the most formidable armament that ever in history has crossed the Atlantic Ocean. It was a fleet of forty ships and an army of 30,000 men, under the command of his own brother-in-law, General Leclerc. Toussaint, of course, refused to be the re-enslaver of his own people, and so the storm broke. The French showed no quarter to the "rebellious slaves," as Napoleon termed the negroes, and the negroes in return fought with all conceivable savagery. In Toussaint and his lieutenants, Christophe and Dessalines, they had brave and resourceful leaders, and were more than a match for the best troops ever trained by Napoleon and his marshals. Despairing of victory by force, Leclerc at last tried stratagem and perfidy. Some of the negroes were corrupted, and through them the French negotiated with Toussaint. That great leader was induced, under the most solemn guarantees, to lay down his arms. He was inveigled aboard a French ship, and then basely entrapped and carried a prisoner to France, where he was kept in confinement until his death. This act of infamy roused the Haytians to renewed efforts. Under Christophe, Dessalines and other leaders they resumed the war, waging it with added ferocity. Yellow fever was their ally, sweeping away thousands of French soldiers. Leclerc drew new armies from France, but in vain. At last he contracted the fever and died. Rochambeau succeeded him, and exerted all his valor and skill, but also in vain. In December, 1803, he abandoned the attempt to re-enslave the Haytians, and returned to France with all that was

left of his army. The war had cost France 55,000 men and more than $40,000,000.

Dessalines was now at the head of affairs. On January 1, 1804, he proclaimed the independence of the Haytian Republic, and decreed the expulsion or extermination of all Frenchmen still on the island, a bloody policy which was carried out to the letter. Soon after he proclaimed himself Emperor, and was assassinated in November, 1806. The republic was then restored, with a constitution modelled after that of the United States, and Christophe was made President. He refused the office, and established himself in the north of the island as King Henry I. There he reigned cruelly, but greatly developed the material prosperity of the island, and introduced the English language and the Protestant religion. Meantime Petion accepted the Presidency which Christophe had refused, and for years there was war between the two, which ended only with Petion's death in 1818. Two years later Christophe was assassinated. Boyer then became undisputed President of the whole island, and held the place for twenty-five years. That was an era of prosperity and honor. England recognized the independence of the republic in 1825, and France did the same in 1838, on condition that the island should pay her a heavy indemnity, which was fully paid. But Boyer remained in office too long. In 1843 a successful revolution was organized against him. He was overthrown, and died in exile. Riviere succeeded him, and soon met with a like fate. After that, "the deluge." The island was in 1844 divided into two parts, Hayti at the west and the Dominican Republic at the east, and thus it has since remained. Its later history is to be told under the separate heads of those two States.

Hayti.— The western part of the island, which, as a political entity, bears the name of Hayti, has an area of 10,204 square miles, and a population of about 1,500,000, practically all negroes and mulattoes, the latter forming scarcely one-tenth of the whole. The capital is Port au Prince, a city of 70,000 inhabitants, situated on a fine harbor. Other cities are Cape Haytien, 30,000; Les Cayes, 25,000; Gonaives, 18,000; and Port de Paix, 10,000. The French language prevails, and most of the people profess adherence to the Roman Catholic church, though heathenism prevails in many parts of the country. There is a free public school system, imperfectly maintained at a cost of $1,000,000 a year. The industries of the country are chiefly agricultural, and the most important crop is coffee. This is of good quality, and could be raised in enormous quantities, but the heavy export duty discourages production. Cocoa, cotton and tobacco are extensively grown, and cane sugar is now becoming an important crop. There is a large trade in logwood and other forest products. The chief manufactures are rum and other spirits, soap, candles, matches and cigars. There are a few copper mines, and concessions have been granted for coal and iron mines, but the mineral resources of the country, which are probably great, are practically undeveloped. The chief exports from the country in 1902 were: Coffee, 64,428,104 lbs.; cocoa, 3,680,412 lbs.; logwood, 111,185,790 lbs.; cotton, 1,725,633 lbs.; hides and skins, 393,961 lbs.; gaiac wood, 6,828,770 lbs. In 1901 the total imports were valued at $5,500,000, of which $3,424,662 came from the United States. In the same year the exports amounted to $12,760,000, of which scarcely $2,000,000 came to the United States. The finances of Hayti involve the use of both gold and paper money. Export duties are paid in American gold and the public debt is largely reckoned in the same medium. The import duties and the residue of the debt are stated in terms of paper currency. In 1902-3 the revenue amounted to $2,917,435 gold and $4,409,318 paper, and the expenditures to $2,918,490 gold and $4,422,216 paper. The public debt on December 31, 1902, amounted to $26,154,994 gold and $506,284 paper. In 1902 at the ports of Hayti there were cleared 832 vessels, aggregating 1,089,983 tons. Several lines of steamships, German, French and Dutch, connect the ports of Hayti with New York and the chief ports of Europe. There are less than fifty miles of railroad in the country. Hayti is a member of the International Postal Union, and has 31 post offices. There is a National Bank of Hayti, with a capital of $2,000,000. Its headquarters are in Paris, but it has six branches in Hayti. The unit of currency is the gourde, nominally worth one dollar. The metric system of weights and measures prevails. The army consists nominally of 6,828 men, and there is a navy, consisting of a few small cruisers and gunboats.

History.— The history of Hayti since the final division of the island has been a stormy one. After the Presidencies of Guerrier, Pierrot and Riche, Soulouque became President, and then, in 1849, proclaimed himself Emperor Faustin I. In 1856 he waged an unsuccessful war against the Dominican Republic, and at the end of 1858 was deposed by a revolution, and General Geffrard was made President in his place. In March, 1867, Geffrard was deposed and banished forever, and Salnave became President. He proclaimed himself Emperor in 1868, was overthrown by a revolution, and in 1870 was captured and shot. His successor, General Saget, served out his term of four years in peace, and gave way to his elected successor, Dominguez. The latter was violently expelled in 1876, and ended his days in exile, and his successor, Canal, had the same record. Salomon was elected President in 1879, and was re-elected, but was deposed in 1888. After him, Legitime and Hippolyte alternated in office, by virtue of successive revolutions, until 1896, when General Tiresias Augustin Simon Sam was elected President. The latter was forced to resign in May, 1900, and for a time Canal and Firmin were rival claimants and the country was involved in civil war. In September, 1902, a Haytian gunboat was fired upon and sunk by a German cruiser. Finally, in December, 1902, General Nord, a man of ability and character, was elected and installed as President, and the much-troubled republic entered upon what promised to be a new era of peace and progress.

The Dominican Republic.— The eastern part of the Island of Hayti is officially known as the Dominican Republic, sometimes as Dominica, and commonly as Santo or San Domingo. It has an area estimated at about 20,000 square miles, and a population of about 700,000, being less thickly settled than Hayti. It is not, like Hayti, a purely negro republic, but has a composite population, consisting of Spaniards, a few Indians, mulattoes, and negroes. The whites, though comprising scarcely half the population, are the dominant element. The Spanish language is generally spoken, though French and English are used to some extent. The capital city is Santo Domingo, the oldest European settlement in the western hemisphere, having been founded by Bartholomew Columbus in 1494. In its cathedral the bones of Christopher Columbus were interred. The city of Santo Domingo has 20,000 inhabitants, and Puerto Plata has 5,000. The Roman Catholic religion prevails, but others are tolerated under certain conditions. There is a free compulsory system of public education, culminating in a university. About 40 newspapers are published. The chief products of the country are tobacco, sugar, coffee, cocoa, mahogany and other woods, hides, bananas, turtles, etc. There are some gold mines, and copper mines of great value. In 1901 the imports amounted to $2,986,921, of which $1,799,685 were from the United States; and the exports to $5,224,043, of which $3,553,776 were to the United States. In 1900 the country exported 53,971 tons of sugar, 2,234 tons of logwood, 8,696 tons of tobacco, 3,952,000 pounds of coffee, 11,231,000 pounds of cocoa, 285,000 bunches of bananas, and 665,951 feet of mahogany. Estimates for 1902-3 were $1,910,000 receipts, and $1,721,000 expenditures. The public debt is $19,426,750, foreign, and $2,845,550 gold, and $10,126,629 silver, domestic. In 1902 the ports of the republic were visited by 235 vessels, of 381,201 tons. There are about 126 miles of railroads and also telegraph and telephone lines, and there is direct cable communication with the rest of the world. The republic is a member of the International Postal Union, and has 25 post offices. The United States gold dollar is the standard unit of currency, but silver and paper are the circulating mediums. The metric system of weights and measures has been adopted.

History.— The story of the Dominican Republic has been a varied one. After the secession from Hayti, Buenoventura Baez was President from 1849 to 1853; Santana from 1853 to 1856; and Baez again to 1858. Jose Valverde followed, from 1858 to 1861, when the republic was for a time reunited with Spain. In 1863, however, it revolted against Spain, and after two years of war regained its independence. After the provisional Presidency of Cabral for a few weeks in 1865, Baez was proclaimed President, but was deposed two years later by Pimentel, and Cabral was restored to the place. In March, 1868, Baez regained power, and entered into negotiations with the United States for the cession of Samaná Bay to this country, and indeed for the annexation of the whole republic. Baez was peacefully succeeded in 1873 by Ganier d'Aton, but an insurrection in favor of Baez occurred, and was suppressed, in 1875. Espaillat then became President, and was peacefully deposed in favor of Gonzales in 1876. The latter served his term of four years and was succeeded by Fernando Arturo de Marino, a priest, who a few months after his accession proclaimed himself Dictator, and thus provoked a civil war which ravaged the country. General Bellini became President in 1884, and in 1886 General Ulysses Heureaux was elected and installed. He was re-elected, and served until 1899, when he was assassinated just after he had been succeeded by General Jiminez. The latter was in turn succeeded, through a violent revolution, by General Vasquez, in 1902. A successful revolution was organized against Vasquez in 1903 by General Wos-y-Gil, who was in June of that year elected President for a full term. In the fall of the same year, however, the country was plunged into civil war by Jiminez and his partisans, Wos-y-Gil was compelled to flee, and for some time the state of the country more nearly resembled anarchy than government. W. Fletcher Johnson.

June, 1904.

HAYWARD, Sir John (*c.* 1560–1627), one of the earliest writers of English history as distinguished from the old chroniclers, was born about 1560 at or near Felixstow on the coast of Suffolk. According to a statement in his will he "received the means of his education" out of the parish of Felixstow. It is affirmed by the old authorities that he studied at Cambridge and took the degree of doctor in civil law, but his name does not occur in any of the registers. In 1599 he published *The First Part of the Life and Raigne of King Henrie the IIII., extending to the end of the first yeare of his raigne*, which, from its dedication to the earl of Essex, and a passage it contained on hereditary

rights, led to the author's imprisonment by Elizabeth. The queen also caused Francis Bacon to search the book for "places in it that might be drawn within case of treason," who reported, "For treason surely I find none, but for felony very many,"—explaining that many of his sentences had been stolen from Cornelius Tacitus. Notwithstanding this jocular exculpation Hayward was continued in prison, in all probability until after the death of the queen. On the accession of James I. he courted that monarch's favor by the publication of two political pamphlets—*On the Right of Succession* (1603), and *A Treatise of Union of England and Scotland* (1604), and in 1610 he was appointed historiographer along with Camden of the college which King James attempted to found at Chelsea. In 1613 he published his *Lives of the Three Norman Kings of England*, which he wrote at the request of Prince Henry. In 1616 he was admitted an advocate of Doctors Commons, and in 1619 he received the honor of knighthood. He died 27th June, 1627. Among his manuscripts was found *The Life and Raigne of K. Edward VI.*, first published in 1630, and *Certain Yeres of Queen Elizabeth's Raigne*, the beginning of which was printed in an edition of the *Reign of Edward VI.*, published in 1636, but which was first published in a complete form in 1840, for the Camden Society, under the editorship of John Bruce, who prefixed an introduction on the life and writings of the author. Hayward was conscientious and diligent in obtaining information, and, although his reasoning on questions of morality is often childish, his descriptions are generally graphic and vigorous. Notwithstanding his imprisonment by Elizabeth, his portrait of the qualities of her mind and person is flattering rather than detractive.

HAZÁRA, or HUZARA, a British district in the lieutenant-governorship of the Punjab, India, lying between 33° 45′ and 35° 2′ N. lat., and between 72° 35′ 30″ and 74° 9′ E. long. It forms the north-eastern district of the Pesháwar Division, and is bounded on the N. by the Black Mountains, the Swáthi country, Kohistán, and Chilás; on the E. by the native state of Kashmír; on the S. by Ráwal Pindi district; and on the W. by the river Indus. The area is 2771 square miles.

The district forms a wedge of territory extending far into the heart of the outer Himalayan range, and consisting of a long narrow valley, shut in on both sides by lofty mountains, whose peaks rise to a height of 17,000 feet above sea level. Towards the centre of the district the vale of Khágán is bounded by mountain chains, which sweep southward still maintaining a general parallel direction, and send off spurs on every side which divide the country into numerous minor dales. The district is well watered by the tributaries of the Indus, the Kunhár, which flows through the Khágán Valley into the Jhílam (Jhelum), and many rivulets. Throughout the scenery is picturesque. To the north rise the distant peaks of the snow-clad ranges; midway, the central mountains stand clothed to their rounded summits with pines and other forest trees, while grass and brushwood spread a green cloak over the nearer hills, and cultivation covers every available slope.

The enumeration of 1868, which extended over an area of 3000 square miles (including the feudal territory of Tanawal), showed a population of 367,218 (males, 191,423; females, 175,795). The Mahometans numbered 346,112; Hindus, 18,563; Síkhs, 973; "others," 1570. The gross revenue in 1875–76 was £25,292. In the same year the police force numbered 510 men, besides 390 village watchmen; and there were 24 schools with 1042 pupils. The principal crops consist of wheat, barley, oil-seeds, maize, rice, pulses, millets, and cotton. Out of a cultivated area of 393,918 acres, 36,380 are artificially irrigated by means of wells and embankments on the rivers and hill torrents. Hazára has not suffered from any calamity since the famine of 1783, which affected it as well as the rest of Upper India. The chief imports are English cloth, salt, indigo; and the exports *ghí*, mustard oil, barley, wheat, rice, and live stock. In 1875–76 there were 676 miles of unmetalled roads within the district. The average rainfall for the eight years ending 1873–74 amounted to 47 inches. The station of Abbottábád is the headquarters of the Punjab frontier force.

History.—The name Hazára probably belonged originally to a Túrki family which entered India with Timúr in the 14th century, and subsequently settled in this remote region. During the prosperous period of the Mughal dynasty, the population included a number of mixed tribes, which each began to assert its independence, so that the utmost anarchy prevailed until the time when Hazára attracted the attention of the rising Síkh monarchy. Ranjít Sinh first obtained a footing in the district in 1818, and, after eight years of constant aggression, became master of the whole country. During the minority of the young Mahárája Dhulíp Sinh, the Síkh capital fell into a state of complete disorganization; the people seized the opportunity for recovering their independence, and rose in 1845 in rebellion. They stormed the Síkh forts, laid siege to Haripur, and drove the governor across the borders. In the following year the greater part of the district was included in the territory ceded to Rájá Ghuláb Sinh by the British, at the conclusion of the first Síkh war. On the outbreak of the second Síkh war the troops in garrison revolted, but the Mussulman inhabitants supported Lieutenant Abbott under the Lahore government, and the insurrection was soon quelled. Since then Hazára has passed under direct British rule, and has enjoyed for more than quarter of a century uninterrupted peace.

HAZARAS. See AFGHANISTAN.

HAZARD, a game played with dice. The player or "caster" calls a "main" (that is, any number from five to nine inclusive). He then throws with two dice. If he "throws in," or "nicks," he wins the sum played for from the banker or "setter." Five is a nick to five, six and twelve are nicks to six, seven and eleven to seven, eight and twelve to eight, and nine to nine. If the caster "throws out" by throwing aces, or deuce, ace (called crabs), he loses. When the main is five or nine the caster throws out with eleven or twelve; when the main is six or eight he throws out with eleven; when the main is seven he throws out with twelve. If the caster neither nicks nor throws out, the number thrown is his "chance," and he keeps on throwing till either the chance comes up, when he wins, or till the main comes up, when he loses. When a chance is thrown, the "odds" for or against the chance are laid by the setter to the amount of the original stake.

Suppose, for example, 7 is the main. If the caster throws 7 or 11 he wins; if he throws aces, crabs, or 12 he loses. If he throws any other number, that is his chance. Say 7 is the main and 4 the chance, the odds against the caster are now 2 to 1 (as will appear from the table below). If the stake were £1, the setter would lay £2 to £1 in addition. The caster goes on throwing till either 7 or 4 appears, when he loses £2 or wins £3.

In laying the odds, the setter gains no advantage, as can easily be shown, examining the various ways in which two dice can be thrown.

		Ways.
2	1 and 1	1
3	2 — 1, 1 and 2	2
4	2 — 2, 3 — 1, 1 and 3	3
5	4 — 1, 1 — 4, 3 — 2, 2 and 3	4
6	3 — 3, 5 — 1, 1 — 5, 4 — 2, 2 and 4	5
7	6 — 1, 1 — 6, 5 — 2, 2 — 5, 4 — 3, 3 and 4	6
8	4 — 4, 6 — 2, 2 — 6, 5 — 3, 3 — 5	5
9	6 — 3, 3 — 6, 5 — 4, 4 — 5	4
10	5 — 5, 6 — 4, 4 — 6	3
11	6 — 5, 5 — 6	2
12	6 — 6	1

(can be thrown by)

in all 36 ways. The table shows that there are six ways in which 7 can be thrown, three ways in which 4 can be thrown. Hence the odds are 6 to 3, or 2 to 1.

But there is always an advantage in favor of the setter on the stake first played for. The least disadvantageous main for the caster to call is 7.

Take the case in which 7 is the main and £18 (to avoid fractions) the caster's stake, and £36 therefore the sum played for. Then (1) if 7 or 11 is thrown the caster wins. There are eight ways out of 36 in his favor; therefore his expectation on nicking is $\frac{8}{36}$ths of £18 = £8. (2) If the chance is 6, in order to win he must throw 6 before he throws 7. There are five ways of throwing 6, and six ways of throwing 7. His expectation on 6 is therefore $\frac{5}{11}$ths of $\frac{5}{11}$ths of £36 = £2 5s. 5½d. (3) The expectation on a chance of 8 is the same as on 6, viz., £2 5s. 5½d. (4 and 5) If the chance is 9 or 5 the expectation is $\frac{4}{36}$ths of ½d of £36 = £1 12s. (twice). (6 and 7) If the chance is 10 or 4 the expectation is $\frac{3}{36}$ths of ½d of £36 = £1 (twice). The total expectation of the caster is all the separate expectations added together, viz., £17 14s. 11d. If his expectation were equal to the setter's, it should amount to £18. Therefore the caster's expectation is 5s. 1d. less than it would be if the probabilities of his winning or losing were equal. This makes his disadvantage when 7 is the main equal to 3½d. and half a farthing in the pound.

The calculations applied to the main of 7 can easily be made use of for any other main, when it will be found that the caster's expectation of loss when 5 or 9 is the main is 3½d. and half a farthing in the pound, and when 6 or 8 is the main 5½d. and nearly half a farthing in the pound.

HAZÁRIBÁGH, a British district in the lieutenant-

governorship of Bengal, India, lying between 23° 25′ and 24° 48′ N. lat., and between 84° 29′ and 86° 38′ E. long. It is bounded on the N. by the districts of Gayá and Monghyr, on the E. by the Santál Parganás and Mánbhúm districts, on the S. by Lohárdagá, and on the W. by Lohárdagá and Gayá; it forms the north-east portion of the Chutiá Nágpur division, and has an area of 7020 square miles.

The physical formation of Hazáribágh exhibits three distinct features—(1) a high central plateau occupying the western section, the surface of which is undulating and cultivated; (2) a lower and more extensive plateau stretching along the north and eastern portions; to the north, the land is well cultivated, while to the east the country is of a more varied character, the elevation is lower, and the character of a plateau is gradually lost; (3) the central valley of the Dámodar river occupying the entire southern section. Indeed, although the characteristics of the district are rock, hill, and wide-spreading jungle, fine patches of cultivation are met with in all parts, and the scenery is generally pleasing and often picturesque. The district forms a part of the chain of high land which extends across the continent of India, south of the Nerbudda on the west, and south of the Són river on the east. The most important river of Hazáribágh is the Dámodar, with its many tributaries, which drains an area of 2480 square miles. The only other river of any importance is the Barakhar. The jungle gives shelter to wild animals of all sorts. Game birds are plentiful.

The census of 1872 showed a population of 771,875 (males, 397,045; females, 374,830). Belonging to aboriginal tribes there are 57,120; semi-Hinduized aborigines, 216,712; Hindus, 421,622; persons of Hindu origin not recognizing caste, 2664; Mahometans, 72,338; non-Asiatics, 1362; and mixed races, 57. Three municipalities contain more than 5000 inhabitants:—Hazáribágh, 11,050; Ichak, 8999; and Chatrá, 8818. The only place of special interest is Párasnáth Hill, a celebrated place of pilgrimage, which is annually visited by large numbers of Jain worshippers. The revenue in 1870 amounted to £32,841, and the expenditure to £31,367. The regular police force (1872) numbered 557 men of all ranks; municipal force, 65; and rural police, 3834 men; maintained at a total cost of £15,763. There were, in 1873, 86 schools with 2183 pupils. Rice is the staple crop, and the three principal kinds are grown. Among the other crops are wheat, barley, Indian corn, the usual pulses and green crops of Bengal, jute, flax, aloes, sugar-cane, opium, cotton, etc. The trade is concentrated at Chatrá, the great central market. The chief exports are lac, metal cooking utensils, *ghí*, iron, and cattle; and the imports, rice, salt, cattle, and tobacco. There are 400 miles of road. Six coal-fields are known to exist in the district,—the most important being that of Karharbárí, which is capable of supplying 250,000 tons a year for 300 years. In 1877 there were three tea plantations containing mature plants, and one on Párasnáth Hill which promises well. The average mean temperature for 1874 was 74° F.; the average yearly rainfall, 52·4 inches. The climate is very healthy, but rheumatism, fever, and dysentery are not uncommon; cholera is rare.

The history of the district is involved in obscurity until 1755, about which time a certain Mukund Sinh was chief of the country. In a few years he was superseded by a Tej Sinh, who had gained the assistance of the British. In 1780 Hazáribágh, along with the surrounding territory, passed under direct British rule.

HAZÁRIBÁGH, the chief town and administrative headquarters of the above district, is picturesquely situated on the high central plateau of the district, at an elevation of 2000 feet above sea-level, and in the midst of a group of conical hills, 23° 59′ 21″ N. lat. and 85° 24′ 32″ E. long. The town is little more than a cluster of villages, with intervening cultivation, which have sprung up round the military *bázár*. Hazáribágh has been the military headquarters of the district since 1780, and the seat of civil administration since 1834. The cantonment lies south-east of the town. Population in 1872, 11,050 (6312 males, 4738 females):—Hindus, 7240; Mahometans, 3384; Christians, 52; "others," 374.

HAZEBROUCK, a town of France, capital of an arrondissement of the same name in the department of Nord, is situated on the Bourre, 32 miles W.N.W. of Lille, in a district formerly covered with marshes. It stands on the Lille and Calais Railway, at the junction of the branch from Dunkirk. The town is governed by a sub-prefect, and has a court of primary instance with two juges de paix, besides various offices of excise and inland revenue. There are numerous religious and charitable societies including the Frères des Écoles Chrétiens, Sœurs de Charité, and Dames de la Sainte Union. The convent of Capuchins, built near the town in 1854, is now occupied by a school. Hazebrouck contains some handsome public buildings, as the church of St. Nicolas, with a tower 260 feet high, of fine open work, built about 1520, the hôtel de ville (1807–1813), the prison for the department, two theatres, and the communal college. The Augustinian convent, built in the 16th century, with a façade of the 17th century, is now occupied in its several parts by the hospital, a tobacco-warehouse, a market, and college lecture-rooms. A chamber of agriculture meets in the town, where there are also a small public library and a secondary school. The principal manufactures are linen cloth, thread, soap, beer, oil, lime, and salt. There are also tanneries, salt-refineries, corn-mills, and dye-works. Trade in country produce, cattle, timber, and hops is also carried on. Population (1901) of the district 9857, of the town 9,194.

HAZEL (Anglo-Saxon, *Hæsel*;[1] German, *Hasel*; French, *Noisetier, Coudrier*), *Corylus*, Tournef., a genus of shrubs or low trees of the natural order *Cupuliferæ* and sub-order *Coryleæ*. The common hazel, *Corylus Avellana*, L., is distributed throughout Europe, in North Africa, and in Central and Russian Asia, except the northernmost parts. It is commonly found in hedges and coppices, and as an undergrowth in woods, and reaches the height of some 12 feet; occasionally, as at Eastwell Park, Kent, it may attain to 30 feet. According to Evelyn (*Sylva*, p. 35, 1664), hazels "above all affect cold, barren, dry, and sandy soils; also mountains, and even rockie ground produce them; but more plentifully if somewhat moist, dankish, and mossie." In Kent they flourish best in a calcareous soil. The bark of the older stems is of a bright brown, mottled with gray, that of the young twigs is ash-colored, and glandular and hairy. The leaves are alternate, from 2 to 4 inches in length, downy below, roundish-cordate, pointed, and shortly petiolate; occasionally they are found with the margins coherent at the base, or with the disk so depressed as to form a pitcher-like structure (Masters). In the variety *C. purpurea*, the leaves, as also the pellicle of the kernel and the husk of the nut, are purple, and in *C. heterophylla* they are thickly clothed with hairs. In autumn the rich yellow tint acquired by the leaves of the hazel adds greatly to the beauty of landscapes. The flowers are monœcious, and appear in Great Britain in February and March, before the leaves, and sometimes in October (Loudon). The cylindrical, drooping, and yellow male catkins (see BOTANY, vol. iv. p. 110, fig. 161) are 1 to 2½ inches in length, and occur 2 to 4 in a raceme; when in unusual numbers they may be terminal in position. The female flowers are small, subglobose, and sessile, resembling leaf-buds, and have protruding crimson stigmas; the minute inner bracts, by their enlargement, form the palmately lobed and cut involucre or husk of the nut. The ovary is not visible till nearly midsummer, and is not fully developed before autumn. The nuts have a length of from ½ to ¾ inch, and grow in clusters. Double or treble nuts are the result of the equal development of two or all the three carpels of the original flower, of which ordinarily two become abortive. Fusion of two or more nuts is not uncommon, and Masters gives an instance of the union of as many as five. From the light-brown or brown color of the nuts the terms *hazel* and *hazelly, i. e.*, "in hue as hazel nuts" (Shakespeare, *Taming of the Shrew*, ii. 1), derive their significance.[2] The wood of the hazel is whitish-red, close in texture, and pliant, and has when dry a weight of 49 lb per cub. foot; it has been used in cabinet-making, and for toys and turned articles. Curiously veined veneers are obtained from the roots; and the root-shoots are largely employed in the making of crates, coal-corves or baskets, hurdles, withs and bands, whip-handles, and other objects. The rods are reputed to be most durable when from the driest ground, and to be especially good where the bottom is chalky. The light charcoal afforded by the hazel serves well for crayons, and is valued by gunpowder manufacturers. An objection to the construction of hedges of hazel is the injury not infrequently done to them by the nut-gatherer, who "with active vigor crushes

[1] Derived, it has been supposed, from Ang.-Sax. *hæs*, a behest, connected with *hatan* = Germ. *heissen*, to give orders: the hazel-wand was the sceptre of authority of the shepherd chieftain (ποιμὴν λαῶν) of olden times. See Grimm, *Gesch. d. deutsch. Sprache*, p. 1016, 1848.

[2] On the expression "hazel eyes," see *Notes and Queries*, 2d ser., xii. 337 and 3d ser., iii. 18, 39.

down the tree" (Thomson's *Seasons*, "Autumn"), and otherwise damages it.

The filbert,[1] among the numerous varieties of *Corylus Avellana*, is extensively cultivated, especially in Kent, for the sake of its nuts, which are readily distinguished from cob-nuts by their ample involucre and greater length. It may be propagated by suckers and layers, by grafting, and (see ARBORICULTURE, ii. 282) by sowing. Suckers afford the strongest and earliest-bearing plants. Grafted filberts are less liable than others to be encumbered by suckers at the root. By the Maidstone growers the best plants are considered to be obtained from layers. These become well rooted in about a twelvemonth, and then, after pruning, are bedded out in the nursery for two or three years. The filbert may be economically grown on the borders of plantations or orchards, or in open spots in woods. It thrives most in a light loam with a dry subsoil; rich and, in particular, wet soils are unsuitable, conducing to the formation of too much wood. Plantations of filberts are made in autumn, in well-drained ground, and a space of about 10 feet by 8 has to be allowed for each tree. Ground good for hops is good also for filberts, according to Williamson, who recommends old woollen rags as the best manure for the latter ("On the Cultivation of the Filbert," *Trans. Hort. Soc.*, iv. 145). In the third year after planting the trees may require root-pruning; in the fifth or sixth they should bear well. The nuts grow in greatest abundance on the extremities of second year's branches, where light and air have ready access. In 1819, a very productive year, Williamson obtained from 57 trees, mostly not above six years old, and growing on 360 square yards of ground, 2 cwt. of nuts. To obtain a good tree, the practice in Kent is to select a stout upright shoot 3 feet in length; this is cut down to about 18 inches, of which the lower 12 are kept free from outgrowth. The head is pruned to form six or eight strong offsets; and by judicious use of the knife, and by training, preferably on a hoop placed within them, these are caused to grow outwards and upwards to a height of about 6 feet, so as to form a bowl-like shape. Excessive luxuriance of the laterals may be combated by root-pruning, or by checking them early in the season, and again later, and by cutting back to a female blossom bud, or else spurring nearly down to the main branch in the following spring. In certain conditions of growth the trees may bear almost exclusively male or female flowers, and those produced in the first blossoming are stated (*Gent. Mag.*, 1788, vol. lviii., pt. 1, p. 495) to be female only. The fertilization of the latter may be secured by suspending amongst them a branch with male bloom.

Filbert nuts required for keeping must be gathered only when quite ripe; they may then be preserved in dry sand, or, after drying, by packing with a sprinkling of salt in sound casks or new flower-pots. Their different forms include the Cosford, which are thin-shelled and oblong; the Downton, or large square nut, having a lancinated husk; the white or Wrotham Park filbert; and the red hazel or filbert, the kernel of which has a red pellicle. The last two, on account of their elongated husk, were by Willdenow distinguished as a species, under the name *Corylus tubulosa*. Like these, apparently, were the nuts of Abella, or Avella, in the Campania (*cf.* Fr. *aveline*, filbert), said by Pliny to have been originally designated "Pontic," from their introduction into Asia and Greece from Pontus (see *Nat. Hist.*, xv. 24, xxiii. 78). Cob-nuts are short and roundish, and have a thick and strong shell. Hazel-nuts, under the name of Barcelona or Spanish nuts, are largely exported from France and Portugal, and especially Tarragona and other places in Spain. They afford 60 per cent. of a colorless or pale-yellow, sweet-tasting, non-drying oil, which has a specific gravity of 0·92 nearly, becomes solid at −19° C. (Cloez), and consists approximately of carbon 77, and hydrogen and oxygen each 11·5 per cent. Hazel-nuts formed part of the food of the ancient lake-dwellers of Switzerland and other countries of Europe (see Keller, *Lake Dwellings*, trans. Lee, 2d ed., 1878). By the Romans they were sometimes eaten roasted. Kaltenbach (*Pflanzenfeinde*, pp. 633–38, 1874) enumerates ninety-eight insects which attack the hazel. Among these the beetle *Balaninus nucum*, L., the nut-weevil, seen on hazel and oak stems from the end of May till July, is highly destructive to the nuts. The female lays an egg in the unripe nut, on the kernel of which the larva subsists till September, when it bores its way through the shell, and enters the earth, to undergo transformation into a chrysalis in the ensuing spring. The leaves of the hazel are frequently found mined on the upper and under side respectively by the larvæ of the moths *Lithocolletis coryli*, Nic., and *L. Nicelii*, Sta. The tomtit has been observed to pass over the filbert whilst destroying other nuts (Darwin, *Anim. and Pl.*, ii. 231). Parasitic on the roots of the hazel is found the curious leafless *Lathræa squamosa*, or Toothwort, of the natural order *Orobanchaceæ*.

[1] For derivations of the word see Latham's *Johnson's Dictionary*.

The Hebrew word *luz*, translated "hazel" in the authorized version of the English Bible (Gen. xxx. 37), is believed to signify "Almond" (see Kitto, *Cycl. of Bibl. Lit.*, ii. 869, and iii. 811, 1864). A belief in the efficacy of divining-rods of hazel for the discovery of concealed objects is probably of remote origin (*cf.* Hosea iv. 12). G. Agricola, in his treatise *Vom Bergwerck* (pp. xxix.–xxxi., Basel, 1557), gives an account, accompanied by a wood-cut, of their employment in searching for mineral veins. By certain persons, who for different metals used rods of various materials, rods of hazel, he says, were held serviceable simply for silver lodes, and by the skilled miner, who trusted to natural signs of mineral veins, they were regarded as of no avail at all. The virtue of the hazel wand was supposed to be dependent on its having two forks; these were to be grasped in the fists, with the fingers uppermost, but with moderate firmness only, lest the free motion of the opposite end downwards towards the looked-for object should be interfered with. According to Cornish tradition, the divining or dowsing rod is guided to lodes by the pixies, the guardians of the treasures of the earth. By Vallemont, who wrote towards the end of the 17th century, the divining-rod of hazel, or "baguette divinatoire," is described as instrumental in the pursuit of criminals. The Jesuit Vanièro, who flourished in the early part of the 18th century, in the *Præ-dium Rusticum* (pp. 12, 13, new ed., Toulouse, 1742), amusingly relates the manner in which he exposed the chicanery of one who pretended by the aid of a hazel divining-rod to point out hidden water-courses and gold. The burning of hazel-nuts for the magical investigation of the future is alluded to by Gay in *Thursday, or the Spell*, and by Burns in *Hallowe'en*. The hazel is very frequently mentioned by the old French romance writers. The *Corylus rostrata* and *americana* of North America have edible fruits like those of *C. Avellana*. The Witch Hazel is the species *Hamamelis virginica* (see vol. ii. p. 281), of the natural order *Hamamelideæ*, the astringent bark of which is used in medicine.

See Loudon, *Arboretum*, iii. 2016 *seq.*; *Gardener's Chron.*, 1850, pp. 101 and 552; C. M'Intosh, *The Book of the Garden*, ii. 563, 1855; Syme, *Sowerby's Eng. Bot.*, viii. 170, 1868; Masters, *Vegetable Teratology*, Ray Soc., 1869; J. D. Hooker, *Student's Flora*, pp. 363–4, 2d ed., 1878. (F. H. B.)

HAZEL-HEN. See GROUSE.

HAZLETON, a post-borough of Luzerne county, Pennsylvania, U.S., is situated about 80 miles N. N. W. of Philadelphia. Owing to its elevated and healthy situation, its agreeable climate, and the facilities afforded by its railway connections with other districts, it has become a favorite and fashionable health-resort in summer. The manufactures include both iron and timber; and a part of the rolling-stock of the Lehigh Valley Railway is made in the town. There are several valuable coal-mines in the vicinity. The population in 1860 was only 1707; in 1870 it was 4317, and in 1900, 14,230.

HAZLITT, WILLIAM (1778–1830), one of the most eminent of English critics, was born April 10, 1778, at Maidstone, where his father was minister of the Presbyterian congregation. He was educated privately, and afterwards at the Unitarian College at Hackney, where he first began to speculate upon metaphysical subjects. Feeling disinclined to enter the dissenting ministry, he returned to Wem in Shropshire, where his father had in the mean time settled, and there led an idle and desultory life until, about 1802, he determined upon becoming a painter. Metaphysics and art continued his joint passion throughout his life. It was his singular lot to be animated by an equal enthusiasm for two of the most dissimilar fields of human effort, in neither of which was he capable of achieving eminence, and yet, by a combination of the qualities proper to both, to obtain the most distinguished success in another sphere which he only entered by accident. The secret of his distinction as a critic is the union in him of the metaphysician's acuteness with the painter's eye for color and substance. Nowhere else is abstract thought so picturesquely bodied forth by concrete illustration. He commenced the practice of painting in London, where his elder brother had already acquired some reputation as an artist, and soon found his way into literary and artistic circles, becoming especially intimate with Lamb, Hunt, and Godwin. Previously to this he had (January, 1798) been powerfully influenced by Coleridge, who had come to preach in his father's neighborhood, and of whose conversation and general demeanor he has left a most vivid picture. His professional painting did not prosper, and little remains of it except a few portraits; but in 1805 he published his

Essay on the Principles of Human Action, which had occupied him at intervals for six or seven years. This work, further defined by the author as an argument in favor of the natural disinterestedness of the human mind, was preferred by him to all his other writings, but never attracted any attention from the public. In 1807 appeared a most useful abridgment of Abraham Tucker's *Light of Nature Pursued*, and a clever but fallacious attempt to invalidate the natural law established in Malthus's *Essay on Population*. In the following year he married Sarah, sister of Dr. Stoddard, well known for his connection with the journalism of the day, a woman of literary tastes and great strength of character, but cold, formal, and utterly uncongenial to him. No man indeed could well be less adapted for domestic life than Hazlitt, whose habits, notwithstanding his exemplary sobriety, were most irregular, whose temper was fitful and moody, and the intensity of whose passions rendered him for the time insensible to the feelings and rightful claims of those who might stand in the way of their gratification. The dissolution of the ill-assorted union was nevertheless deferred for fourteen years, during which much of his best literary work had been produced. After three or four years, during which he almost disappears from observation, he came forward prominently as a writer in the *Examiner* and as a lecturer at the Surrey Institution, bringing out in rapid succession his *Round Table*, a collection of essays on literature, men, and manners, his *View* of the contemporary English stage, and his lectures on the poets, the English comic writers, and the dramatic literature of the age of Elizabeth. By these works, together with his *Characters of Shakespeare's Plays* (1817), and his *Table Talk* (1821), his reputation as a critic and essayist will mainly be sustained. Next to Coleridge, Hazlitt was perhaps the most powerful exponent of the dawning perception that Shakespeare's art was no less marvellous than his genius; and Hazlitt's criticism did not, like Coleridge's, remain in the condition of a series of brilliant but fitful glimpses of insight, but was elaborated with steady care. His lectures on the Elizabethan dramatists performed a similar service for the earlier, sweeter, and simpler among them, such as Dekker, till then unduly eclipsed by later writers like Massinger, better playwrights but worse poets. Treating of the contemporary drama, he successfully vindicated for Edmund Kean (whom, however, he had at first disparaged) the high place which he has retained as an actor; while his criticisms on the English comic writers and men of letters in general are masterpieces of ingenious and felicitous exposition, though rarely, like Coleridge's, penetrating to the inmost core of the subject. As an essayist Hazlitt is even more effective than as a critic, for this style of composition allows more scope to the striking individuality of his character. Being enabled to select his own subjects, he escapes dependence upon others either for his matter or his illustrations, and presents himself by turns as a metaphysician, a moralist, a humorist, a painter of manners and characteristics, but always, whatever his ostensible theme, deriving the essence of his commentary from his own bosom. This combination of intense subjectivity with strict adherence to his subject is one of Hazlitt's most distinctive and creditable traits. Intellectual truthfulness is a passion with him. He steeps his topic in the hues of his own individuality, but never uses it as a means of self-display. The first reception of these admirable essays was by no means in accordance with their deserts. Hazlitt's political sympathies and antipathies were vehement, and he had taken the unfashionable side. The *Quarterly* attacked him with deliberate malignity, stopped the sale of his writings for a time, and blighted his credit with publishers. He had become estranged from his early friends, the Lake poets, by what he uncharitably but not unnaturally regarded as their political apostasy; as well as by an escapade of his own, obscurely related, but apparently not creditable. His inequalities of temper separated him for a time even from Leigh Hunt and Charles Lamb, and on the whole the period of his most brilliant literary success was that when he was most soured and broken. Domestic troubles supervened; his marriage, long little more than nominal, was dissolved in consequence of the infatuated passion he had conceived for a servant girl, a most ordinary person in the eyes of every one else. It is impossible to regard Hazlitt as a responsible agent while he continued subject to this influence. His own record of the transaction, published by himself under the title of *Liber Amoris, or the New Pygmalion* (1823), is a most remarkable psychological curiosity, and one of the most signal examples extant of the power of genuine passion, not merely to palliate what is wrong, but to dignify what is ridiculous. "His idolatry," says Mrs. Jameson, "in its intense earnestness and reality assumes something of the sublimity of an act of faith." The business-like dissolution of his marriage under the law of Scotland is related with amazing naiveté by the family biographer. Rid of his wife and cured of his mistress, he shortly afterwards astonished his friends by marrying a widow. "All I know," says his grandson, "is that Mrs. Bridgewater became Mrs. Hazlitt." They travelled on the Continent for a year, and then parted never to meet again. Hazlitt's study of the Italian masters during this tour, described in a series of letters contributed to the *Morning Chronicle*, had a deep effect upon him, and perhaps conduced to that intimacy with the cynical old painter Northcote which, shortly after his return, engendered a curious but eminently readable volume of conversations with him. The respective shares of author and artist are not always easy to determine. During the recent agitations of his life he had been writing essays, collected in 1826 under the title of *The Plain Speaker;* others subsequently written were published after his death. They are in no respect inferior to his earlier performances. *The Spirit of the Age* (1825), a series of criticisms on the leading intellectual characters of the day, reveals that he was less qualified to assign their true place to contemporaries than to revise the verdicts of the past, but is in point of style perhaps the most splendid and copious of his compositions. It is eager and animated to impetuosity, with no trace of carelessness or disorder. He now undertook a work which was to have crowned his literary reputation, but which can hardly be said to have even enhanced it—*The Life of Napoleon* (1828–30). The undertaking was at best premature, and was inevitably disfigured by partiality to Napoleon as the representative of the popular cause, excusable and even becoming in a Liberal politician writing in the days of the Holy Alliance, but preposterous now that the true tendencies of French imperialism are recognized. Owing to the failure of his publishers Hazlitt received no recompense for this laborious work. Pecuniary anxieties and disappointments may have contributed to hasten his death, which took place on September 18, 1830. Charles Lamb was with him to the last.

With many serious defects both on the intellectual and the moral side, Hazlitt's character in both had at least the merit of sincerity and consistency. He was a compound of intellect and passion, and the refinement of his critical analysis is associated with vehement eloquence and glowing imagery. He was essentially a critic, a dissector, and, as Bulwer justly remarks, a much better judge of men of thought than of men of action. But he also possessed many gifts in no way essential to the critical character, and transcending the critic's ordinary sphere. These, while giving him rank as an independent writer, frequently perturbed the natural clearness of his critical judgment, and seduced him into the paradoxes with which his works abound. These paradoxes, however, never spring from affectation; they are in general the sallies of a mind so agile and ardent as to overrun its own goal. His style is perfectly natural, and yet admirably calculated for effect. His diction, always rich and masculine, seems to kindle as he proceeds; and when thoroughly animated by his subject, he advances with a succession of energetic, hard-hitting sentences, each carrying his argument a step further, like a champion dealing out blows as he presses upon the enemy. Although, however, his grasp upon his subject is strenuous, his insight into it is rarely profound. He can amply satisfy men of taste and culture; he cannot, like Coleridge or Burke, dissatisfy them with themselves by showing them how much they would have missed without him. He belongs to the class of critics that exhibits the beauties of an author, rather than to the class that reveals them. He was somewhat backward in appreciating contemporary merit; he venerated Coleridge's intellect, but his estimate of his poetry is ridiculously low; his review of Shelley's posthumous poems, though rhetorically fine, is critically poor; and he did little to vindicate the fame of Keats. As a moralist and observer of manners his chief merit consists in the extreme felicity of his occasional observations. But all shortcomings are forgotten in the genuineness and fervor of the writer's self-portraiture, and the bold relief in which he stands out from the crowd of mankind. The intensity of his personal

convictions causes all he wrote to appear in a manner autobiographic. Other men have been said to speak like books, Hazlitt's books speak like men. To read his works in connection with Leigh Hunt's and Charles Lamb's is to be introduced into one of the most attractive of English literary circles, and this alone will long preserve them from oblivion.

The most copious source of information respecting Hazlitt is the biography by his grandson (1867), a medley rather than a memoir, yet full of interest. A slight but appropriate sketch had previously been prefixed by his son to the posthumous essays published in 1836, accompanied by elegant but partial estimates of his intellectual character by Bulwer and Talfourd. Valuable biographical particulars have been preserved in Barry Cornwall's memoirs of Lamb, and in the reminiscences of Mr. P. G. Patmore, Hazlitt's most intimate associate in his later years. A full bibliographical list of his writings, with a collection of the most remarkable critical judgments upon them from all quarters, has been tastefully and industriously prepared by Mr. Alexander Ireland (1868). (R. G.)

HEAD, Sir Edmund Walker, Bart. (1805–1868), a popular writer on art, was born in 1805 at Wiarton Place, near Maidstone in Kent. He was educated at Winchester school and Oriel College, Oxford, and taking his degree with first-class honors in classics, he became in 1827 fellow of Merton College, and in 1834 university examiner in classics. Two years later he married; and on his father's death in 1838, he succeeded to the baronetcy as eighth baronet. His services as poor-law commissioner, to which post he was appointed in 1841 after three years as assistant-commissioner, procured for him in 1847 the office of lieutenant-governor of New Brunswick, whence he passed in 1854 to the governor-generalship of Canada, which he retained till 1861. The following year, having returned to England, Head was nominated a civil-service commissioner. In 1857 he was sworn of the Privy Council, and in 1860 was decorated as K. C. B., while in the course of his career he received the degrees of D. C. L. at Oxford and LL.D. at Cambridge. He died in London, January 28, 1868.

Sir Edmund Head wrote the article "Painting," in the *Penny Cyclopædia; A Handbook of the Spanish and French Schools of Painting*, 1845; *Shall and Will, or two chapters on future Auxiliary Verbs*, 1856; and *Ballads and other Poems, original and translated*, 1868. He also edited *A Handbook of Painting of the German, Flemish, Dutch, Spanish, and French Schools*, 1854. His translation from the Icelandic of *Viga Glum's Saga* appeared in 1865.

HEAD, Sir Francis Bond, Bart. (1793–1875), soldier, traveller, and author, son of James Roper Head of the Hermitage, Kent, was born there January 1, 1793. He served with the Royal Engineers at the battles of Waterloo and Fleurus, and when he retired from the army he had risen to the rank of major. In 1825 he accepted the charge of an association formed to work the gold and silver mines of Rio de la Plata. In connection with this enterprise he made several rapid journeys across the Pampas and among the Andes, his *Rough Notes* of which, published in 1826, and written in a clear and spirited style, obtained for him the name of "Galloping Head." In 1835 he was appointed governor of Upper Canada, where he manifested similar energy in dealing with the discontents from which the colony was at that time suffering. He resigned his office in 1837, and in recognition of his services he was in 1838 created a baronet. The narrative of his administration in Upper Canada was published by him in 1839. In 1867 he became a privy councillor. He died at his residence at Croydon, July 20, 1875. Some time previously a pension of £100 per annum was conferred upon him for his "services to literature."

Sir Francis Head was the author of a considerable number of works, chiefly of travel, written in a clever, amusing, and graphic fashion, and displaying both acute observation and genial humor. Besides those already mentioned, his principal works, which have all gone through more than one edition, are *Bubbles from the Brunnen of Nassau*, 1833; *Life of Bruce*, 1844; *The Emigrant*, 1846; *Stokers and Pokers*, 1850; *The Defenceless State of Great Britain*, 1850; *A Faggot of French Sticks*, 1851; *A Fortnight in Ireland*, 1852; *Descriptive Essays*, 1856; *The Horse and his Rider*, 1860; *The Royal Engineer*, 1870.

HEAD, Sir George (1782–1855), brother of the preceding, was born in 1782. He was educated at the Charterhouse. In 1808 he received an appointment in the commissariat of the British army in the Peninsula, where he was a witness of many exciting scenes and important battles, of which he gave an interesting account in "Memoirs of an Assistant Commissary-General" attached to the second volume of his *Home Tour*, published in 1837. In 1814 he was sent to America to take charge of the commissariat in a naval establishment on the Canadian lakes, and he subsequently held appointments at Halifax and Nova Scotia. Some of his Canadian experiences were narrated by him in *Forest Scenery and Incidents in the Wilds of North America*, published in 1829. In 1831 he received the honor of knighthood. He published in 1835 *A Home Tour through the Manufacturing Districts of England*, and in 1837 a sequel to it, entitled *A Home Tour through various parts of the United Kingdom*. Both works are amusing and instructive, but his *Rome, a Tour of Many Days*, published in 1849, is somewhat dull and tedious. He also contributed several articles to the *Quarterly Review*, and translated *Historical Memoirs of Cardinal Pacca*, 1850, and the *Metamorphoses of Apuleius*, 1851. He died in London, May, 2, 1855.

HEARNE, Samuel (1745–1792), an English explorer, was born at London in 1745. At the age of eleven he entered the Royal Navy as midshipman in the vessel of Lord Hood, but at the conclusion of the war he took service with the Hudson's Bay Company as quartermaster. In 1768 he was appointed to examine portions of the coasts of Hudson's Bay with a view to the improvement of the cod-fishing, when he executed his task with such ability that it was resolved to employ him in the discovery of the north-west passage, and of certain mines of copper whose existence was asserted by the Indians. His first attempt, upon which he set out on November 6, 1769, was unsuccessful owing to the desertion of the Indians; and his second, entered upon on 23d February, 1770, was by the breaking of his quadrant likewise rendered abortive; but in his third expedition, upon which he started in December, 1770, he was completely successful, as he not only discovered the existence of copper on the banks of what is now known as Coppermine river, but traced the course of that river till it joined the Arctic Ocean. After an absence of eighteen months and twenty-three days he arrived at Fort Churchill, of which he was subsequently promoted to be the governor. He returned to England in 1787, and died there in 1792. An account of his journeys from Prince of Wales Fort to the Northern Ocean was published posthumously in 1795.

HEARNE, Thomas (1678–1735), an English antiquary, was born in 1678 at Littlefield Green, in the parish of White Waltham, Berkshire, where his father, the parish clerk, in payment of the rental of the vicarage house in which he lived, taught ten boys yearly. Thomas, after receiving the rudiments of education from his father, was sent by the kindness of a gentleman to the free school of Bray, "on purpose to learn the Latin tongue." This gentleman in 1695 took him into his house, and his education was continued at Bray till the Easter of 1696, when he was sent to study at Edmund Hall, Oxford. There his diligence and scholarship attracted the attention of Dr. John Mill, the editor of the Greek Testament with various readings, who employed him to compare several MSS. Hearne took the degree of B. A. in 1699, and on account of the reputation he had acquired for his knowledge of books he was in 1701 appointed assistant-keeper of the Bodleian Library. There at his own option he set himself diligently to correct the catalogue, and prepared an appendix which was afterwards incorporated in the new catalogue without acknowledgment. His interest in the antiquarian treasures of the library induced him to refuse many valuable preferments, and in 1712 he was appointed second keeper, with the stipulation made by himself that he should also be janitor, so as to obtain access to the library at any time he pleased. In 1714 or 1715 he was elected archi-typographus and esquire beadle of civil law in the university, but, an objection being taken to his holding this office along with that of second librarian, he resigned it in the November following. In January, 1716, he was compelled, on account of his refusal to take the oaths to the Government, to resign also his appointment of librarian, but he continued to reside principally at Oxford, where he occupied himself chiefly in preparing for publication the works of old English authors. His injudicious and inappropriate insertion of Jacobite sentiments in his prefaces awakened, however, the hostility of the university magnates, and subjected him to several prosecutions. He died 10th June, 1735. Though Hearne

was somewhat indiscriminate in his antiquarian taste, and rambling and desultory in his style of composition, his persevering diligence and minute accuracy enabled him to do valuable service in bibliography.

His publications were nearly all printed by subscription at Oxford. The principal of them are—*Ductor Historicus; Reliquiæ Bodleianæ;* an edition of *Livy;* Spelman's *Life of Alfred the Great;* Leland's *Itinerary;* Leland's *Collectanea; Acta Apostolorum; Titi Livii Foro-Juliensis Vita Henrici Quinti, Regis Angliæ; Aluredi Beverlacensis Annales; Gulielmi Roperi Vita D. Thomæ Mori Equitis Aurati; Gulielmi Camdeni Annales Rerum Anglicarum et Hibernicarum regnante Elizabetha; Gulielmi Neubrigensis Historia; Thomæ Sprotti Chronica; A Collection of Curious Discourses written by Eminent Antiquaries upon English Antiquities; Roberti de Avesbury Historia de Mirabilibus Gestis Edwardi III.; Johannis de Fordun Scotichronicon Genuinum; History and Antiquities of Glastonbury;* Robert of Gloucester's *Chronicle; Annals of Dunstable;* and *Benedict, Abbot of Peterborough.* Most of these have been reprinted. His MSS. were left by him to Dr. William Bradford, of whom they were bought by Dr. Richard Rawlinson and bequeathed to the Bodleian Library. *Bibliotheca Hearniana, Excerpts from the Catalogue of Thomas Hearne, M. A.,* appeared in 1848. *Reliquæ Hearnianæ, the remains of Thomas Hearne of Edmund Hall, being extracts from his MS. diaries, collected with a few notes by Philip Bliss,* was published in two volumes, Oxford, 1857; 2d ed., London, 1869.

See *Impartial Memorials of the Life and Writings of Thomas Hearne, M. A., by several hands,* London, 1736; *Lives of Leland, Hearne, and Wood,* Oxford, 1772; and Nichol's *Literary Anecdotes. Letters addressed to T. Hearne,* edited by T. Ouvry, were privately printed at London, 1874. Bliss's copy of *The Life of T. Hearne,* with copious notes, is in the Library of the British Museum.

HEART, DISEASES OF THE, form a large proportion of the most serious disorders that afflict mankind, in youth as well as in advanced life. For the structure and functions of the organ the reader is referred to ANATOMY and PHYSIOLOGY.

In the early ages of medicine, the absence of correct anatomical, physiological, and pathological knowledge prevented diseases of the heart from being recognized with any certainty during life, and almost entirely precluded them from becoming the objects of medical treatment. But no sooner did Harvey (1628) publish the discovery of the circulation of the blood, and its dependence on the heart as its central organ, than derangements of the circulation began to be recognized as signs of disease of that central organ. The earliest indications of this important step in the diagnosis of these diseases are to be found in the instructive records contained in the writings of the great pathologists of the beginning of the 18th century, of whom the chief in this respect are Lancisi, Morgagni, Senac, and Meckel. There is, however, a limit to the information obtainable in this way; and, though its range has been largely increased in our day by the invention of such instruments as the sphygmograph and cardiograph, etc., it was very easily reached in those early times, when men had only their unaided senses to depend upon, and but little experience to guide them. We need not wonder, then, that after the first great step was taken there was but little further progress made, and medicine had to wait till the beginning of another century, when Corvisart (1806) first made practical use of Auenbrugger's (1761) invention of percussion to determine the size of the heart, enlargement of that organ bulking largely in those days as a substantive disease. Corvisart was also in the habit of listening to the sounds made by the heart, and he may therefore be regarded as the first practical exponent of our modern methods of physical exploration, though scarcely as their founder. For as Auenbrugger invented percussion, so Laennec (1819) was undoubtedly the first to make a scientific application of mediate auscultation to the diagnosis of diseases of the chest, and it is to him we trace all the benefits derived from this method of inquiry, though it is to Bouillaud (1824) that we are chiefly indebted for its extension to the diagnosis of diseases of the heart; while it is to the clinical experience, and above all to the practical experiments, of James Hope (1832) that we owe much of that precision we have now attained in our diagnosis of those diseases from abnormalities in the sounds produced during the cardiac movements; just as we have learned from M. Forget (1851) the doctrine of retro-dilatation, which rightly interpreted is capable of greatly informing us as to the origin and progress of heart disease, and from William Stokes (1854) some instructive views on defective heart power as a cause of certain symptoms simulating disease of the brain, which have proved most valuable and suggestive in the diagnosis of diseases of the heart as well as in their treatment.

The half dozen works just alluded to by no means exhaust the literature of this subject during the past ages, but each of them marks an era, and by their means we may readily trace the progress of cardiac diagnosis during the 130 years intervening between Lancisi and Stokes; but during the twenty odd years that have since elapsed the literature of this subject has become so unusually copious and exhaustive that it would occupy too much space merely to enumerate the authors' names. Fortunately this further development need not concern us here.

As in former so in recent times the progress made in the diagnosis of diseases of the heart has been entirely based on physics and on physiology, and the heart is an organ so situated and so connected as to render it singularly amenable to these methods of investigation. Resting on the diaphragm, and projected against the anterior chest-wall, the heart is partly within reach, and is otherwise so completely surrounded on three sides by resonant organs (the lungs) that any change in its position or in its size is readily made out by palpation and percussion, while by listening over the cardiac area—auscultation—we can ascertain whether the valves of the heart remain intact, have an unusual strain thrown upon them, or have been rendered incompetent by disease.

As the four openings of the heart lie so close together that a superficial area of half a square inch includes a part of each, it is only by taking advantage of certain well-known laws regulating the conduction of sound that we are able to differentiate the sounds produced at each of these openings respectively, and to assign to each a definite position on the chest-wall, where it is heard at its maximum intensity. Physiology, on the other hand, teaches us that each individual cardiac pulsation, the time of which is marked for us by that impulse against the chest-wall of which we are all more or less conscious, consists of alternate acts of contraction and dilatation affecting the four cavities of the heart. Some of these acts precede this impulse, some accompany it, and others follow it, and the relation of any sound produced within the heart to these physiological acts is termed its rhythm.

The functional perfection of the heart is thus easily determined by ascertaining that it is of a normal size, that its impulse is neither too strong nor too weak, and that its sounds are normal when listened to, each in its own position of maximum intensity. When these conditions are present, any abnormal cardiac phenomena, such as palpitation, irregular action, etc., are to be regarded as entirely due to abnormal innervation, and not to any actual disease of the heart. On the other hand functional imperfection is readily detected by the occurrence of any abnormality in the phenomena already referred to, especially if accompanied by a blowing sound instead of the usual valve sound in any of the normal auscultatory areas. And an intelligent appreciation of these facts, together with a correlation of the physical with the physiological phenomena, that is, a correct determination of the rhythm of the sounds heard, enables us to ascertain with certainty, not only the valve implicated, but also the mode in which the lesion has affected or is likely to affect the heart and through it the circulation. Having found the heart to be functionally imperfect, we have two alternatives presented to us—either the valves are incurably deformed from previous disease, or they are merely functionally imperfect from over-distension of the cardiac cavities, a state of matters which may arise from various causes, and which is always susceptible of great relief and very often of perfect cure.

The great function of the heart is to keep up such a pressure within the arterial section of the vascular canals as will suffice for the maintenance of the circulation and of all the organic functions of the body dependent upon it. The tendency, however, of all the extrinsic forces connected with the circulation is to equalize the blood pressure throughout the vascular system, and so to bring the circulation to a stand-still; and indeed it is in this way that death at last occurs; whether it happen suddenly or slowly the cause is still the same—cessation of the circulation brought about by equalization of the blood pressure throughout the whole of the vascular system, or, as it may be otherwise put, from decline of the arterial (aortic) blood pressure.

Valvular lesions of the heart, however produced, tend, as may be readily understood, to neutralize the cardiac function and to lower the arterial blood pressure, either by permitting an unnatural escape of the blood backward (regurgitation) or by obstructing its onward flow (obstruction). And this action is further intensified by the interference with the cardiac nutrition which necessarily results, first of all directly, from the heart being flushed with blood at a low pressure, and secondly indirectly, from the imperfect performance of all those functions, such as digestion, etc., upon which the formation of healthy blood depends, arising from the same cause.

Valvular disease thus gives the heart more work to do, while it takes from it the power of doing it, putting the organ in a vicious circle. In this way curable disease if neglected may readily lapse into incurability, while to incurable disease there can be but one ending, though, apart from such accidents as embolism or asystole from violent emotion or exertion, that is neither so sudden nor so speedy as is commonly supposed, and indeed usually occurs from gradual asthenia, often accompanied by dropsy, and preceded by a life of more or less active exertion, averaging in many cases not less than twenty years from the primary onset of the disease. During this comparatively long period the disease may have been entirely mute; that is, the valve lesion has progressed so slowly from its trifling commencement that the residual accumulation in the cavity primarily affected has gone on *guttatim*, and has spread itself backwards over the other sections of the circulation in the same gradual manner, the resulting dilatation being so immediately followed by compensating hypertrophy that the sufferer has never been aware of any derangement of his functions. A time comes at last, however, when, from a failure of nutrition due to physical causes, the increase in the heart's bulk ceases to be muscular, and it becomes fibrous; then indeed the disease is no longer mute, serious rupture of the compensation sets in, and all that art can do is to make the inevitable declension as gradual as possible. Up to this period any accidental rupture of the compensation, which readily enough occurs from over-exertion, imperfect nutrition from any cause, or from any feverish attack, is as a rule perfectly amenable to appropriate treatment, though the restored compensation is always less stable than it had been previously.

Ruptured compensation is often attended by very alarming symptoms, such as great general dropsy and extreme irregularity of the heart's action, but the true measure of the patient's danger lies less in these symptoms than in the condition of the cardiac muscle, and in the circumstances which threaten asystole, that is, arrest of the heart's action.

If in early times the diagnosis of diseases of the heart was a matter of great difficulty, this seemed of less importance as their treatment was so hopeless. "A mésure qu'on pénètre," says Senac, "dans les maladies du cœur, la médicine parait plus stérile; que peut-on espérer des médicaments, par exemple, dans les dilatations du cœur?" But modern science, which has rendered the heart so accessible from all sides that there is nowadays probably no organ of the body whose diseases can be so readily detected or so accurately discriminated, has not only pointed out the true source of danger in these diseases, but has also put into our hands a remedy by which some are cured who were formerly thought incurable, while many incurables have their downward progress so successfully arrested that they feel themselves to be practically cured. And yet DIGITALIS (*q. v.*) was all but unknown 100 years ago, while so little was known of its real action—*ratio medendi*—that within the last thirty years a living author wrote that the use of digitalis as a diuretic in heart disease was quite "indefensible," as "the failing heart is absolutely incapable of sustaining the depressing influence of the drug." Nowadays we know digitalis to be the only drug that can be relied on for increasing the power of the heart's contractions, and it also slows them,—the result being that the blood pressure is increased throughout the whole arterial system, and that, time being given for the heart itself to be flushed by blood at an increased pressure, its nutrition is improved. The heart not only acts more powerfully under the immediate influence of the drug, but it becomes more able to act, so that by and by the drug may be left off; though indeed, should the muscular degeneration determinately threaten a rapid progression, tonic doses of the drug may be safely given daily for many years continuously, in spite of all our forefathers' croaking as to the dangers of accumulation. But however marvellous the effects of tonic doses of digitalis may be, the virtues of the drug in larger doses are even more wonderful in appropriate cases, for by means of large doses the skilled physician has it in his power permanently to contract many dilated hearts, and so to cure what seemed an incurable disease not only to Senac but even to many of his more modern successors.

There are many other drugs employed in the treatment of diseases of the heart, but there is no other deserving of special mention. Other medicines are employed to relieve pain, aid digestion, dispel flatulence, unload the bowels, improve the blood, or simply as general tonics, and may be catalogued as morphia, chloroform, belladonna, pepsine, asafœtida, aloes, rhubarb, iron, etc.

ANGINA PECTORIS (*q. v.*) is a painful disease of the heart which has been already described. *Palpitation* is an extremely rapid and sometimes forcible action of the heart. *Irregular* and *Intermittent Action* are sufficiently described by their names; irregular action may be tumultuous or so peculiar as to deserve the name of a veritable *delirium cordis*; intermission consists in the dropping of a beat every second, third, or fourth time, or seldomer. Sometimes the intermission only applies to the pulse, the heart acting regularly, and is caused by that particular systole not being forcible enough to propel the blood to the periphery; occasionally we have two beats of the pulse and then an intermission, constituting what has been termed a *pulsus bigeminus*, or the rhythm of the intermission may be even more varied. All these forms of perverted action of the heart may accompany valvular lesions, or they may occur in hearts whose valves are sound; the walls of such hearts are, however, almost invariably more or less feeble, imperfectly nourished, and the blood often poor and watery. They are rarely indicative of any real danger, though sufficiently troublesome and alarming to the sufferer; they arise from abnormal innervation, and are part of the penalties we pay for our present state of organization. We could enjoy nothing if we could not also suffer; and the blush of sensitiveness, the quickened pulse of affection, are paid for by the throb of anxiety, and the fatal inhibition of the heart's action due to overwhelming emotion. Most of these cases, however, own a much more ignoble origin: a flatulent distension of the stomach, a crapulous dyspepsia, the abuse of alcohol and tobacco, etc., are frequent sources of nervous heart trouble, so frequent that in some parts where young men most do congregate the tobacco-heart especially is quite a proverbial ailment. Overwork, worry, or excess of any kind is sufficient to bring on heart trouble of this character, as we can readily understand when we reflect that the heart does about one-fifth of the whole mechanical work of the body—a work equivalent to raising its own weight over 13,000 feet an hour; that it takes its rest only in short snatches as it were, its action as a whole being continuous; and that it must necessarily be the earliest sufferer from any improvidence as regards nutrition,—mental emotion being in this respect quite as potential a cause of constitutional bankruptcy as the most violent muscular exertion. Fortunately, to a skilled physician there is no difficulty of determining the true nature of these cases, and they are all more or less amenable to appropriate treatment. *Syncope*, or fainting, is an affection somewhat similar to those just described; it essentially consists in an emotional inhibition of the cardiac systole, so that the blood pressure within the brain falls below that necessary for the maintenance of consciousness; as the heart's action fortunately does not in these cases entirely cease, the best plan is to favor the flow of blood to the head by maintaining the sufferer with a lowered and slightly depending head until the effects of the momentary inhibition have passed off. The inflammatory affections of the heart, *Carditis*, *Endocarditis*, and *Pericarditis* are most important and serious affections, but their history and treatment are more suited for a work on practice of physic, in any of which full information regarding them may be found. They are mainly rheumatic and gouty in character, and they are to be regarded as varieties of these diseases; the mere fact of their affecting the heart is of but little consequence as to their immediate result, however important it may by and by become from the valvular lesions to which they so often give rise. There are but few exceptions to this rule, and amongst them are those rare cases in which acute endarteritis blocks the coronary vessels

and gives rise to fatal angina. *Fatty Degeneration* of the heart, which bulks so largely in the popular mind as a cause of sudden death, is an almost hypothetical lesion of most infrequent occurrence, probably never found apart from disease of the coronary arteries, impossible of diagnosis, and very rarely of itself proving suddenly fatal.

(G. W. B.)

HEAT.[1] By Sir William Thomson. Heat is a property of matter which first became known to us by one of six very distinct senses.

§ 1. *Sense of Heat.*—The sense of touch, as commonly meant, has two distinct objects—force and heat. If a person stretches out his hand till it meets anything solid, or holds it out while something solid is placed upon it, he experiences a sensation of force. He perceives resistance to the previous motion of his hand in one case, in the other case the necessity of resisting to prevent his hand from being forced downwards; the immediate object of this perception in each case is force.[2] But there is another very distinct sensation, that of heat or cold, which he may or may not perceive in either of those cases, and which he may also perceive, still by what is commonly called the sense of touch, in other cases even when no sense of force is also experienced. Thus, in the first case, if the solid be a fixed can of warm water, or of iced water, the person perceives a sense of heat or of cold; and, supposing him to have performed the operation with his eyes shut, his mind is informed by the double sense of touch that his hand has met with a hot fixed body or a cold fixed body: in the other case he may perceive that a hot heavy solid, or a cold heavy solid, has been laid upon his hand. But if he dips his hand gently into a can of water, or if he holds it towards a fire, or if he exposes it to a gentle current of air, or waves it about through the air, he perceives heat or cold without any accompanying sense of force.

The earliest scientific thoughts respecting these sensations of heat and cold must have led to the true conclusion that there is some property of external matter on which the sensations depend, and a little advance into the natural philosophy of the subject has suggested and proved that this property is also possessed by the living body, and that the sensation of heat or cold in the hand, in the instances referred to above, depends on the change produced in the hand in respect to this property by a change of circumstances which preceded the sensation. We now call heat the property of matter concerned in these sensations, and temperature a certain variable quality of matter varying according to its temporary condition in respect to heat.

In the strictest modern scientific language (compare § 3 below) the word heat is used to denote something communicable from one body or piece of matter to another, and temperature a definite variable quality of matter, varying generally in any particular piece of matter when heat is communicated to it or taken from it, varying also as we shall see (§§ 8 and 9 below; also Thermodynamics) in consequence of operations which can take place within the body itself, or which may be performed upon it from without, but which cannot be described as communication of heat to it or drawing off of heat from it.

§ 2. *Latent Heat.*—There are exceptional cases in which temperature does not vary in a mass of matter when heat is communicated to it from, or taken from it to, external matter. For instance, when the body is ice at the melting point, heat communicated to it does not raise its temperature; or if the body be water at the freezing point with ever so small a piece of ice in it (see Matter, Properties of), heat taken from it does not cause its temperature to fall; or if the whole mass considered be ice and water well mixed, heat may be either communicated to it or taken from it without altering its temperature; or if the body be water at the boiling point in the open air, heat very slowly communicated to it in however great quantities does not raise its temperature sensibly, but causes it to disappear by evaporation from its surface; or if the body be steam in a cylinder with a little water in the bottom and with a frictionless piston above it for roof (fig. 1), under atmospheric pressure, heat taken from it very slowly does not cool it until the whole steam has become condensed into water, and heat communicated to it very slowly does not warm it until the whole water has become evaporated into steam or if the body be ice (or frozen water), in place of the liquid water of the last case, and if the pressure on the upper side of the piston, instead of atmospheric pressure of about 1033 grammes per square centimetre (14·7 lb per square inch), be anything less than $\frac{1}{30}$th of a gramme per square centimetre, the same statement will still apply with "ice" substituted for water. Black's celebrated doctrine of latent heat is merely the declaration of a class of phenomena of which the preceding illustrations sufficiently indicate the character. Modern mysticism has been much exercised in respect to the terms sensible heat and latent heat, whether in decrying them, or in continuing to use them, but with aggravating haziness, instead of the clear wrongness of the old doctrine. It has become of late years somewhat the fashion to decry the designation of latent heat, because it had been very often stated in language involving the assumption of the materiality of heat.[3] Now that we know heat to be a mode of motion, and not a material substance, the old "impressive, clear, and wrong" statements regarding latent heat, evolution and absorption of heat by compression, specific heats of bodies and quantities of heat possessed by them, are summarily discarded. But they have not yet been generally enough followed by equally clear and concise statements of what we now know to be the truth. A combination of impressions surviving from the old erroneous notions regarding the nature of heat with imperfectly developed apprehension of the new theory has somewhat liberally perplexed the modern student of thermodynamics with questions unanswerable by theory or experiment, and propositions which escape the merit of being false by having no assignable meaning. There is no occasion to give up either "sensible heat" or "latent heat;" and there is a positive need to retain the term latent heat, because if it were given up a term would be needed to replace it, and it seems impossible to invent a better. Heat given to a substance and warming it is said to be sensible in the substance. Heat given to a substance and not warming it is said to become latent. These designations express with perfect clearness the relation of certain material phenomena to our sensory perception of them. Thus when heat given to a quantity of water warms it, the heat becomes sensible to a hand held in the water. When a basin of warm water and a basin of water and ice are placed side by side, a hand dipped first in one and then in the other perceives the heat. If now the warm water be poured into the basin of ice and water, and stirred for a few seconds of time (unless there is enough of warm water to melt all the ice), the hand perceives no warmth; on the contrary, it perceives that the temperature is the same that it was in the basin of ice and water at the beginning. Thus the heat which was sensible in the basin of warm water has ceased to be sensible in the water that was in that basin, and has not become sensible

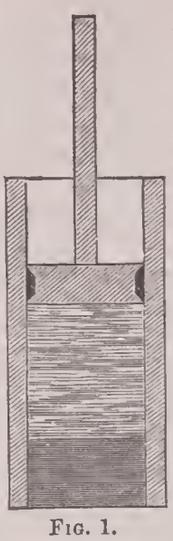


Fig. 1.

Sensible heat and latent heat.

[1] Entered according to Act of Parliament of Canada, in the year 1880, by William Thomson, Knt., Glasgow, Scotland, in the office of the Minister of Agriculture.

[2] The sense of smoothness and roughness to which physiologists have sometimes given the special name "tactile sense" is as clearly a sense of force as is what they call the muscular sense. The sense of roughness is a sense of force at places of application distributed over the skin of the finger, while in the muscular sense of force the place of application on a larger scale is distinguished by the position of the hand perceiving the force. The internal mechanism of tissue and nerves in one case and that of muscles in the other, through which the perception of places of application of force is obtained, are no doubt different, but the thing perceived is essentially the same—force—the complete discrimination of which involves magnitude of the force, its place of application, and its direction.

[3] A hundred years ago those deeper philosophers who in their judgment anticipated, or tended to anticipate, what we now know to be the true theory of the nature of heat, had indeed good grounds to be jealous of even the phrase *latent heat*. Maxwell says—"It is worthy of remark that Cavendish, though one of the greatest chemical discoverers of his time, would not accept the phrase *latent heat*. He prefers to speak of the generation of heat when steam is condensed, a phrase inconsistent with the notion that heat is matter, and objects to Black's term as relating 'to an hypothesis depending on the supposition that the heat of bodies is owing to their containing more or less of a substance called the matter of heat; and, as I think Sir Isaac Newton's opinion that heat consists in the internal motion of the particles of bodies much the most probable, I choose to use the expression *heat is generated*' (*Phil. Trans.*, 1783, quoted by Forbes). We shall not now be in danger of any error if we use latent heat as an expression meaning neither more nor less than this:—

"Definition.—*Latent heat is the quantity of heat which must be communicated to a body in a given state in order to convert it into another state without changing its temperature.*"—Maxwell's *Theory of Heat*, pp. 72, 73.

in the other. It is therefore well said to have become latent.

Calorimetry.

§ 3. *Calorimetry by Latent Heat.*—The doctrine of latent heat leads us very smoothly to a most important measurement in thermal science, the measurement of quantities of this wonderful property of matter which we call heat; and this without our knowing anything of what the nature of heat is,—whether it be a subtle elastic fluid, or a state of motion, or possibly some modification of matter related to action of force. Without, in the first place, admitting into our minds any definite idea as to the nature of heat, we may agree to measure quantities of heat by quantities of ice melted into water without change of temperature. Thus if a kilogramme of ice is melted by a large quantity of water at a lukewarm temperature, or by a comparatively small quantity of very hot water, the same quantity of heat has certainly gone from the warm water to the ice in each case, supposing that the result in each case is the ice and warm water left all in a state of ice-cold water. The measurement of quantities of heat, whether thus by the melting of ice, or by any other means, received the name of "Calorimetry," when the essence of heat was supposed to be a fluid, and this fluid called caloric. The name calorimetry is still by general consent retained to designate measurement of quantities of heat, as distinguished from thermometry, or the measurement of temperature (§§ 10–67). As long as the truth or falsity of the materialistic hypothesis seemed an open question, the word caloric was held to imply the materiality of heat. Thus Davy, after discussing some of the fundamental dogmas of the "Calorists," as he called them, and describing his own experiments, which proved beyond all doubt the falsity of their fundamental hypothesis that heat is matter, varied the statement of his conclusion by saying, "or caloric does not exist." While accepting Davy's conclusion, however, we need not accept this way of stating it; and as most of our best modern writers still use the word calorimetry, and as French writers have, in comparatively recent times, introduced the word "calorie" to designate a unit quantity of heat, it is decidedly convenient still to retain the name caloric to denote definitely the measureable essence of heat. This is convenient scientifically as tending to give precision to language and ideas respecting the two classes of measurement, calorimetry and thermometry; and it has the advantage of leaving the more popular word heat available for that somewhat lax general usage, from which we cannot altogether displace it, in which it may sometimes mean high temperature, as when we speak of great heat, or summer heat, or blood heat, sometimes a measurable quantity of heat, as in the term latent heat, and sometimes a branch of study or science dealing with the transference of heat by conduction and radiation, as in the title of Fourier's great work *Théorie analytique de la Chaleur*, or the whole province of science concerned with heat, including calorimetry and thermometry, and conduction and radiation of heat, and generation of heat, and dynamical relations of heat, as in English titles of separate books such as Dixen's, Balfour Stewart's, and Maxwell's, or of chapters or divisions of larger treatises, such as even the present article.

§ 4. *Calorimetry by Melting of Ice.*—Calorimetry was first practised by means of the melting of ice as explained above, and the first thermal unit, or unit quantity of heat, or "calorie," although not then called calorie, was the quantity of heat required to melt unit weight of ice. This, for example, is the unit on which Fourier founds his reckoning illustratively when he explains the fundamental principles of his theory of the conduction of heat. Ice seems to have been first used for calorimetry by Wilcke, a Swede. For the systematic application of this method for the measurement of quantities of heat in various physical inquiries Laplace and Lavoisier constructed an instrument, the first to which the name of calorimeter was applied, and described it in the memoirs of the French Academy of Sciences for 1780.[1] Though in the hands of Laplace and Lavoisier it gave good results, it had a great inconvenience, which with less careful and less scientific experimenters might lead to great inaccuracies, on account of the water adhering by capillary attraction to the broken ice, instead of draining away from it completely and showing exactly how much ice had been melted. To avoid this evil Sir John Herschel suggested that, instead of draining away the water from the ice, the water and ice should all be kept together, and the whole bulk measured. The diminution of bulk of the whole thus gives an accurate measurement of the quantity of ice melted, because ice melting into water comes to occupy just 91·675 per cent. of its original volume. This suggestion is admirably carried out by Bunsen[2] in his ice-calorimeter, an instrument possessing also other novel features of remarkable beauty and scientific interest. It is particularly valuable for the measurement of small quantities of heat. Its inventor, for example, by means of it succeeded in making satisfactory determinations of the specific heats of some of those rarer metals, such as indium, of which only a few grammes have been obtained.

Laplace and Lavoisier's ice-calorimeter.

Bunsen's ice-calorimeter.

§ 5. *Calorimetry by the Evaporation of Water.*—By another application of Black's doctrine of latent heat, the evaporation of water may be used for calorimetry with great advantage in many scientific investigations. It is used generally in engineering practice, particularly for testing the heating power of different qualities of coal and the economy of various forms of furnaces. The thermal unit, which presents itself naturally in this system, is the quantity of heat required to evaporate unit weight of water when the pressure of the atmosphere as measured by the barometer is of some conventional standard amount, such as that called one atmosphere, or one atmo, being that for which the barometer, with its mercury column at zero centigrade (or the temperature at which ice melts), stands at 76 centimetres in the latitude of Paris, 48° 50′,[3] or at

$$\frac{76 \times (1 + \cdot00531 \sin^2 48° 50')}{1 + \cdot00531 \sin^2 l}$$

in any latitude l. This thermal unit (see Thermodynamics) is, according to Regnault's observations, equal to 6·8 times the ice-calorimetric unit.

§ 6. *Thermometric Calorimetry.*—The most prevalent mode of calorimetry in scientific investigation has been hitherto, however, neither that by the melting of ice, nor that by evaporation of water, nor indeed anything founded on the doctrine of latent heat at all. It has been founded on the elevation of temperature produced in water by the communication to it of the heat to be measured; and, for the sake of distinction from calorimetry by latent heat or otherwise, it may be called thermometric calorimetry. We can only consider it now in anticipation, as we have not yet reached the foundation of any thermometric scale; but even now we can see that, if in any way we fix upon any two particular determinate temperatures, the quantity of water warmed from the lower to the higher of them by the heat to be measured is a perfectly definite measure for the quantity of this heat. The two temperatures chosen for thermometric calorimetry are those marked 0° and 1° on the centigrade scale. The first of these we can understand at present, being the temperature at which ice melts under ordinary atmospheric pressure. The second is fully defined in §§ 35, 37, 51, 67. The quantity of heat required to raise unit mass of water (1 kilogramme, or 1 gramme, or 1 milligramme, or 1 lb, as the case may be) from zero to 1° C. is called the thermal unit centigrade, and sometimes, especially by French writers, the "calorie."

§ 7. *Comparison of Calorimetric Units.*—Observations by Provostaye and Desains, and by Regnault, on the latent heat of fusion of ice, show it to be 79·25 thermal units centigrade, a result differing but little from Black's original determination, which made it 142 thermal units Fahr.,—this being equal to 78·9 thermal units centigrade. Thus if one kilogramme of ice be put into 79¼ kilogrammes of water at 1° C., and left till the whole is melted (the process may be accelerated by not too violent stirring, § 9), the result will be 80¼ kilogrammes of water at 0° C.

[1] The instrument itself is preserved in the *Conservatoire des Arts et Métiers* in Paris. It is described and explained in Maxwell's *Theory of Heat*, chap. iii.

[2] *Pogg. Ann.*, Sept., 1870, and *Phil. Mag.*, 1871; Maxwell's *Theory of Heat*, p. 61.

[3] This is chosen because all the most accurate experimental determinations depending on a conventional standard for atmospheric pressure, such as measurements of thermal expansions and specific heats of gases, of latent heat of melting solids in terms of a calorimetric unit depending on the centigrade thermometric scale, of latent heats of vapors, and thermal expansions of mercury and glass, and comparisons of mercury and air thermometers, are those of Regnault, and were made in Paris and calculated and given to the world according to an arbitrary standard atmosphere corresponding to 76 centimetres of mercury there.

Regnault's experiments on the latent heat of steam show that the quantity of heat required to convert into steam unit mass of water at the boiling temperature, under standard atmospheric pressure (§ 5), is 536½ thermal units centigrade. This number, which is no doubt very accurate, differs but little from Watt's final result, 960 thermal units Fahr. (equal to 533·3 thermal units centigrade), obtained by him, in a repetition in 1781 of experiments which he had commenced in 1765 at the invitation of Black, whose pupil he was.

§ 8. *Preliminary regarding the Nature of Heat.—Dynamical Calorimetry.*—From the dawn of science till the close of last century two rival hypotheses had been entertained regarding the nature of heat, each with more or less of plausibility, but neither on any sure experimental basis:—one that heat consisted of a subtle elastic fluid permeating through the pores or interstices among the particles of matter, like water in a sponge; the other that it was an intestine commotion among the particles or molecules of matter. In the year 1799 Davy, in his first published work entitled *An Essay on Heat, Light, and Combinations of Light*,[1] conclusively overthrew the former of these hypotheses, and gave good reason for accepting as true the latter, by his celebrated experiment of converting ice into water by rubbing two pieces of ice together, without communicating any heat from surrounding matter. A few years earlier Rumford had been led to the same conclusion, and had given very convincing evidence of it in his observation of the great amount of heat produced in the process of boring cannon in the military arsenal at Munich, and the experimental investigation on the excitation of heat by friction[2] with which he followed up that observation. He had not, however, given a perfect logical demonstration of his conclusion, nor even quite a complete experimental basis on which it could be established with absolute certainty. According to the materialistic doctrine it would have been held that the heat excited by the friction was not *generated*,[3] but was *produced*, squeezed out, or let flow out like honey from a broken honeycomb, from those parts of the solid which were cut or broken into small fragments, or rubbed to powder in the frictional process. If this were true, the very small fragments or powder would contain much less heat in them than an equal mass of continuous solid of the same substance as theirs. But unhappily the caloristic doctrine, besides its fundamental hypothesis, which we now know to be wrong, had given an absurd and illogical test for quantity of heat in a body, of which a not altogether innocuous influence still survives in our modern name "specific heat;" and Rumford actually, in trying to disprove the materialistic doctrine, was baffled by this sophism. That is to say, he measured the specific heat or "capacity for heat" of the powder, and he found that the powder took as much heat to warm it to a certain degree as did an equal mass of the continuous solid, and from this he concluded that the powder did not contain less heat than the continuous solid at the same temperature. This conclusion is so obviously unwarranted by the premises that it is difficult to imagine how Rumford could have for a moment put forward the "capacity for heat" experiment as proving it, or could have rested in the conclusion without a real proof, or at least a suggestion of a real proof. All that Rumford's *argument* proved was that the fundamental hypothesis of the "calorists" and their other altogether gratuitous doctrine of equality of "specific heat" as a test for equality of whole quantities of heat in matter could not be both true; and any one not inclined to give up the materialistic hypothesis might have cheerfully abandoned the minor doctrine, and remained unmoved by Rumford's argument. If Rumford had but melted a quantity of the powder (or dissolved it in an acid), and compared the heat which it took with that taken by an equal weight of the continuous solid, he would have had no difficulty in proving that the enormous quantity of heat which he had found to be excited by the friction had not been squeezed, or rubbed, or pounded, out of the solid matter, but was really brought into existence, and therefore could not be a material substance. He might even, without experiment, have pointed out that, if the materialistic doctrine were true, it would follow that sufficiently long-continued pounding of any solid substance by pestle and mortar, whether by hand or by aid of machinery, would convert it into a marvellous powder possessing one or other of two properties about equally marvellous. Either the smallest quantity of it thrown into an acid would constitute a freezing mixture of unlimited intensity,—the longer it had been pounded, the more intense would be its frigorific effect on being dissolved,—or the powder would be incapable of being warmed by friction, because it had already parted with all the heat which friction could rub out of it. The real effect of Rumford's argument seems to have been to salve the intellectual consciences of those who are not inclined to give up the materialistic doctrine, and to save them from the trouble of reading through Rumford's paper and thinking for themselves, by which they would have seen that his philosophy was better than his logic, and would inevitably have been forced to agree with him in his conclusion. It is remarkable that Davy's logic, too, was at fault, and on just the same point as Rumford's, but with even more transparently logical fallaciousness, because his argument is put in a more definitely logical form.

"Let heat be considered as matter, and let it be granted that the temperature of bodies cannot be increased unless their capacities are diminished from some cause, or heat added to them from some bodies in contact"!!

* * * * * * *

"*Experiment II.*—I procured two parallelepipedons of ice,[4] of the temperature of 29°, 6 inches long, 2 wide, and ¾ of an inch thick; they were fastened by wires to two bars of iron. By a peculiar mechanism their surfaces were placed in contact and kept in a continued and violent friction for some minutes. They were almost entirely converted into water, which water was collected and its temperature ascertained to be 35° after remaining in an atmosphere of a lower temperature for some minutes. The fusion took place only at the plane of contact of the two pieces of ice, and no bodies were in friction but ice. From this experiment it is evident that ice by friction is converted into water, and, according to the supposition, its capacity is diminished; but it is a well-known fact that the capacity of water for heat is much greater than that of ice, and ice must have an absolute quantity of heat added to it before it can be converted into water. Friction consequently does not diminish the capacities of bodies for heat."—Davy's *Essay on Heat, Light, and Combinations of Light*, pp. 10–12.

[Delete from "and, according to the supposition," to "greater than that of ice" inclusive; and delete the lame and impotent conclusion stated in the last eleven words. The residue constitutes an unanswerable demonstration of Davy's negative proposition that heat is not matter.]

§ 9. *Joule's Dynamical Equivalent of Heat.*—It is remarkable that, while Davy's experiment alone sufficed to overthrow the hypothesis that heat is matter, and Rumford's, with the addition of just a little consideration of its relations to possibilities or probabilities of inevitable alternatives, did the same, fifty years passed before the scientific world became converted to their conclusion,—a remarkable instance of the tremendous efficiency of bad logic in confounding public opinion and obstructing true philosophic thought. Joule's great experiments from 1840 to 1849,[5] creating new

[1] Published in 1799 in *Contributions to Physical and Medical Knowledge, principally from the West of England*, collected by Thomas Beddoes, M.D., and republished in Dr. Davy's edition of his brother's collected works, vol. ii., London, 1836.

[2] "An Enquiry concerning the Source of Heat which is excited by Friction" (*Phil. Trans.*, abridged, vol. xviii. p. 286).

[3] Compare quotation from Cavendish, footnote, § 2 above.

[4] "The result of the experiment is the same if wax, tallow, resin, or any substance fusible at a low temperature be used; even iron may be fused by collision, as is evident by the first experiment."

[5] List of titles of, and references to, papers by Dr. James Prescott Joule, F.R.S.:—

"Description of an Electromagnetic Engine," *Sturgeon Ann. Electr.*, ii., 1838, pp. 122–123. "Description of an Electromagnetic Engine," *Sturgeon Ann. Electr.*, 1839, pp. 437–439. "On the use of Electromagnets made of Iron Wire for the Electromagnetic Engine," *Sturgeon Ann. Electr.*, iv., 1839–40, pp. 58–62. "Investigations in Magnetism and Electromagnetism," *Sturgeon Ann. Electr.*, iv., 1839–40, pp. 131–137. "Description of an Electromagnetic Engine," *Sturgeon Ann. Electr.*, iv., 1839–40, pp. 203–205. "On Electromagnetic Forces," *Sturgeon Ann. Electr.*, iv., 1839–40, pp. 474–481; v., 1840, pp. 187–198, 470–472. "On the Production of Heat by Voltaic Electricity," *Roy. Soc. Proc.*, iv., 1840, pp. 280–282. "On the Heat evolved by Metallic Conductors of Electricity, and in the Cells of a Battery during Electrolysis," *Phil. Mag.*, xix., 1841, pp. 260–277; *Archives de l'Electr.*, ii., 1842, pp. 54–79; *Sturgeon Ann. Electr.*, viii., 1842, pp. 287–301. "On the Electric Origin of the Heat of Combustion," *Brit. Assoc. Report*, 1842 (pt. 2), p. 31; *Archives de l'Electr.*, ii., 1842, pp. 80–102; *Phil. Mag.*, xx., 1842., pp. 98–113; *Sturgeon Ann. Electr.*, viii., 1842, pp. 302–315. "On the Electrical Origin of Chemical Heat," *Phil. Mag.*, xxii., 1843, pp. 204–208; *Annal. de Chimie*, xvi., 1846, pp. 474–480; *Napoli Rendiconto*, iii., 1844, pp. 226–233. "On the Calorific Effects of Magneto-electricity, and on the Mechanical Value of Heat," *Phil. Mag.*, xxiii., 1843, pp. 263–276, 347–355, 435–443; *Annal. de Chimie*, xxxiv., 1852, pp. 504–508; *Brit. Assoc. Report*, 1843 (pt. 2), p. 33. "On the Intermittent Character of the Voltaic Current in certain cases of Electrolysis, and on the Intensities of various Voltaic Arrangements," *Phil. Mag.*, xxiv., 1844, pp. 106–115; *Archives de l'Electr.*, iv., 1844, pp. 269–275; "On Specific Heat," *Phil. Mag.*, xxv., 1844, pp. 334–337. "On the Changes of Temperature produced by the Rarefaction and Condensation of Air," *Roy. Soc. Proc.*,

provinces of science in the thermodynamics of electricity, and magnetism, and electro-chemistry, recalled attention to Davy and Rumford's doctrine regarding the nature of heat, and supplied several fresh proofs, each like Davy's absolutely in itself complete and cogent, that heat is not a material substance, and each advancing with exact dynamical measurement on the way pointed out by Rumford in his measurement of the quantity of heat generated in a certain time by the action of two horses not urged to overwork themselves. The full conversion of the scientific world to the kinetic theory of heat took place about the middle of this century, and was no doubt an immediate consequence of Joule's work, although Rumford and Davy's demonstrative experiments, and the ingenious and penetrating speculations of Mohr, and Séguin, and Mayer, and the experimental thermodynamic measurements of Colding, all no doubt contributed to the result. Each of the several subjects of thermodynamic measurement undertaken by Joule gave him a means of estimating the quantity of work required to generate a certain quantity of heat, but after several years of trials he was led to prefer to all others the direct method of simply stirring a quantity of water by a paddle, and measuring the quantity of heat produced by a measured quantity of work; and this method he has accordingly used in all his experiments for the purpose of determining the "dynamical equivalent of heat" from the year 1845 to the present time. By this he found his final result of 1849,[1] which was 772 Manchester foot-pounds for the quantity of work required to warm by 1° Fahr., at any temperature between 55° and 61° Fahr., 1 lb of water weighed in vacuum. In 1870 he commenced work for a fresh determination of the dynamical equivalent of heat at the request of the British Association, and the result was communicated to the Royal Society[2] about the end of 1877, with the following preface:—

"The committee of the British Association on standards of electrical resistance having judged it desirable that a fresh determination of the mechanical equivalent of heat should be made by observing the thermal effects due to the transmission of electrical currents through resistances measured by the unit they had issued, I undertook experiments with that view, resulting in a larger figure (782·5, *Brit. Assoc. Report*, Dundee, 1867, p. 522) than that which I had obtained by the friction of fluids (772·6, *Phil. Trans.*, 1850, p. 82).

"The only way to account for this discrepancy was to admit the existence of error either in my thermal experiments or in the unit of resistance. A committee, consisting of Sir William Thomson, Professor P. G. Tait, Professor Clerk Maxwell, Professor B. Stewart, and myself, were appointed at the meeting of the British Association in 1870; and with the funds thus placed at my disposal I was charged with the present investigation, for the purpose of giving greater accuracy to the results of the direct method."

The result of this final investigation of Joule's is 772·43 Manchester foot-pounds for the quantity of heat required to warm from 60° to 61° Fahr. a pound of water weighed in vacuum, which is about $\frac{1}{20}$th per cent. greater than the final result of 1849 expressed in the same terms. According to Regnault's measurements[3] of the thermal capacity of water at different temperatures from 0° to 230° C., it must be about ·08 per cent. greater at 60° Fahr. than at 32°. According to this, Joule's thermodynamic result would be 771·81 Manchester foot-pounds, for the work required to warm a pound of water from 32° to 33° Fahr., or 1389·26 to warm a pound of water from 0° to 1° C. Reducing 1389·26 feet to metres, we have 423·437 metres. At Paris the force of gravity is about $\frac{4}{1000}$ per cent. less than in Manchester. Hence for about the middle of France and the southern latitudes of Germany, Joule's result, according to the ordinary reckoning of French and German engineers, may be stated as 423·5 kilogramme-metres for the amount of work required to warm 1 kilogramme of water from 0° to 1° C. The force of gravity at Manchester is 981·34 dynes (centimetres per second). Multiplying 423·437 by this, we find accordingly 41,553,000 centimetre-dynes, or "ergs," for the amount of work in C. G. S. measure required to warm 1 gramme of water from 0° to 1° C.

v., 1844, pp. 517–518; *Annal. de Chimie*, xxxv., 1852, pp. 118–120; *Phil. Mag.*, xxvi., 1845, pp. 369–383. "On the Mechanical Equivalent of Heat," *Brit. Assoc. Report*, 1845 (pt. 2), p. 31. "On the Existence of an Equivalent Relation between Heat and the ordinary forms of Mechanical Power," *Phil. Mag.*, xxvii., 1845, pp. 205–207. "On the Heat evolved during the Electrolysis of Water" (1843), *Manchester Phil. Soc. Mem.*, vii., 1846, pp. 87–113. "On a new Theory of Heat," *Manchester Phil. Soc. Mem.*, vii., 1846, pp. 111–112. "On a new Method of ascertaining the Specific Heat of Bodies (1845)," *Manchester Phil. Soc. Mem.*, vii., 1846, pp. 559–573. "Expériences sur l'identité entre le calorique et la force mécanique," *Paris Comptes Rendus*, xxv., 1847, pp. 309–324. "On the Theoretical Velocity of Sound," *Phil. Mag.*, xxxi., 1847, pp. 114–115. "On the Mechanical Equivalent of Heat as determined by the Friction of Fluids," *Phil. Mag.*, xxxi., 1847, pp. 173–176; *Brit. Assoc. Report*, 1847 (pt. 2), p. 55; *Poggen. Annal.*, lxxiii., 1848, pp. 479–484. "On the Mechanical Equivalent of Heat, and on the Constitution of Elastic Fluids," *Brit. Assoc. Report*, 1848 (pt. 2), pp. 21–22. "On Shooting Stars," *Phil. Mag.*, xxxii., 1848, pp. 349–351. "Sur l'équivalent mécanique du calorique," *Paris Comptes Rendus*, xxviii., 1849, pp. 132–135.

[1] Joule "On the Mechanical Equivalent of Heat," *Philosophical Transactions* of 1850.

[2] "New Determination of the Mechanical Equivalent of Heat," by James Prescott Joule, *Phil. Trans.* for 1878, pp. 365–383.

[3] *Relation des Expériences*, vol. i. p. 748, Paris, 1847.

Thermometry.

§ 10. *Preliminary for Thermometry.—Sense of Heat* (*resumed from* § 1).—The sense of heat and cold is not simply dependent on the temperature of the body touched. If a person takes a piece of iron, or a stone, or a piece of wood, or a ball of worsted, or a quantity of finely carded cotton-wool, or of eider down, in his hand, or touches an iron column, or a stone wall, or a wooden beam, or a mass of wool or of down, he will perceive the iron cold, the stone cold, but less cold than the iron, the wood but slightly cold—much less cold than the stone, the wool or down decidedly warm.

We now know that if all the bodies before being touched were near one another in similar exposure, they must have been at the same temperature, and from the iron and stone being felt cold we know that this mean temperature is lower than the temperature of the hand. Each of the bodies touched must at the first instant have taken some heat from the hand, and therefore, if the perception were quick enough, all at the very instant of being touched would have seemed cold to the sense. The iron by its high thermal conductivity (§§ 76, 78, 80) keeps drawing off heat from the hand and lowering its temperature, till after many seconds of time an approximately permanent temperature is reached, which may be considerably lower than the temperature of the hand before contact, but somewhat higher than the previous temperature of the iron, because of the internal furnace (see Thermodynamics) generating heat in the hand. A similar result, but in less time and with less ultimate lowering of temperature of the hand, takes place when stone is touched. When wood is touched its comparatively small conductivity (§ 76) allows its surface to be warmed again after the first few seconds, sometimes to a higher temperature than that of the hand before contact; and thus, if the sensation could be perfectly remembered, it would be perceived that the wood was first felt to be cold, and afterwards to be warm. This latter warmth is rendered very perceptible by first holding the hand in contact with a piece of wood, as for instance a mahogany table, for a considerable time, half a minute or more, and then suddenly removing it; a sense of cold is immediately perceived in consequence of the exposure of the hand to the air. The foot is similarly sensitive. If, after holding a bare foot for some time in the air, it be placed on a varnished wooden floor, the floor is perceived to be cold, and if, after standing some time with it pressed to the floor, the foot be suddenly lifted, the air now seems cold by contrast. If a person walks with bare feet on a wooden floor, a continued sense of cold is experienced; and if, immediately after doing so, he sits down, and holds his feet in the air, the air seems to be warm by contrast. The same sensations are perceived even on a carpeted floor, but much less markedly than on a plain wooden floor, and much less markedly on a plain wooden floor than on a varnished wooden floor, and much less markedly on a varnished wooden floor than on a stone floor. In the case of touching soft wool, or finely carded cotton-wool, or eider down, the first instantaneous sensation of cold is scarcely if at all perceived, and that which first provokes consciousness is the subsequent heating; and it is very startling to find a body which we know to be ice-cold on a frosty day feeling positively warm to the first consciously perceptible sensation after it is touched. In this case the small thermal conductivity or great thermal resistance of the substance is such that heat is carried off by it from the hand slower than it was carried off by radiation and aerial convection (§§ 70, 71) before contact; and thus, after the first momentary cooling of the hand by the initial cataract of heat from it to the cold body touched, in a small fraction of a

second of time a higher temperature is attained by the hand than it had before contact.

§ 11. *Sense of Temperature.*—The sense of heat is in reality a somewhat delicate thermal test when properly used. Even an unskilled hand alternately dipped into two basins of water will, as we have found by experiment, detect a difference of temperature of less than a quarter of a degree centigrade; and there can be no doubt that bath and hospital attendants, and persons occupied with hot liquors in various manufactures, such as dyeing, can detect much smaller differences of temperature than that, and, what is still more remarkable, can remember permanently sensations of absolute temperature sufficiently to tell within less than a degree centigrade that the temperature of a bath, or a poultice, or dyeing liquor is "blood heat," or "fever heat," or some other definite temperature to which they have been accustomed.

§ 12. *Thermometry by Sense of Heat—with arbitrary Centigrade Scale deduced from Mixtures of Hot and Cold Water.*—Without knowing anything of the nature of heat we might found a complete system of thermometry on the mixing of hot and cold water with no other thermoscope (§ 13) than our sense of heat, if we had but two definite constant temperatures of reference. These in practical thermometry are supplied by the melting point of ice, and the temperature of steam from water boiling in air at a definite pressure (the "atmo" or standard atmosphere, § 5). Thus, suppose perfectly abundant supplies of iced water and of water at the boiling temperature to be available, and suppose it to be desired to measure the temperature of a river, or lake, or sea. Take measured quantities of the boiling and of the ice-cold water, and mix them by trial until, tested by the hand, the mixture is found to have the same temperature as that of the mass of water of which the temperature is to be determined. Suppose, for example, the mixture giving the required temperature to consist of 86·6 parts by weight of ice-cold water, and 13·4 parts by weight of boiling water; the required temperature is 13·4 on a perfectly definite scale of thermometry in which the temperature of ice-cold water is called zero, that of boiling water 100, and other temperatures are reckoned according to the law of proportion of mixtures of water in the manner indicated by the example, and defined generally in § 31 below. For temperatures within the range of sensibility of the hand this method would give more accurate results than many common thermometers sold by instrument makers for ordinary popular purposes. It may be relied upon for absolute accuracy within $\frac{2}{10}$ths of a degree centigrade, provided the mixing of hot and cold water is performed with sufficiently large quantities of water, and with all proper precautions to obtain in that part of the process all the accuracy obtainable by the living thermoscope.

An arbitrary centigrade scale founded on assuming the specific heat (§ 68) of water to be constant.

We shall see (§ 25) that with the most accurate mercury or air thermometers, made for scientific investigation and carefully tested, absolute determinations can scarcely be depended upon within $\frac{1}{10}$th of a degree centigrade. The method of mixtures with only the sensory thermoscope is not limited to the range of temperature directly perceptible with unimpaired sensibility; but when the temperature to be tested is beyond this range an indirect method must be followed, as thus:

A large quantity of water too warm for the hand is to be tested. Mix it with say twice its weight of ice-cold water, this giving a convenient temperature for the hand; then find by trial what proportions of ice-cold and boiling water give a mixture of the same temperature as tested by the hand; suppose these proportions to be 26·2 of boiling water and 73·8 of ice-cold water. The temperature of the mixture is by definition 26·2, and on the same principle the required temperature is three times this, or 78.6.

This system of thermometry is, however, strictly limited to the range between the freezing and boiling points of water, for we do not at present consider the possibilities (see LIQUID; STEAM; MATTER, PROPERTIES OF; THERMODYNAMICS) of obtaining and using thermometrically quantities of water below the freezing point and above the boiling point. It is described here, not only because it is very instructive in respect to the principles of thermometry, but because it is in point of fact the thermometric method used through a large range of processes not only in the arts but in scientific investigation. In many cases the hand is a more convenient and easy test than a common mercury thermometer, and it has just about the same sensibility, the commonest thermometers in popular use being in fact scarcely to be read to a quarter of a degree centigrade. In respect to accuracy a common cheap thermometer, though perhaps a degree or two wrong in its absolute indications, may still be used as an accurate indicator of equality of temperatures just as is the hand in the method of mixtures.

In many cases the hand is more convenient than the thermometer, in other cases the thermometer is more convenient than the hand, but in many cases the thermometer is applicable when the hand is not. When the quantities of water tested are abundant, the hand is always the quicker test, but there must be abundance of water to allow it to be satisfactorily and accurately applicable.

THERMOSCOPES DIFFERENTIAL AND INTRINSIC.

Differential Thermoscopes essentially continuous.—Intrinsic Thermoscopes discontinuous and continuous.—Single and Multiple Intrinsic Thermoscopes (discontinuous).—Continuous Intrinsic Thermoscopes.

§ 13. A thermoscope is an indicator of temperature. A differential thermoscope is a thermoscope which shows difference, or tests equality, of simultaneous temperatures in two places. Its action is essentially continuous, depending on difference of temperature between the two places, and showing zero continuously when the temperatures of the two places are varied, provided they are kept exactly equal. Every kind of differential thermoscope, and of continuous intrinsic thermoscope, must be founded on some property of matter, continuously varying with the temperature, as density of a fluid under constant pressure, pressure of a fluid in constant volume, volume of the liquid part of a whole mass of liquid and solid kept in constant volume,[1] steam-pressure of a solid or liquid,[2] shape or density of an elastic solid under constant stress, stress of an elastic solid in a constant state of strain, viscosity of a fluid, electric current in a circuit of two metals with their junctions at unequal temperatures, electric resistance of a conductor, magnetic moment of a steel or loadstone magnet.

Differential thermoscopes.

Continuous thermoscopes.

Examples:—(1) Leslie's differential air thermometer; (2) steam-pressure differential thermometers (§§ 39-44 below); (3) Joule's hydraulic and pneumatic differential thermoscopes (*Memoirs Chem. Soc.*, vol. iii. p. 201; *Proc. Lit. and Phil. Soc. Manchester*, vol. iii. p. 73; *Ibid.*, vol. vii. p. 35); (4) viscosity differential thermoscope (*Proceedings R. S. E.*, April 5, 1880; (5) thermo-electric differential thermometer; (6) Siemens electric resistance differential thermometer; (7) thermo-magnetic differential thermometer (see *Proceedings R. S. E.* for April 5, 1880).

§ 14. *Intrinsic Thermoscopes.*—An intrinsic thermoscope is an instrument capable of indicating one definite temperature or several definite temperatures, or all temperatures within the range of the instrument, whatever it may be—the temperature or temperatures indicated being intrinsically determined by the constitution of the instrument and indicated by some recognizable feature of the instrument which changes discontinuously or continuously, as the case may be, and which is always the same when the instrument is brought back again and again to the same temperature, whatever changes it may have experienced in the intervals. Discontinuous intrinsic thermoscopes show only a limited number of temperatures. A continuous intrinsic thermoscope shows any temperature whatever throughout the range of efficiency of the instrument, ideally any temperature whatever, though in practice every thermoscope is limited, some with both inferior and superior limit, as the mercury thermometer by the freezing of mercury at about −39° C., and the bursting pressure of mercury-steam a little above +360° C.; others with only a superior limit, as metallic thermoscopes, whether thermo-elastic, or thermo-electric, or electric-resistance, or thermo-magnetic, by the melting of their substances at very high temperatures, or, in the case of the thermo-magnetic instrument, by the total or partial loss of its magnetism at some temperature much below the melting point of its substance. A continuous intrinsic thermoscope, when applied to a body whose temperature is changing, shows continuously every variation of temperature within its range of efficiency.

[1] This is the principle of the ordinary mercury or spirit thermometer.

[2] For definition of steam see § 17 below.

§ 15. *Discontinuous Intrinsic Thermoscopes.*—A single intrinsic thermoscope is a thermoscope which shows whether the temperature of the body to which it is applied is higher or lower than some one definite temperature depending on intrinsic quality of the instrument.

Examples:—(1) a piece of ice, or of wax, or of fusible metal; (2) an apparatus for boiling water or other liquid under a perfectly constant pressure; (3) an apparatus for boiling water under the natural atmospheric pressure, and a barometer to measure exactly what the pressure is at the time.

A multiple intrinsic thermoscope might be made by preparing a graduated series of metallic alloys, numbering them in order of their melting points, and arranging them together conveniently for use. The temperature might be reckoned numerically, according to the number of the alloys that melt, when the whole series is exposed to the temperature to be tested. This discontinuous numerical reckoning of temperature is perfectly analogous to the Birmingham reckoning of wires and sheet metals by numbered gauges. Ideally it may be made infinitely nearly continuous by making a series of alloys with fine enough gradation of composition, but the method is in its essence discontinuous. It is useful for many special applications in science and in the arts, as for instance in that very fundamental one (§ 12) of giving one of the fixed points in the ordinary thermometric scale, the "freezing point;" also in a form of safety valve for boilers or hot-water pipes, in which a plug fixed by solder is released by the melting of the solder when the temperature reaches a certain limit; also an exceedingly useful guard against overheating in the flue of a stove, by which a stopper is allowed to fall by the melting of a leaden support, and stop the draught, before the temperature reaches the highest limit judged permissible.

§ 16. *Continuous Intrinsic Thermoscopes.*—Continuity of indication requires, as said above (§ 13), choice of some property or properties of matter varying continuously with temperature such as those enumerated in § 13. A continuous intrinsic thermoscope must have a feature, depending on the chosen property of matter, which shall vary with perfect continuity when the temperature is gradually changed, and shall always be the same when the instrument is brought to the same temperature again and again, whatever variation of temperature it may have experienced in the intervals. The accuracy of an intrinsic thermometer, whether discontinuous or continuous, depends upon permanence of quality of the material and of the mechanical constitution of the instrument, according to which the recognized feature shall always be very accurately the same for the same temperature. The sensibility or delicacy of a continuous intrinsic thermometer depends upon the recognizability of change in its indicating feature with very small change of temperature.

§ 17. The property of matter chosen as the foundation of almost all ordinary continuous intrinsic thermoscopes in common use is interdependence of the density, the temperature, and the pressure of a fluid. The only other thermoscopes which can be said to be in common use at all are "metallic thermometers" (see THERMOMETER; MATTER, PROPERTIES OF); these depend upon the change of shape of a rigid elastic solid under a stated stress, or on the change of shape of a compound solid, composed of two elastic solids of different substances melted or soldered together. For the present we confine our attention to the former and much larger class of instruments. The general type of all those instruments, except the steam-pressure thermometer (§§ 39–46 below), is a glass measure, measuring the bulk of a fluid. To give the requisite practical sensibility to the measurement, the glass, except for the case, of the constant-pressure gas thermometer (§§ 64–67 below) and of the steam-pressure thermometer is made of a shape which may be generally described as a bottle with a long narrow neck. The body of the bottle, which may either be spherical or of an elongated form, is called the bulb, and the neck is called the tube or stem (stem we shall most frequently call it, to obviate ambiguities without circumlocutions). The thermometric fluid may be all liquid, as mercury, or oil, or alcohol, or ether, or glycerine and water; or it may be all gas, as common air, or hydrogen, or carbonic acid; or it may be partly liquid and partly steam (steam being a name which we shall invariably use to designate the less dense portion of a fluid substance at one temperature and pressure throughout, and in equilibrium, with two parts of different densities). This last case is different from the two preceding, in respect to the character of the thermometric indication: the whole volume of the thermometric substance may be changed from that of all liquid to that of all steam without changing the temperature or the pressure, and the pressure cannot be changed without changing the temperature, provided the substance is kept in the double condition of part liquid and part steam; in other words, in this case the pressure depends upon the temperature alone and is independent of the volume. In the steam-pressure thermometer, therefore, there is no delicate measuring of volume of the thermometric substance, and the vessel containing it is not in the shape of bulb and stem; but the instrument consists essentially of a means of measuring the pressure of the thermometric substance, with a test that it is really in the twofold condition of part liquid and part steam, whether by seeing it through a glass containing-vessel, or by a proper hydraulic appliance for ascertaining that the pressure is not altered by rarefaction or condensation when the temperature is kept constant. Realized thermometers of this species, quite convenient for many practical purposes, with steam of sulphurous acid, of water, and of mercury, to serve for different ranges of temperature, from below −30° C. to above +520° C., are described in §§ 39–44 below.

Steam, definition of.

Manometric thermometry.

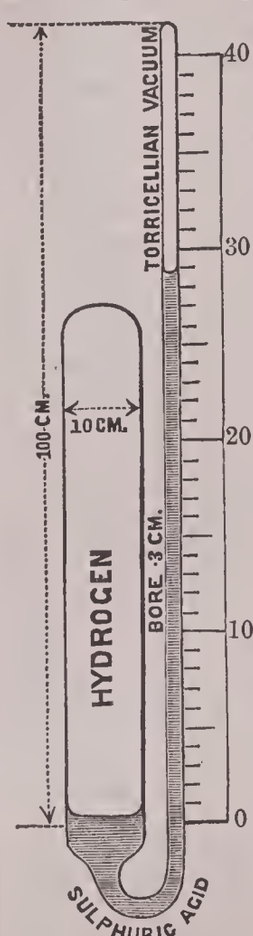


FIG. 2.

§ 18. In respect to general convenience for large varieties of uses, whether for scientific investigation, or for the arts, or for ordinary life, liquid thermometers are generally and with good reason preferred; but the general preference of either mercury or spirits of wine for the liquid, which is so much the rule, is not (§ 20 below) so clearly reasonable. For ordinary uses in which the thermometer has to be moved about and placed in various positions, gas thermometers are much less convenient, because they require essentially an accurate measurement of pressure, and generally for this purpose a column of liquid. But when the thermometer is to be kept always in one position, as for instance when it is devoted to testing the temperature of the air in-doors or out of doors, Amonton's air or gas thermometer is really as convenient and as easily read as any liquid thermometer can be: but even it, simple as it is, involves a triple division of the hermetically sealed space, with three different conditions of occupation—one part occupied by the thermometric substance, another by the pressure-measuring vaporless liquid,[1] and the third vacuous; and it is by so

[1] An instrument closely resembling that shown in the drawing (fig. 2), but with common air instead of hydrogen, was made for the writer of this article, by Casella, about fifteen years ago, and has been used for illustrations in the natural philosophy class in Glasgow university ever since. It is probably an exceedingly accurate air thermometer. When it was set up in the new lecture-room after the migration to its present locality in 1870, the tube above the manometric liquid column was cleared of air. To do this the instrument must be held in such a sloping position, with the closed end of the tube down, as to allow the bubble of air always found in it to rise and burst in the bulb. If now the instrument is placed in its upright position, the liquid refuses to leave the top of the tube, and it would remain filling the tube (probably, for ever?) if left in that position. No violence of knocking which has been ventured to try to bring it down has succeeded. To bring it down a bubble of air must be introduced. The bubble must be very small, so that the pressure of the air which fills it may become insensible when this air expands into the space of the tube left above the manometric column after it descends to its proper thermoscopic position. Special experiments made for this article in September, 1879, showed that in the nine years during which the instrument had remained undisturbed in the lecture-rooom a very sensible quantity of air (enough to render the temperature indication about 35° C. too low) had leaked from the bulb through the sulphuric acid into the tube above the liquid column. This air was eliminated, and the instrument reset up for use, an operation completed in a minute at any time if need be. Some careful experiments were then made by Mr. Macfarlane to ascertain if the pressure of vapor or gas

much the less simple than the liquid thermometer that in the liquid thermometer the enclosed space is divided into only two parts, one occupied by the thermometric liquid, and the other by its steam, with or without some admixture of common air. For accuracy the air or gas thermometer is superior, we might almost say incomparably superior, to the mercury thermometer, and, though in a much less degree, still decidedly superior to even the most accurate liquid thermometer, on account of the imperfect constancy of the glass containing-vessel.

§ 19. If we were quite sure of the bulk measurement given by the glass bulb and tube, liquid thermometers would be quite as accurate as gas thermometers. For there is no difficulty in giving any required degree of sensibility to the instrument by making the bulb large enough; and the quality of the liquid itself, hermetically sealed in glass, may be regarded as being as constant as anything we know of in the material world. But, alas for thermometry, the glass measure is not constant! In fact, glass is a substance of very imperfect elasticity (ELASTICITY, § 4, vol. vii. p. 691); and it is found that the bulb of a thermometer is not always of the same volume at the same temperature, but that, on the contrary, it experiences uncertain changes exceedingly embarrassing in thermometry. In the course of a few months after a thermometer is filled and sealed, the bulb generally shrinks by some uncertain amount of from $\frac{1}{4000}$ to $\frac{1}{2000}$ of its bulk, sometimes even in the course of years to almost $\frac{1}{1000}$. This has been discovered by a gradual rising of the freezing point, in new mercury thermometers, generally as much as from $\frac{1}{4}°$ to $\frac{1}{2}°$ C., sometimes to as much as 1°, which corresponds to its shrinkage of $\frac{1}{1000}$, as the bulk-expansion of mercury is when its temperature is raised from 0° to 100° C. (Table II. below) $\frac{1}{55 \cdot 1}$, or ·01815, of its bulk at 0°. After a few months or a few years this progressive shrinkage ceases to be sensible; but if the thermometer at any time is exposed to the temperature of boiling water or any higher temperature, an abrupt sub-permanent enlargement of the bulb is produced, and the freezing point, if tested for by placing the thermometer in ice and water, is found to be lowered; then again for weeks or months or years there is a gradual shrinkage, as shown by a gradual rising of the freezing point when the thermometer is tested again and again by placing it in ice and water. A very delicate mercury thermometer, which has been kept for years at ordinary atmospheric pressures when out of use, and never when in experimental use exposed to any temperature higher than about 30° C., or much lower than the freezing point, becomes very constant, and probably may never show any change of as much as $\frac{1}{10}$ of a degree C. in its freezing point or in its indication at any other absolutely definite temperature, within some such range as from −20° or −10° C. to +30° or +40° C. But the abrupt and irregular changes, produced by exposing the thermometer to temperatures much above or much below some such limited range as that, constitute a very serious difficulty in the way of accurate thermometry by the mercury-in-glass thermometer. Although the greatest care has been bestowed by Regnault, Joule, and all other accurate thermometric experimenters to avoid error from this cause, we have still but little definite information as to its natural history in thermometers of different qualities of glass, different shapes of bulb, and constructed differently in respect to processes of glass-blowing, boiling the mercury, and sealing the stem. We do not even know whether the excess of the atmospheric pressure outside the bulb over the pressure due to mercury and Torricellian vacuum inside is influential sensibly, or to any considerable degree, in producing the gradual initial shrinkage. If it were so we might expect that the effect of heating the thermometer up to 100° or more at any time would be rather to produce an accelerated shrinkage for the time than what it is found to be, which is a return towards the original larger volume, followed by gradual shrinkage from day to day and week to week afterwards. A careful comparison between two thermometers constructed similarly in all respects, except sealing one of them with Torricellian vacuum and the other with air above the mercury, would be an important contribution to knowledge of this subject, interesting, not only in respect to thermometry, but also to that very fundamental question of physical science, the imperfect elasticity of solids (see ELASTICITY, § 4).

§ 20. The error of a thermometer due to irregular shrinkages and enlargements of the bulb is clearly the less the greater is the expansion of the thermometric fluid with the given change of temperature. By the investigation of § 30 we can calculate exactly how much the error is for any stated amount of abnormal change of bulk in the bulb. But it is enough at present to remark that for different liquids in the same or in similar bulbs the errors are very nearly in the inverse proportions of the expansions of the liquids. Now (Table III. below) in being warmed from 0° to 1° C. alcohol expands 6 times as much as mercury, methyl butyrate 7 times, and sulphuric ether 8½ times. Hence if irregular changes of bulk of the bulb leave, as they probably do in practice, an uncertainty of $\frac{1}{10}$ths of a degree in respect to absolute temperature by the best possible mercury-in-glass thermometers used freely at all temperatures from the lowest up to 100° C., the uncertainty from this cause will be reduced to $\frac{1}{80}$th of a degree by using alcohol, or $\frac{1}{85}$th by using methyl butyrate instead of mercury; it may therefore, in a glass thermometer of alcohol or of the butyrate, be considered as practically annulled (§ 19) after a few weeks or months have passed, and the first main shrinkage is over.

§ 21. An alcohol-in-glass thermometer is easily made strong enough to bear a temperature of 100° C., as this gives by the pressure of the vapor an internal bursting pressure of not quite an atmosphere and a quarter in excess of the atmospheric pressure outside. The boiling point of methyl butyrate (Table III. below) is 102° C.; a thermometer of it may therefore be used for temperatures considerdably above 100° C., but how much above we cannot tell, as we have not experiments as yet on the pressure of its vapor at temperatures above its boiling point. The pressure of vapor of sulphuric ether (Table VI. below) is too great to allow a thermometer of this liquid sealed in glass to be used much above 60° or 70° C., but for low temperatures it makes a very valuable thermometer. It was used in 1850 by W. Thomson in finding by experiment the lowering of the freezing point of water, predicted theoretically (see THERMODYNAMICS) by J. Thomson in 1849 (*Trans. R. S. E.*), and gave a sensibility of 128 divisions to 1° C. Glass thermometers with ether, or chloroform (whose expansion is about 4 per cent. greater than that of ether), were used by Joule and W. Thomson in experiments[1] on changes of temperature experienced by bodies moving through air, in one of which the sensibility was as great as 330 scale divisions to the 1° C. All these liquids and many others in the modern chemist's repertory of oils and ethers and alcohols, besides the superior sensibility which they give by their greater expansions, have a great advantage over mercury for some thermometric purposes in their smaller specific gravity. This allows the bulb to be larger, with less liability to break or to give disturbed readings through distortion by the weight of the contained liquid.

§ 22. Liquids which wet the glass have another great advantage over mercury in their smaller capillary attraction (see CAPILLARY ACTION, vol. v. pp. 50, 51; and MATTER, PROPERTIES OF) and in the constancy of their 180° angle of contact with the glass, instead of the much greater absolute intensity of capillary attraction in the mercury, and its very variable angle of contact, averaging about 45° when the mercury is rising, and about as much as 90° when it is falling. On account of these variations the bulb of the mercury thermometer is subjected to abrupt variations of pressure when the mercury is rising or falling. The greatest and least pressures due to this cause are experienced when the angle of contact is respectively least and greatest, and differ by the pressure due to a vertical column of mercury equal in height to the difference of depressions of mercury in a capillary tube of the same bore as the thermometer stem when the angle of contact is changing from one to the other of the supposed extreme values. Hence the mercury in a thermometer rises and falls by jerks very noticeable in a delicate thermometer when looked at

from the sulphuric acid, in the tube, was sensible, with a happily decisive result in the negative. The bulb was kept at a very constant temperature by cold water; the uppermost few centimetres of the liquid column, and the whole of the tube above it, were heated to about 100° C. by steam blown through a glass jacket-tube, fitted round it for the purpose. The height of the manometric column remained sensibly unchanged! Further experiments must be made to ascertain whether or not there is enough of variation of absorption of the air by the sulphuric acid with variation of temperature, and enough of the consequent variation of pressure in the bulb, to vitiate sensibly the thermometric use of the instrument. If, as seems improbable, the answer to this question be unhappily affirmative, a satisfactory negative might be found by substituting hydrogen for common air.

[1] *Phil. Trans.* for 1860, p. 325.

with a lens of moderate magnifying power, or even with the naked eye. Dr. Joule informs us that this defect is much greater in some thermometers than in others, and that he believes it is greatly owing to the tube being left unsealed for too long a time after the introduction of the mercury (by which it is to be presumed something of a film of oxide of mercury is left on the glass to reappear on the surface of the mercury when it sinks as it cools after the sealing of the end). In Joule's own thermometers not the smallest indication has ever been detected of what he calls "this untoward phenomenon, which is calculated to drive an observer mad, if he discovers it towards the close of a series of careful experiments." Their admirable quality in this respect is no doubt due to the great care taken by the maker, Mr. Daneer, under Joule's own instructions, to have the mercury and the interior of the bulb and tube thoroughly clean, and to guard it from exposure to any "matter in its wrong place" until completion of the sealing. But no amount of care could possibly produce a mercury thermometer of moderate dimensions moving otherwise than by jerks of ever so many divisions, if its stem were of fine enough bore to give anything approaching to two or three hundred divisions to the centigrade degree.

§ 23. One chief objection to the use of alcohol or other volatile liquid for the thermometric substance in ordinary glass thermometers is the liability to distillation of some of the liquid into the stem and head reservoir, unless the glass above the level of the liquid be kept at least as warm as the liquid. On this account a spirit thermometer is not suitable for being plunged into a space warmer than the surrounding atmosphere with the stem simply left to take the temperature to which it comes in the circumstances. But whether for elaborate experimental use, or for the most ordinary thermometric purposes, there is little difficulty in arranging to keep the part of the stem which is above the liquid surface somewhat warmer than at the liquid surface, and this suffices absolutely to prevent the evil of distillation. The only other objection of any grave validity[1] against the use of highly expansive liquids instead of mercury is the difficulty of allowing for the expansion of the liquid in the stem, if it is not at the same temperature as the bulb. With the same difference of temperatures in different parts of the instrument, the error on this account is clearly in simple proportion to the expansibility of the liquid; and therefore, the residual error due to want of perfect accuracy in the data for the allowance will, generally speaking, be greater with the more expansive than with the less expansive liquid. But in every case in which the bulb and stem can all conveniently be kept at one temperature, a thermometer having for its thermometric substance some highly expansive oil or alcohol or ether, or other so-called organic liquid of perfectly permanent chemical constitution, cannot but be much more accurate and sensitive than the mercury thermometer, which has hitherto been used almost exclusively in thermometric work of the highest rank. We shall see (§§ 62 and 64–68) that the ultimate standard for thermometry, according to the absolute thermodynamic scale (§ 34), is practically attained by the use of hydrogen or nitrogen gas as the thermometric substance, but that for ordinary use a gas thermometer can scarcely be made as convenient as one in which the thermometric substance is a liquid. For practical thermometry of the most accurate kind it seems that the best plan will be to use as ordinary working standard thermometers highly sensitive thermometers constructed of some chosen "organic" liquid, and graduated according to the absolute thermodynamic scale, by aid of the thermodynamically corrected air thermometer (§ 62) used as ultimate standard of reference. The great convenience of the mercury thermometer in respect to freedom from liability to distillation and smallness of error on account of difference of temperature between the bulb and stem renders it the most convenient for a large variety of scientific and practical purposes in which the most minute accuracy or the most extreme sensibility is not required.

§ 24. Without any *thermodynamic* reason for preferring air to mercury as thermometric fluid, Regnault preferred it for two very good reasons. (1) Its expansion is 20 times that of mercury and 160 times the cubical expansion of glass, and therefore with air the error due to irregularity in the expansion of the glass is 20 times smaller than with mercury, and small enough to produce no practical defalcation from absolute accuracy in thermometry, as he found by elaborate and varied trials. So far as this is concerned, some highly expansive organic liquids would answer nearly as well as air for thermometric fluid, and would have the advantage of giving a thermometer much more easily used. (2) For an ultimate standard of reference air has the advantage over organic liquids generally, that different samples of it taken at different times, or in different parts of the world, and purified of water and carbonic acid[2] by well-known and easily practised processes, are sufficiently uniform to give thermometric results between which the accordance is practically perfect, provided the thermometric plan according to which the different samples are used is the same, or as approximately the same as is easily secured in practice. Two plans for the thermometric use of air naturally present themselves:—(I.) augmentation of volume of air kept in constant pressure; and (II.) augmentation of pressure of air kept in constant volume. Regnault tried both plans, but found that he could only arrange his apparatus to give good results by the second, and on it therefore he founded what he called his "normal air thermometer." For the sake of perfect definiteness he chose, as the density of the air in his normal thermometer, the density which air has when at the temperature of melting ice and under the pressure of one atmo. He adopted the centigrade scale in respect to the marking of the freezing and boiling points by 0° and 100°; and the principle which he assumed for the reckoning of other temperatures was to call equal those differences of temperature for which differences of pressure of the air in his normal thermometer are equal. Thus he was led to a definition of temperature expressed by the following formula:—

Regnault's normal air thermometer.

$$t = 100\,\frac{p - \Pi}{p_{100} - \Pi}, \quad \ldots\ldots\ldots \quad (1),$$

where Π denotes the pressure one atmo, and p and p_{100} the pressures of the air of the normal thermometer at the temperatures denoted by t and by 100 respectively, the latter being the temperature of steam issuing from water boiling under the pressure of one atmo. By the most accurate observations which he could make Regnault found for his "normal air" $p_{100} = 1{\cdot}3665 \times \Pi$. Hence his thermometric formula becomes

$$t = 100\,\frac{p - \Pi}{{\cdot}3665 \times \Pi} = 272{\cdot}85\left(\frac{p}{\Pi} - 1\right) \quad \ldots \quad (2).$$

§ 25. Regnault compared with his normal air thermometer thermometers on the same plan of constant volume, but with air at other than the normal density of 1 atmo, and with other gases than air; also air and gas thermometers on the plan of constant *apparent* volume as measured in a glass bulb and stem; also a thermometer founded simply on the dilatation of mercury; also thermometers of mercury in different kinds of glass, each graduated on the glass stem with divisions corresponding to exactly equal volumes of the bore; also *overflowing thermometers* (thermomètres à déversement), in which a bulb with a short piece of fine stem was perfectly filled with mercury at 0° and the quantity of mercury expelled by the high temperature to be measured was weighed, instead of being volumetrically measured by divisions of a long stem as in the ordinary thermometer.

Regnault's comparison of thermometers.

The whole of this thermometric investigation is full of scientific interest, and abounds with results of great practical value in respect even of the minutest details of Regnault's work. It will be found fully described in the first

[1] There is one other objection which, though often stated as very grave against the thermometric use of any other liquid than mercury, we do not admit to be so. It is that when the temperature is rapidly sinking, before becoming stationary, a little of the liquid lags behind the descending free surface, detained on the glass, and, trickling slowly down to rejoin the main column, must be waited for before the stationary temperature can be correctly read. We believe that if a fairly inviscid (or mobile) liquid such as alcohol or ether or butyrate of oxide of methyl be used, there will be practically *no time lost* from this cause, and certainly no accuracy lost when proper care is taken by the observer. The observer must be on his guard against a possibly false steadiness, through the falling of temperature being *momentarily* balanced in its effect on the free surface by the trickling down of liquid from the glass above, when the free surface is still above, or, it may be, has gone down to a little below, the true position for the final temperature.

[2] Henceforth, to avoid circumlocutions, the unqualified word "air" will be used to denote atmospheric air taken in any part of the world, and deprived of carbonic acid and whatever vapor of water it may have contained, by aid of hydrated lime, or caustic potash, or some other suitable reagent for removing the carbonic acid, and quicklime or chloride of calcium, or sulphuric acid, or phosphoric acid, for removing the water.

of his three volumes, entitled *Relation des Expériences entreprises par ordre de Monsieur le Ministre des Travaux Publics et sur la proposition de la Commission centrale des Machines à Vapeur pour Déterminer les Principales Lois et Données Numériques qui entrent dans le Calcul des Machines à Vapeur*, which were published at Paris in 1847, 1862, and 1870. Here we can but state some of the most important of the general conclusions:—

(1) The air thermometers with pressure at 0° of from 44 to 149 centimetres of mercury agreed perfectly with the normal air thermometer calculated according to the same formula (2), and nearly the same numerical co-efficient 272·85. A slightly larger value 272·98 (or ·0036632^{-1})gave the best agreement for the 44 c.m. pressure, and the somewhat smaller value 272·7 (or ·003667^{-1}) for the pressure 149 c.m.

(2) The hydrogen gas thermometer, with pressure one atmo at 0°, and with its indications calculated according to formula (2) but with a different numerical coefficient,[1] agreed perfectly with the normal air thermometer from 0°to 325°.

(3) The carbonic acid gas thermometer with pressure 46 c.m. at 0°, and its indications calculated with the coefficient 271·59 (·003682^{-1}), agreed perfectly with the normal air thermometer from 0° to 308°.

(4) The carbonic acid gas thermometer with pressure at 0°, 74 centimetres (or nearly 1 atmo), calculated with the coefficient 270·64 (·003695^{-1}) to make it agree with the normal air thermometer at 100°, gave numbers somewhat too large for all temperatures from 200° to 323°. The difference seemed to rise to a maximum at about 180°, when it was about $\frac{1}{3}$°, and to diminish so as to be only about $\frac{1}{10}$° at the highest temperatures of the comparison. Two sulphurous acid gas thermometers, with pressures 59 c.m. and 75 c.m. at 0°, calculated with coefficients 263·6 (·003794^{-1}) and 261·4 (·003825^{-1}) respectively to make them agree at 100° with the normal air thermometer, each gave numbers too small for the higher temperatures by differences increasing gradually from $\frac{1}{2}$° at 140° to 3° at 320°.

(5) Air and gas thermometers calculated according to differences of pressure of the gas kept at the same apparent volume (that is to say, with the bounding mercury column at a constant mark on the glass stem of the thermometer) gave numbers too small at the higher temperatures by differences gradually increasing up to 2$\frac{1}{4}$° at 350° in the case of *Choisi le Roi* crystal, a hard glass without lead, and to as much as 3$\frac{1}{4}$° in the case of ordinary glass.

In connection with these observations Regnault remarks that the greatest cause of uncertainty in his air thermometry is the allowance for expansion of the glass. It was only by most carefully made special experiments[2] on each particular bulb and tube, to determine its expansion throughout the range for which it was to be used, that he succeeded in obtaining the great accuracy which we find in his results, according to which the probable error, whether by his normal air thermometer, or by other air or gas thermometers of those stated above to agree with it perfectly, was not more than from ·1 to ·15 of a degree for any temperature up to 350°.

(6) The mercury-in-glass thermometers which Regnault generally used for comparison with his normal air thermometer were overflowing thermometers, because he found that with such he could more easily obtain the very minute accuracy at which he aimed than with the ordinary volumetric thermometers; but the formula by which he calculated temperature from the overflowing thermometer was adapted to give exactly the same result as would have been obtained by the ordinary thermometer with divisions on the stem corresponding to equal volumes of the bore. It must be remembered, however, that this perfect agreement between the volumetric and overflowing thermometers would not be found unless the expansion of the bulb and tube were uniform and isotropic throughout.

[1] Instead of the ·003665 of his normal air thermometer, Regnault states that for his hydrogen thermometer he used ·003652 (which would make the coefficient in formula (2) be 273·82 instead of 272·85). But this must surely be a mistake, as he found ·0036678 for the "coefficient of dilatation" of hydrogen calculated from its increase of pressure in constant volume, and ·0036613 for the coefficient of dilatation observed directly for hydrogen under constant pressures of from 1 to 4 atmos (pp. 78, 80, 91, 115, 116), and he nowhere speaks of having found any smaller value than ·003661 for hydrogen.

[2] These experiments were made by finding the weight of mercury contained in each bulb and tube at several different temperatures throughout the range through which it was to be used, and thence calculating the bulks according to the density of mercury for the different temperatures found by his independent investigation of the absolute dilatation of mercury by the hydrostatic method, this method being independent of the expansion of the containing glass or other solid.

(7) The general results of Regnault's comparisons of mercury thermometers with his normal air thermometer were given by himself in a diagram of curves from which the accompanying is copied on a reduced scale (fig. 3). It shows that at a temperature of 320° the independent mercury thermometer stands at 329·8° the thermometer of mercury in Choisi le Roi crystal at 327·25°, and the thermometer of mercury in ordinary glass at 321·8°; and that the independent mercury thermometer and the mercury in Choisi le Roi crystal stand 10° higher than the normal air thermometer at the temperatures by it of 323° and 345° respectively.

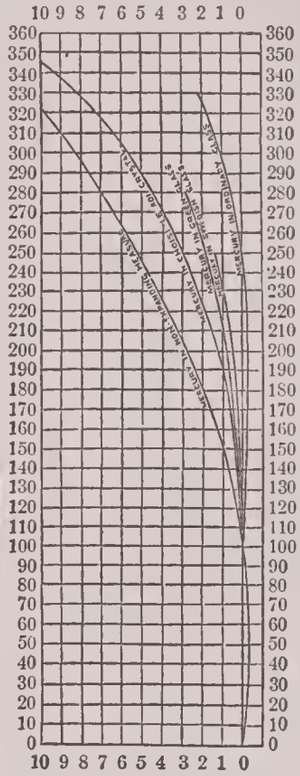


Fig. 3.

Absolute expansion of mercury thermometer.

§ 26. The curve for the independent mercury thermometer is merely Regnault's graphic representation of his experiments on the absolute expansion of mercury (*Relation des Expériences*, vol. i. p. 328). It shows that the addition of bulk given to the same mass of mercury under constant pressure by elevation of temperature is for the same difference of temperatures as indicated by his normal air thermometer regularly greater and greater the higher the temperature.

§ 27. It is interesting to see by the diagram that at the high temperatures all the mercury thermometers keep nearer to the air thermometer than does the independent mercury thermometer, and that the mercury in ordinary soft glass keeps much nearer to the air thermometer than does the mercury in the hard Choisi le Roi glass. We infer that, still reckoning temperature by the air thermometer, we have regular augmentation of expansion at the high temperatures in all the different glasses, each greater than the augmentation of expansion of mercury, and that this augmentation is greater in the soft ordinary glass than in the hard Choisi le Roi glass, being in the ordinary glass great enough to overcompensate in the resulting thermometric indication the augmenting expansion of the mercury from 100° to 245°; while above 245° in the ordinary glass thermometer, and at all temperatures above 100° in the Choisi le Roi thermometer, the compensation is only partial. Between 0° and 100° the independent mercury thermometer stands regularly lower than the air thermometer by as great a difference as ·35° at 50°, where it is a maximum. The curves for the mercury-in-glass thermometers are not shown between 0° and 100°, but it is clear from the diagram that the Choisi le Roi thermometer must, like the independent mercury thermometer, stand lower than the air thermometer, but by a smaller difference, probably only about ·2° at 50°; and the ordinary glass thermometer higher than the air thermometer from 0° to 100° by a difference which may be ·2° or ·3° at 50°. This last inference from the diagram is confirmed by Regnault's table of results facing page 227 of his first volume.

Fig. 4.

§ 28. In the best modern thermometers the graduations are actually engraved on the glass; but in most popular thermometers, and in many for scientific investigation, they are on an attached scale of wood, or ivory, or brass, or paper. Some of the best popular thermometers are the German bath thermometers, in which the graduation is on a paper scale guarded by being enclosed in a wide glass tube hermetically sealed round the stem and over the bulb of the glass which contains the mercury, in the manner shown in fig. 4. The graduation is clearer and more easily read in this kind of thermometer than in any other. The complete protection of the paper scale against damp and damage afforded by its hermet-

ically sealed glass envelope gives a perennially enduring quality to this form of thermometer,[1] such as is possessed by no others except those graduated on the glass; and the lightness of the paper renders its proper attachment to the inner stem, by gum or otherwise, thoroughly trustworthy, when once well done by the maker of the instrument. For scientific purposes the paper scale was too cheap, and common, and good, to satisfy the ideas of those instrument makers who in Germany and France substituted the heavy graduated slab of opal glass for the paper, while still adhering to the bath thermometer pattern in hermetically enclosing this scale in an outer containing glass tube,—very unnecessarily, as the glass scale, unlike the paper scale, does not require any such protection.

Ordinary scientific thermometer of mercury in glass.

This is now, however, a thing of the past. At the present time all high-class scientific thermometers are graduated on the glass of the stem without any attached scale of other material. Except in respect to ease of reading the indications this simplest form is, both for popular and for scientific purposes, superior even to the German bath thermometer with hermetically sealed paper scale; and this will be the form intended when we speak of a mercury thermometer, or a spirit thermometer, or a liquid thermometer, without any special qualification.

§ 29. *Properties of Matter concerned in Liquid Thermometers.*—The indications of the liquid thermometer depend not only upon the expansion of the liquid with heat; they are seriously modified by the expansion experienced also by the containing solid. The instrument in fact consists of a glass measure measuring the bulk of a liquid. If the bulk of the hollow space in the glass and the bulk of the liquid expand by the same amount, the apparent bulk of the liquid as thus measured will remain unchanged. Now, supposing the glass to be perfectly homogeneous and isotropic (see art. ELASTICITY, §§ 38, 39, and chap. i. of Mathematical Theory), and the bulb to be free from internal strain, the glass will, when warmed uniformly, expand equally in all directions, and the volume of the hollow space will be altered in the same ratio as the volume of the glass itself. Hence the indications of the thermometer depend on a difference between the expansion of the glass and the expansion of the liquid.

§ 30. To define exactly the indications of a thermometer founded on the expansion of a fluid, let the volume of the bore of the stem between two consecutive divisions be called for brevity a *degree measure*. The degree measure is habitually made as nearly as possible equal throughout the scale in the best mercury-in-glass thermometers; and, as we shall see (§ 62), it ought to be so in an air thermometer to give indications agreeing with the absolute thermodynamic scale nearly enough for the most accurate practical thermometry. But in practical spirit-thermometers the divisions are made to correspond as nearly as may be to degrees of a standard mercury or air thermometer, and the degree measures are therefore (Table II. below) larger and larger from the lower to the upper end of the scale. For the purpose, however, of comparing the thermometric performances of different liquids, we shall suppose the degree measure to be of equal volume throughout the scale in each case.

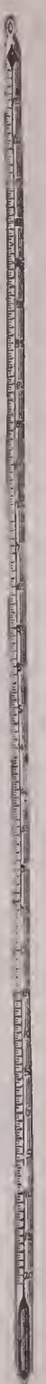


FIG. 5.

Let N be the number of degree measures contained in the volume of the bulb and stem up to the point marked zero on the scale; and let D_t denote the volume, at any temperature t, of the degree measure reckoned in absolute units of volume. The volume of the bulb and stem up to zero will be ND_t. On the supposition of perfect isotropy and freedom from strain in the glass, N will be independent of the temperature and D_t/D_0 will be the ratio of the volume of any portion of the glass at temperature t to its volume at the temperature called zero, if D_0 denote the volume of the degree measure when the glass is at this zero temperature. Let now L_t and L_0 denote the volumes of the whole liquid in a thermometer at the two temperatures t and 0; we have $L_0 = ND_0$. And if s be the number of scale divisions marking the place of the liquid surface in the thermometer tube, we have $L_t = (N + s)D_t$. Hence $L_t/L_0 = (1 + s/N)D_t/D_0$. Hence $s = N\left(\frac{L_t/L_0}{D_t/D_0} - 1\right)$. Hence, if E'_t denote augmentation of bulk of the liquid, and E_t augmentation of bulk of each degree-division of the stem, when temperature is raised from 0 to t, each reckoned in terms of the bulk at zero temperature, we have

$$s = N\left(\frac{1 + E_t}{1 + E'_t} - 1\right) = N\,\frac{E_t - E'_t}{1 + E'_t}.$$

This is the formula for the ordinary liquid thermometer. It is also applicable to the constant pressure air thermometer, in which, with proper instrumental means to keep the pressure constant, air is allowed to expand or contract with elevation or depression of temperature, and its volume is measured in a properly shaped glass measuring vessel. We may arbitrarily determine to take s as the numeric for the temperature which is indicated by any one particular thermometer of this kind, for instance, a methyl butyrate thermometer, or an alcohol thermometer, or a mercury or an air thermometer. But if $s = t$ for any one individual thermometer, it cannot be *exactly* so for any other. In the first advances towards accurate thermometry it was taken so for *the* mercury-in-glass thermometer, and by general consent it was continued so until it was found (§ 25) that different mercury-in-glass thermometers, each made with absolute accuracy, differ largely in their reckonings of temperature.

§ 31. *Numerical Thermometry.*—In § 12 above, a perfectly definite and very simple basis for numerical thermometry was described, not as having been adopted in practice, but as an illustration of a very general principle upon which reckoning of temperature may be done in numbers. The principle is this. Two definite temperatures depending on properties of some particular substance or substances are first fixed upon and marked by two arbitrary numbers,—as, for instance, the temperature of melting ice marked zero, and the temperature of steam issuing from boiling water under atmospheric pressure of exactly one atmo, marked 100. Then any intermediate temperature t is obtained by taking t parts of water at zero and $(100 - t)$ parts at 100° and mixing them together. As said in § 12 this method is limited to temperatures at which liquid water can be obtained, and therefore practically it is only applicable between the melting point of ice and the boiling point of water, under ordinary atmospheric pressure.

Thermometer defined to make constant the specific heat of water.

§ 32. Any other liquid of permanent chemical constitution might be used instead of water as the thermometric substance in thermometry founded on mixtures; so even might a powdered solid. Oil if used instead of water would have the advantage of being available for higher temperatures; but want of perfect definiteness and constancy of chemical constitution is a fatal disqualification for it as the fundamental thermometric substance for thermometry by mixtures. Liquid mercury might be used with the advantage of being available for both higher and lower temperatures than water, through a much wider whole range indeed than either water or oil. For use as thermometric substance for the method of mixtures both water and mercury, in the conditions of approximate purity in which they are easily obtained in abundance, have a paramount advantage over all other liquids, in near enough approximation to perfect definiteness and constancy of constitution to give practically perfect thermometric results.

Thermometry by mixtures.

§ 33. In §§ 12, 24, 25, 30, 31, 32, several distinct definitions of numerical reckoning of temperature have been given. In each of these the differences of temperature which are to be called equal are defined specially, and this is the essence of the thermometric scale in each case (the marking of 0° and 100° for the "freezing" and "boiling" points being common to all as a matter of practical usage and not an essential of the thermometric principle in any case) Thus in, §§ 12, 31, and 32 differences of temperature are called equal which are produced by the communication of

Different equally permissible thermometric assumptions.

[1] Provided it is never exposed to "browning" temperatures (or temperatures high enough to produce partially destructive distillation of the paper). Instrument makers ignoring this caution have actually made it with graduation extending to such temperatures for kitchen use. The result is that it gets injured to the extent of partially browning the hermetically sealed paper, and befogging the inner surface of the glass envelope, by applying it to test the temperature of melted fat in cooking. For this purpose the simple scientific thermometer with graduation on the glass stem is proper.

equal quantities of heat to a given quantity of the particular thermometric substance chosen—water, for example, or mercury; in other words (§ 68 below), this thermometric system is chosen so as to make the specific heat of a particular thermometric substance the same for all temperatures. Again in § 24 differences of temperature are called equal for which the differences of pressure are equal in air of the particular density which air has if its pressure is one atmo when its temperature is "freezing." This is Regnault's "normal thermometry." In § 25 (1), (2), (3), (4), other reckonings of temperature differing essentially from this, though, as Regnault's experiments proved, by but very small differences, are given simply by the substitution of air of other than Regnault's normal density, and of other gases than air, for the air of Regnault's normal thermometer. In § 25 (5) a thermometry founded on a complex coefficiency of change of pressure and volume of a gas and change of volume of some one particular glass vessel is defined and compared with Regnault's normal thermometry; and in § 25 (6) and (7) the same is done for the ordinary mercury-in-glass thermometer, which depends on a coefficiency of glass and mercury leading to the reckoning of temperature defined in § 30. Again in § 26 and § 24 (I.) is indicated a system of thermometry founded on the absolute dilatation of some fluid, such as mercury or alcohol or butyrate of oxide of methyl or other permanent liquid or air, at some constant pressure, such as one atmo, with equal differences of temperature defined as those which give equal dilatations of the particular substance chosen as the thermometric fluid.

Each founded on a particular property of a particular substance.

§ 34. Each of all these different definitions of temperature is founded on some particular property of a particular substance. A thermometer graduated to fulfil one of the definitions for one particular substance would not agree with another thermometer graduated according to the same definition for another substance, or according to some of the other definitions. A much more satisfactory foundation for thermometry is afforded by thermodynamic science, which (see THERMODYNAMICS) gives us a definition of temperature depending on certain thermodynamic properties of matter in such a manner that if a thermometer is graduated according to it from observation of one class of thermal effects in one particular substance, it will agree with a thermometer graduated according to the same thermodynamic law from the same class of effects in any other substance, or from the same or from some other class of effects in another substance. Thus we have what is called the absolute thermodynamic scale. This scale is now in modern thermal science the ultimate scale of reference for all thermometers of whatever kind (§ 67). It is defined in §§ 35 and 37 after the following preliminary. A piece of matter which we shall call the "thermometric body" or "thermometric substance" must be given, and at each instant it must be throughout at one temperature, whatever operations we perform upon it. For simplicity we shall suppose it to be of one substance throughout. It may be all solid, or it may be partly solid and the remainder gaseous (as the contents of a wholly frozen cryophorus [1] or any other form of closed vessel full of ice and vapor of water, but with no air); or it may at one particular temperature in the course of its use be partly solid and partly liquid and partly gaseous (as the contents of a partially frozen cryophorus); or it may be partially liquid and partially gaseous (as the contents of an unfrozen cryophorus or of a "philosopher's hammer");[2] or it may be all liquid; or it may be all gas; or it may be all fluid at a temperature above the Andrews "critical temperature."[3] If it be all solid it may be under any homogeneous stress (ELASTICITY, Mathematical Theory, part i., chap. i.); but in any case we suppose for simplicity the stress to be homogeneous throughout, and therefore if the thermometric body be partly solid and partly fluid, the stress in the solid as well as in the fluid must be *uniform pressure in all directions*. To avoid excluding the case of all solid from our statements, we shall use generally the word *stress*, which will mean normal pressure reckoned in number of units of force per unit of area in every case in which the whole or any part of the thermometric body is fluid, and will denote this or any other possible stress when the thermometric body is all solid.

Preliminary for thermodynamic definition of temperature.

[1] See articles LIQUID, MATTER (PROPERTIES OF), and STEAM.
[2] *Ibid.* [3] *Ibid.*

§ 35. (1) Alter the bulk or shape of the thermometric substance till it becomes warmer to any desired degree. (2) Keeping it now at this higher temperature, alter bulk or shape farther, and generate the heat which the substance takes to keep its temperature constant, by stirring water, or a portion of the substance itself, if it is partly fluid, and measure the quantity of work spent in this stirring. (3) Bring it back towards its original bulk and shape till it becomes cooled to its original temperature. (4) Keeping it at this temperature, reduce it to its original bulk and shape, carrying off, by a large quantity of water, the heat which it must part with to prevent it from becoming warmed. Find by a special experiment how much work must be done to give an equal amount of heat to an equal amount of water by stirring. Then the ratio of the first measured quantity of work to the second is the ratio of the higher temperature to the lower on the absolute thermodynamic scale.

First definition:—by ratio of two temperatures.

Carnot's thermodynamic cycle generalized.

§ 36. The following is equivalent to § 35, and is more convenient for analytical use. It is derived from § 35 by supposing the first and third operations to be so small that the ratio defined as the ratio of the two temperatures is infinitely nearly unity, and conversely § 35—our first form of definition of absolute temperature—may be derived from the second, which is to be now given, by passing through a finite range of temperature by successive infinitesimal steps, and applying the second definition to each step.

§ 37. Let the thermometric body be infinitesimally warmed by stirring a portion or the whole of itself if it be partially or wholly fluid; or by stirring a quantity of fluid in space around it if it be all solid; and during the process let the stress upon the body be kept unchanged. The body expanding or contracting or changing its shape with the heat, as the case may be, does work upon the surrounding material by which its stress is maintained. Find the ratio of the amount of work thus done to the amount of work spent in the stirring. For brevity we shall call this the work-ratio. Again, let the stress be infinitesimally increased, the thermometric body being now for the time enclosed in an impermeable envelope so that it may neither gain nor lose caloric. It will rise (or fall)[4] in temperature in virtue of the augmentation of stress. *The ratio of this infinitesimal elevation of temperature to the whole absolute temperature is equal to the work-ratio multiplied into the ratio of the infinitesimal augmentation of stress to the whole stress.*

Second definition of absolute temperature:—by ratio of an infinitesimal difference of temperatures to whole temperature.

§ 38. To show how our definition of absolute temperature is to be applied in practice take the following examples. Example 1.—Any case in which the thermometric substance is part in one condition and the remainder in another of different density, as part solid and part vapor, or part solid and part liquid, or part liquid and part steam. In this last case, as explained above (§ 34), we suppose the stress to be uniform pressure in all directions.

Let p be its amount, and let t be the absolute temperature corresponding to this pressure. Let σ be the ratio of the density of the rarer to that of the denser portion, ρ the density of the rarer portion, and $J\kappa$ the quantity of work required to generate the heat taken to convert unit mass of the substance from the lower to the higher condition (κ the "latent heat" of transition from the lower to the higher condition per unit mass of the substance, and J the dynamical equivalent of the thermal unit in which κ is measured). The work done by the substance in passing from the denser to the rarer condition per unit volume of the latter is $p(1-\sigma)$, and the amount of work required to generate the heat taken in doing so is $J\rho\kappa$. Hence the work-ratio of our second definition is

$$\frac{p(1-\sigma)}{J\rho\kappa}, \quad \ldots\ldots\ldots \quad (1).$$

Let now the pressure be increased by an infinitely small quantity dp, and, the substance being still in the two conditions but of uniform temperature throughout, let dt be the corresponding rise in temperature. We have by the definition (§ 37)

$$\frac{dt}{t} = \frac{p(1-\sigma)}{J\rho\kappa}\frac{dp}{p} = \frac{1-\sigma}{J\rho\kappa}dp.$$

[4] In the case of fall the elevation of temperature is to be regarded as negative: and in this case the "work-ratio" is negative also.

Hence
$$\frac{1}{t}\cdot\frac{dt}{dp}=\frac{1-\sigma}{J\rho\kappa} \quad \ldots\ldots (2).$$

Hence by integration

$$\left.\begin{aligned}\log\frac{t}{t_0}&=\int_{p_0}^{p}\frac{(1-\sigma)dp}{J\rho\kappa}\\ \text{or}\quad t&=t_0\varepsilon^{\int_{p_0}^{p}\frac{(1-\sigma)\,dp}{J\rho\kappa}}\end{aligned}\right\} \quad \ldots\ldots (3).$$

Water-steam thermometer.

§ 39. Fig. 6 represents a thermometer constructed to show absolute temperature on the plan of example 1, § 38, realized for the case of water and vapor of water as thermometric substance. The containing vessel consists of a tube with cylindric bulb like an ordinary thermometer; but, unlike an ordinary thermometer, the tube is bent in the manner shown in the drawing. The tube may be of from 1 to 2 or 3 millims. bore, and the cylindrical part of the bulb of about ten times as much. The length of the cylindrical part of the bulb may be rather more than $\frac{1}{100}$ of the length of the straight part of the tube. The contents, water and vapor of water, are to be put in and the glass hermetically sealed to enclose them, with the utmost precautions to obtain pure water as thoroughly freed from air as possible, after better than the best manner of instrument makers in making cryophoruses and water hammers. The quantity of water left in at the sealing must be enough to fill the cylindrical part of the bulb and the horizontal branch of the tube. When in use the straight part of the tube must be vertical with its closed end up, and the part of it occupied by the manometric water-column must be kept at a nearly enough definite temperature by a surrounding glass jacket-tube of iced water. This glass jacket-tube is wide enough to allow little lumps of ice to be dropped into it from its upper end, which is open. By aid of an india-rubber tube connected with its lower end, and a little movable cistern, as shown in the drawing, the level of the water in the jacket is kept from a few inches above to a quarter of an inch below that of the interior manometric column. Thus, by dropping in lumps of ice so as always to keep some unmelted ice floating in the water of the jacket, it is easy to keep the temperature of the top of the manometric water-column exactly at the freezing temperature. As we shall see presently, the manometric water below its free surface may be at any temperature from freezing to 10° C. above freezing without more than $\frac{1}{40}$ per cent. of hydrostatic error. The temperature in the vapor-space above the liquid column may be either freezing or anything higher. It ought not to be lower than freezing, because, if it were so, vapor would condense as hoar frost on the glass, and evaporation from the top of the liquid column would either cryophoruswise (see LIQUID and THERMODYNAMICS) freeze the liquid there, or would cool it below the freezing point.

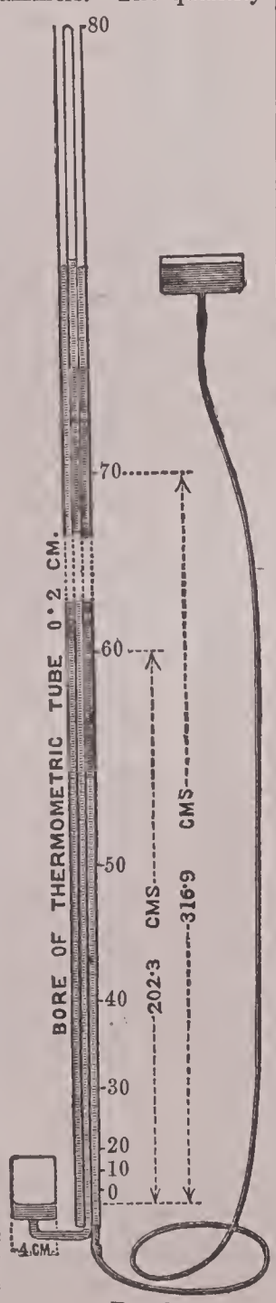


FIG. 6.

§ 40. The chief object of keeping the top of the manometric column exactly at the freezing point is to render perfectly definite and constant the steam pressure in the space above it.

A second object of considerable importance when the bore of the tube is so small as one millimetre is to give constancy to the capillary tension of the surface of the water. The elevation by capillary attraction of ice-cold water in a tube of one millimetre bore is about 7 millims. The constancy of temperature provided by the surrounding iced water will be more than sufficient to prevent any perceptible error due to inequality of this effect. To avoid error from capillary attraction the bore of the tube ought to be very uniform, if it is so small as one millimetre. If it be three millimetres or more, a very rough approach to uniformity would suffice.

A third object of the iced-water jacket, and one of much more importance than the second, is to give accuracy to the hydrostatic measurement by keeping the density of the water throughout the long vertical branch definite and constant. But the density of water at the freezing point is only $\frac{1}{40}$ per cent. less than the maximum density, and is the same as the density at 8° C.; and therefore when $\frac{1}{40}$ per cent. is an admissible error on our thermometric pressure, the density will be nearly enough constant with any temperature from 0° to 10° C. throughout the column. But on account of the first object mentioned above the very top of the water column must be kept with exceeding exactness at the freezing temperature.

§ 41. In this instrument the "thermometric substance" (§ 34) is the water and vapor of water in the bulb, or more properly speaking the portions of water and vapor of water infinitely near their separating interface. The rest of the water is merely a means of measuring hydrostatically the fluid pressure at the interface. When the temperature is so high as to make the pressure too great to be conveniently measured by a water column, the hydrostatic measurement may be done, as shown in the annexed drawing (fig. 7), by a mercury column in a glass tube, surrounded by a glass water jacket not shown in the drawing, to keep it very accurately at some definite temperature so that the density of the mercury may be accurately known.

The simple form of steam thermometer represented with figured dimensions in fig. 6 will be very convenient for practical use for temperatures from freezing to 60°. Through this range the pressure of water-steam, reckoned in terms of the balancing column of water of maximum density, increases (Table V.) from 6¼ to 202·3 centimetres; and for this therefore a tube of a little more than 2 metres will suffice. From 60° to 140° the pressure of steam now reckoned in terms of the length of a balancing column of mercury at 0° increases from 14·88 to 271·8 centimetres; and for this a tube of 280 centimetres may be provided. For higher temperatures a longer column, or several columns, as in the multiple manometer, or an accurate air pressure-gauge, or some other means, such as a very accurate instrument constructed on the principle of Bourdon's metallic pressure-gauge, may be employed, so as to allow us still to use water and vapor of water as thermometric substance.

High pressure steam thermometer.

§ 42. At 230° C., the superior limit of Regnault's high-pressure steam experiments, the pressure is 27·53 atoms, but there is no need for limiting our steam thermometer to this temperature and pressure. Suitable means can easily be found for measuring with all needful accuracy much higher pressures than 27 atmos. But at so high a temperature as 140°, vapor of mercury measured by a water column, as shown in the diagram (fig. 8), becomes available for purposes for which one millimetre to the degree is a sufficient sensibility. The mercury-steam-pressure thermometer, with pressure measured by water-column, of dimensions shown in the drawing, serves from 140° to 280° C., and will have very ample sensibility through the upper half of its scale. At 280° its sensibility will be about 4¾ centimetres to the degree! For temperatures above 280° sufficient sensibility for most purposes is obtained by substituting mercury for water in that simplest form of steam thermometer shown in fig. 6, in which the pressure of the steam is measured by a column of the liquid itself kept at a definite temperature. When the liquid is mercury there is no virtue in the particular temperature 0° C., and a stream of water as nearly as may be of atmospheric temperature will be the easiest as well as the most accurate way of keeping the mercury at a definite temperature. As the pressure of mercury steam is at all ordinary atmospheric temperatures quite imperceptible to the hydrostatic test when mercury itself is the balancing liquid, that which was the chief reason for fixing the temperature at the interface between liquid and vapor at the top of the pressure-measuring column when the balancing liquid was water (§ 40) has no weight in the pres-

ent case; but, on the other hand, a much more precise definiteness than the ten degrees latitude allowed in the former case for the temperature of the main length of the manometric column is now necessary. In fact, a change of temperature of 2·2° in mercury at any atmospheric temperature produces about the same proportionate change of density as is produced in water by a change of temperature from 0° to 10°, that is to say, about $\frac{1}{20}$ per cent.; but there is no difficulty in keeping, by means of a water jacket, the mercury column constant to some definite temperature within a vastly smaller margin of error than 2·2°, especially if we choose for the definite

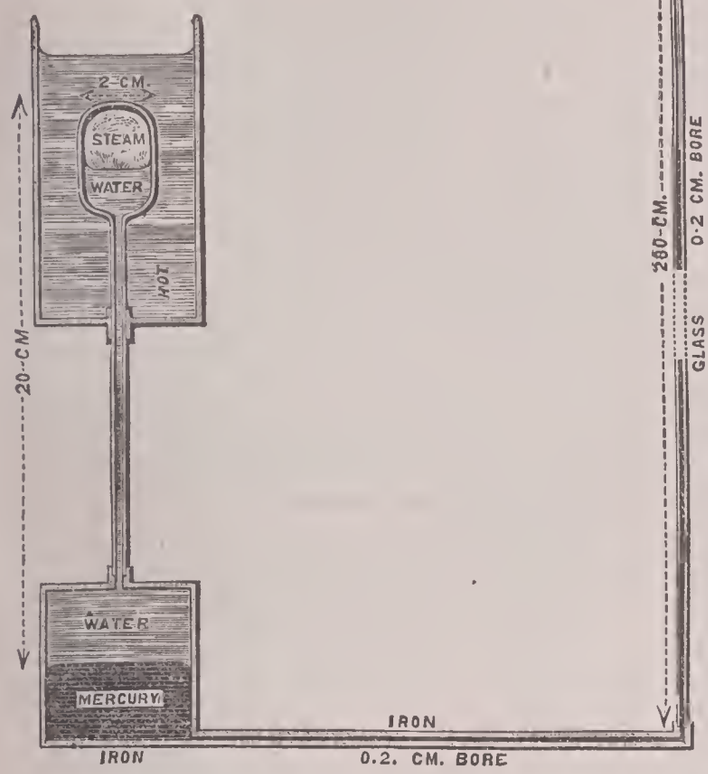


Fig. 7.

temperature something near the atmospheric temperature at the time, or the temperature of whatever abundant water supply may be available. If the vertical tube for the pressure-measuring mercury column be 830 centimetres long, the simple mercury-steam thermometer may be used up to 520° C., the highest temperature reached by Regnault in his experiments (Table V. below) on mercury-steam. By using an iron bulb and tube for the part of the thermometer exposed to the high temperature, and for the lower part of the measuring column to within a few metres of its top, with glass for the upper part to allow the mercury to be seen, a mercury-steam-pressure thermometer can with great ease be made which shall be applicable for temperatures giving pressures up to as many atmospheres as can be measured by the vertical height available. The apparatus may of course be simplified by dispensing with the Torricellian vacuum at the upper end of the tube, and opening the tube to the atmosphere, when the steam-pressure to be measured is so great that a rough and easy barometer observation gives with sufficient accuracy the air-pressure at the top of the measuring column. The easiest, and not necessarily in practice the least accurate, way of measuring very high pressures of mercury-steam will be by enclosing some air above the cool pressure-measuring column of mercury, and so making it into a compressed-air pressure-gauge, it being understood that the law of compression of the air under the pressures for which it is to be used in the gauge is known by accurate independent experiments such as those of Regnault on the compressibility of air and other gases.

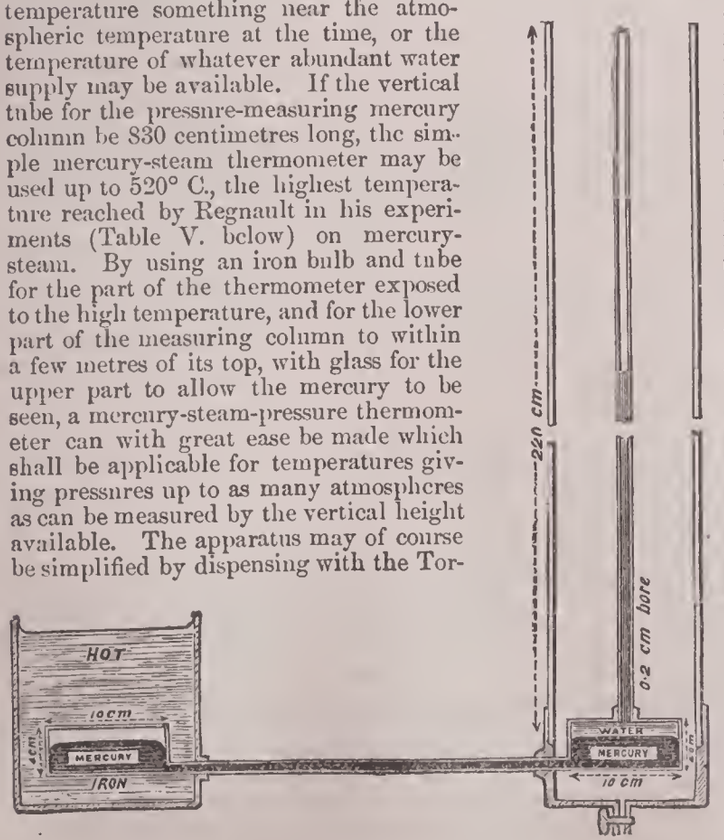


Fig. 8.

§ 43. The water-steam thermometer may be used, but somewhat precariously, for temperatures below the freezing point, because water, especially when enclosed and protected as the portion of it in the bulb of our thermometer is, may be cooled many degrees below its freezing point without becoming frozen; but, not to speak of the uncertainty or instability of this peculiar condition of water, the instrument would be unsatisfactory on account of insufficient thermometric sensibility for temperatures more than two or three degrees below the freezing point. Hence, to make a steam thermometer for such temperatures some other substance than water should be taken, and none seems better adapted for the purpose than sulphurous acid, which, in the apparatus represented with figured dimensions in the accompanying diagram (fig. 9), makes an admirably convenient and sensitive thermometer for temperatures from + 20° to something far below −30°, as we see from the results of Regnault's measurements (Table VI. below).

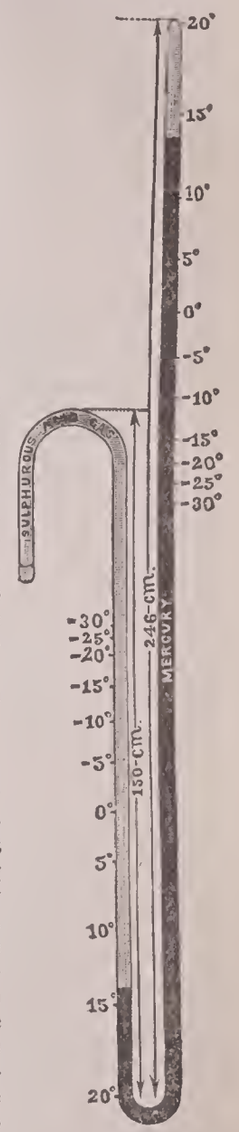


Fig. 9.

§ 44. To sum up, we have in §§ 39 ... 43 a complete series of steam-pressure thermometers, of sulphurous acid, of water, and of mercury, adapted to give absolutely definite and highly sensitive thermometric indications throughout the wide range from something much below −30° to considerably above 520° of the centigrade scale. The graduation of the scales of these thermometers to show absolute temperature is to be made by calculation from formula (3) of § 38, when the requisite experimental data, that is to say, the values of σ and $\rho\kappa$ for different values of p throughout the range for which each substance is to be used as thermometric fluid are available. Hitherto these requisites have not been given by direct experiment for any one of the three substances with sufficient accuracy for our thermometric purpose through any range whatever. Water, naturally, is the one for which the nearest approach to the requisite information has been obtained. For it Regnault's experiments have given, no doubt with great accuracy, the values of p (the steam pressure) and of κ (the latent heat of steam per unit mass) for all temperatures reckoned by his normal air thermometer, which we now regard merely as an arbitrary scale of temperature, through the range from −30° to +230°. If he, or any other experimenter, had given us with similar accuracy through the same range the values of ρ (the density of steam) and σ (the ratio of the density of steam to the density of water in contact with it), for temperatures reckoned on the same arbitrary scale, we should have all the data from experiment required for the gradation of our water-steam thermometer to absolute thermodynamic scale. For it is to be remarked that all reckoning of temperature is eliminated from the second member of formula (3), and that in our use of it Regnault's normal thermometer has merely been referred to for the

values of $\rho\kappa$ and of $1 - \sigma$, which correspond to stated values of p. The arbitrary constant of integration, t_0, is truly arbitrary. It will be convenient to give it such a value that the difference of values of t between the freezing point of water and the temperature for which p is equal to one atmo shall be 100, as this makes it agree with the centigrade scale in respect to the difference between the numbers measuring the temperatures which on the centigrade scale are marked 0° and 100°. We shall see (§ 56 below) that indirectly by means of experiments on hydrogen gas this assignation of the arbitrary constant of integration would give 273 for the absolute temperature 0° C., and 373 for that of 100° C. Meantime, as said above, we have not the complete data from direct experiments even on water-steam for graduating the water-steam thermometer; but on the other hand we have, from experiments on air and on hydrogen and other gases, data which allow us to graduate indirectly any continuous intrinsic thermoscope (§ 19 above) according to the absolute scale; and we shall see that by thus indirectly graduating the water-steam thermometer, we learn the density of steam at different temperatures more accurately than it has hitherto been made known by any direct experiments on water-steam itself.

§ 45. Merely viewed as a continuous intrinsic thermoscope, the steam thermometer, in one or other of the forms described above to suit different parts of the entire range from the lowest temperatures to temperatures somewhat above 520°, is no doubt superior in the conditions for accuracy specified in § 16 to every other thermoscope of any of the different kinds hitherto in use; and it may be trusted more surely for accuracy than any other as a thermometric standard, when once it has been graduated according to the absolute scale, whether by practical experiments on steam, or indirectly by experiments on air or other gases. In fact, the use of steam-pressure measured in definite units of pressure, as a thermoscopic effect, in the steam thermometer is simply a continuous extension to every temperature of the principle already practically adopted for fixing the temperature which is called 100° on the centigrade scale; and it stands on precisely the same theoretical footing as an air thermometer, or a mercury-in-glass thermometer, or an alcohol thermometer, or a methyl butyrate thermometer, in respect to the graduation of its scale according to absolute temperature. Any one intrinsic thermoscope may be so graduated ideally by thermodynamic experiments on the substance itself without the aid of any other thermometer or any other thermometric substance; but the steam-pressure thermometer has the great practical advantage over all others, except the air thermometer, that these experiments are easily realizable with great accuracy instead of being, though ideally possible, hardly to be considered possible as a practical means of attaining to thermodynamic thermometry. In fact, for water-steam it is only the most easily obtained of experimental data, the measurement of the density of the steam at different pressures, that has not already been actually obtained by direct experiment. Whether or not when this lacuna has been filled up by direct experiments, the data from water-steam alone may yield more accurate thermodynamic thermometry than we have at present from the hydrogen or nitrogen gas thermometer (§§ 64 . . . 69 below), we are unable at present to judge. But when once we have the means, directly from itself, or indirectly from comparison with hydrogen or nitrogen or air thermometers, of graduating once for all a sulphurous acid steam thermometer, water-steam thermometer, or mercury-steam thermometer, that is to say, when once we have a table of the absolute thermodynamic temperatures corresponding to the different steam pressures of the substances sulphurous acid, water, and mercury, we have a much more accurate and more easily reproducible standard than either the air or gas thermometer of any form, or the mercury thermometer, or any liquid thermometer can give. In fact, the series of steam thermometers for the whole range from the lowest temperatures can be reproduced with the greatest ease in any part of the world by a person commencing with no other material than a piece of sulphur and air to burn it in,[1] some pure water and some pure mercury, and with no other apparatus than can be made by a moderately skilled glass-blower, and with no other standard of physical measurement of any kind than an accurate linear measure. He may assume the force of gravity to be that calculated for his latitude, with the ordinary rough allowance for his elevation above the sea, and his omission to measure with higher accuracy the actual force of gravity in his locality can lead him into no thermometric error which is not incomparably less than the inevitable errors in the reproduction and use of the air thermometer, or of mercury or other liquid thermometers. In temperatures above the highest for which mercury-steam pressure is not too great to be practically available, nothing hitherto invented but Deville's air thermometer with hard porcelain bulb suited to resist the high temperature is available for accurate thermometry.

Deville's accurate pyrometer.

§ 46. We have given the steam thermometer as our first example of thermodynamic thermometry because intelligence in thermodynamics has been hitherto much retarded, and the student unnecessarily perplexed, and a mere quicksand has been given as a foundation for thermometry, by building from the beginning on an ideal substance called perfect gas, with none of its properties realized rigorously by any real substance, and with some of them (see MATTER, LIQUID, STEAM) unknown, and utterly unassignable, even by guess. But after having been moved by this reason to give the steam-pressure thermometer as our first theoretical example, we have been led into the preceding carefully detailed examination of its practical qualities, and we have thus become convinced that though hitherto used in scientific investigations only for fixing the "boiling point," and (through an inevitable natural selection) by practical engineers for knowing the temperatures of their boilers by the pressures indicated by the Bourdon gauge, it is destined to be of great service both in the strictest scientific thermometry and as a practical thermometer for a great variety of useful applications.

§ 47. Example 2 (including example 1).—Any case in which the stress is uniform pressure in all directions.

Let p and v denote the pressure and volume. The condition of the substance (single, double, or triple, as the case may be) is determinate when p and v are given, and it will therefore be spoken of shortly as the condition (p, v). Let e be the energy which must be communicated to the substance to bring it from any conveniently defined zero condition (p_0, v_0) to any condition whatever (p, v). Remark that e is a function of the two independent variables p, v to be found by experiment, and that the finding of it by experiment is a perfectly determinate practical problem, which can be carried out without the aid of any thermoscope, and without any consideration whatever relating to temperature. We shall see in fact that accurate practical solutions of it for many different substances have been obtained by experiment (see THERMODYNAMICS). The absolute temperature t is also a function of p and v to be also determined by experiment, according to the equivalent definitions of §§ 35 and 37. Let heat be communicated to the substance so as to cause its volume to increase by dv, the pressure being kept constant. The energy of the body will be augmented by

$$\frac{de}{dv} \cdot dv.$$

At the same time the body in expanding and pressing out the matter around it does work to the extent of

$$p \cdot dv \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Hence the whole work required to generate the heat given to it amounts to

$$\left(\frac{de}{dv} + p\right) dv \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5).$$

Hence the ratio of (4) to (5), or

$$\frac{p}{\frac{de}{dv} + p} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6),$$

is the "work-ratio" of § 37. Hence by the definition

$$\frac{Dt}{t} = \frac{dp}{p} \cdot \frac{p}{\frac{de}{dv} + p} = \frac{dp}{\frac{de}{dv} + p} \quad . \quad . \quad . \quad . \quad (7),$$

where Dt denotes the change of temperature produced by augmenting the pressure by dp, and at the same time preventing the substance from either giving heat to or taking heat from the surrounding matter. To express this last condition analytically, let dv be the augmentation of volume (negative, of course, if dp be positive) which it implies. The work done on the substance by the pressure from without is $-p\,dv$, and the energy of the substance is augmented by just this amount, because of the condition to be expressed. Hence

Operation called adiabatic compression by Rankine.

[1] Practically, the best ordinary chemical means of preparing sulphurous acid, as from sulphuric acid by heating with copper, might be adopted in preference to burning sulphur.

$$\frac{de}{dv}\,dv + \frac{de}{dp}\,dp = -p\,dv \quad . \quad . \quad . \quad . \quad . \quad . \quad (8);$$

whence

$$dv = \frac{-\frac{de}{dp}}{\frac{de}{dv} + p}\,dp \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9).$$

But

$$\mathrm{D}t = \frac{dt}{dp}\,dp + \frac{dt}{dv}\,dv,$$

and so we have

$$\mathrm{D}t = \left(\frac{dt}{dp} - \frac{\frac{dt}{dv}\,\frac{de}{dp}}{\frac{de}{dv} + p}\right)dp \quad . \quad . \quad . \quad . \quad . \quad (10).$$

Eliminating $\mathrm{D}t/dp$ from this by (7) we find

$$t = \left(p + \frac{de}{dv}\right)\frac{dt}{dp} - \frac{de}{dp}\,\frac{dt}{dv} \quad . \quad . \quad . \quad . \quad . \quad . \quad (11).$$

§ 48. This is a linear partial differential equation of the first order for the determination of t, supposing, as we do for the present, that e is a known function of p and v. The following graphical illustration of the well-known analytical process for finding the complete solutions of such equations shows exactly how much towards determination of temperature can be done with no other data from experiment than the values of $\frac{de}{dv}$ and $\frac{de}{dp}$ as functions of p and v, and what additional information is required to fully determine t.

Called thermodynamic function by Rankine, called entropy by Clausius and subsequent writers.

First remark that (11) is the condition that $\frac{1}{t}$ be a factor rendering $\left(p + \frac{de}{dv}\right)dv + \frac{de}{dp}\,dp$ a complete differential of a function[1] of two independent variables p and v. Let ϕ be this function,—that is to say, let ϕ be such that

$$\left.\begin{aligned} &\frac{d\phi}{dv} = \frac{1}{t}\left(p + \frac{de}{dv}\right), \text{ and } \frac{d\phi}{dp} = \frac{1}{t}\,\frac{de}{dp} \\ \text{or} \quad &t = \frac{p + \frac{de}{dv}}{\frac{d\phi}{dv}} = \frac{\frac{de}{dp}}{\frac{d\phi}{dp}} \end{aligned}\right\} \quad . \quad . \quad (12).$$

Then every solution of the differential equation

$$\frac{dp}{dv} = -\frac{p + \frac{de}{dv}}{\frac{de}{dp}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

Called adiabatics by Rankine, isentropics by Willard Gibbs. Complete diagram of adiabatics drawn.

renders ϕ constant; and conversely, every series of values of p and v which renders ϕ constant constitutes a solution of (13). Now this differential equation may be solved graphically by taking p and v as rectangular co-ordinates of a point in a plane, and drawing the whole series of curves which satisfy it as follows. Commence with any point and calculate for its values of p and v the value of the second member of (13). Draw through this point an infinitesimal line in the direction of the tangent to the curve given by the value so found for $\frac{dp}{dv}$. With the altered values of p and v corresponding to the other end of this infinitesimal line, calculate a fresh value of $\frac{dp}{dv}$, and continue the curve in the slightly altered direction thus found and so on. Take another point anywhere infinitesimally near this curve but not in it, and draw by a similar process the curve through it satisfying the equation. Take a third point infinitely near this second curve, and draw through it a third curve satisfying (13), and so on till the whole area of values p, v, possible for the substance in question, is filled with a series of curves one of which passes through, or infinitely nearly through every point of the area. Assign arbitrarily a particular value of ϕ to each of these curves; then graphically find $\frac{d\phi}{dv}$ and $\frac{d\phi}{dp}$ for any or every value of p and v. Then either of the two second forms of equation (12) gives us explicitly a value of t for any values whatever of p and v.

[1] This function is of great importance in practical thermodynamics: multiplied by t_0, it is equal to the excess of the energy of the substance above its motivity. Motivity (defined by Sir Wm. Thomson, *Proceedings, R.S.E.*, 1879) is the amount of work obtainable by letting the substance pass from the state (p, v) in which it is given to the zero condition (p_0, v_0), without either taking in heat from or giving out heat to matter at any other temperature than t_0. See THERMODYNAMICS.

§ 49. The solution for t thus obtained involves the arbitrary assumption of a particular value of ϕ for each one of the series of curves which we have determinately traced. Hence, to render t wholly determinate, something more must be given than e as a function of p and v. Now the only thing that can be given respecting temperature for any particular substance before we have a thermometric scale is the relation subsisting between p and v when the temperature is constant. This relation can, with merely a single-temperature-thermoscope (§ 15 above), in addition to dynamical instruments, be determined for some one particular temperature; and this, if e be known for every value of p and v, is the only additional knowledge required for the determination of t for every value of p and v. For let $p = f(v)$ be the relation between p and v for some one particular temperature, t_0. If by this we eliminate p from (12) we find

Completed solution of differential equation for t with one arbitrary function.

Arbitrary function of the analytical solution determined by experiment.

$$\frac{d\phi}{dv} = \frac{1}{t_0}\left[f(v) + \frac{de}{dv}\right] \quad . \quad . \quad . \quad (14);$$

where $\frac{de}{dv}$, when $p = f(v)$, becomes a known function of v alone. Hence by integration we find

$$\phi = \frac{1}{t_0}\left[\mathrm{F}(v) + \mathrm{C}\right] . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (15),$$

where F denotes a known function and C an arbitrary constant. Now trace the curve $p = f(v)$ on our diagram. It must generally cut every one of the previously drawn determinate series of curves. Hence equation (15), with two arbitrarily assigned constants t_0 and C, gives determinately the value of ϕ for every one of the diagram of curves, and thus ϕ is determined for every value of p and v. Either of equations (12) then gives t determinately as a function of p and v, with only the value t_0 arbitrary. The information from experiment, regarding the properties of the thermometric substance, on which this determination is founded, consists of a knowledge of the relation between p and v for any one temperature, and of the value of $e - e_0$ for all values of p, v (e_0 denoting the unknown value of e for some particular values $p_0 v_0$). Although, theoretically, this information is attainable by purely dynamical operations and measurements, with no other thermal guidance or test than that afforded by a single-temperature-intrinsic-thermoscope (§ 15), the whole of it has not in fact been explicitly obtained for any one substance. But less than the whole of it suffices to make a perfect absolute thermometer of any given substance.

Completed determination of absolute temperature from results of experiment.

§ 50. For this purpose it is not necessary to find t for all values of p and v: it is enough to know it for all values mutually related in any manner convenient for thermometric practice. For example, if we could find t for every value of v with p constant at some one particular chosen value,—this would give a "constant pressure" absolute thermometer. Or again, if we find t for every value of p with v kept constant,—this would give us a "constant volume" absolute thermometer. Let us now examine into the restricted dynamic and thermoscopic investigations upon any particular substance, which will suffice to allow us to make of it a standard absolute thermometer of one or other of these species.

§ 51. *Dynamical and thermoscopic investigation required to graduate, according to the absolute scale, a constant-pressure thermometer of any particular fluid.*—Let a large quantity of fluid be given, and let proper mechanical means be taken to cause it to flow slowly and uniformly through a pipe, in one short length of which there is a fixed porous plug. If, as is the case with common air, nitrogen, oxygen, carbonic acid, and no doubt many other gases, the fluid leaves the plug cooler than it enters it, let there be a paddle in the stream flowing from the plug, and let this paddle be turned so as to stir the fluid and cause the temperature, when the rapids are fairly past and the eddies due to the stirring subsided, to be the same as in the stream flowing towards the plug. When, as in the case of hydrogen and of all ordinary liquids, the fluid flows away from the plug warmer than it entered it, let a uniform stream of water be kept flowing in a separate canal outside the tube round a portion of it in which the internal flow is from the plug, and by this means let the temperature of the internal fluid be brought to equality with that which it had on entering the plug. By a separate thermodynamic experiment find how much work would have to be spent in stirring the external stream of water by a paddle to warm it as much as it is warmed by conduction from the internal fluid across the separating tube. Returning now to the internal fluid flowing towards

and from the plug, let $p+\delta p$ be the pressure in the steady stream approaching the disturbed region, and p the pressure in the steady stream flowing from the disturbed region; and let δw be the quantity of work done by the paddle per unit of mass of the fluid passing by, reckoned positive in the first case, that namely in which the paddle compensates a cooling effect experienced in passing through the porous plug. In the second case $-\delta w$ (in this case a positive quantity) must denote the work done by the paddle upon the supposed external stream of water in the separate thermodynamic experiment. It is to be reckoned per unit mass of the internal fluid, irrespeetively of the rate of flow of the external water. Let t denote the temperature of the fluid aeeording to the thermodynamie scale, and let δt denote the infinitely small change of temperature which it must experience to produee an infinitesimal expansion from volume v to volume $v+\delta v$ under constant pressure. We have

$$\frac{v}{t}\frac{dt}{dv}=\frac{1}{1+\frac{1}{v}\frac{\delta w}{\delta p}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (16).$$

Proof.—Let $v+\delta v$, v, and $e+\delta e$, e, be respectively the amounts of the volume and of the energy of the fluid per unit mass, in the tranquil stream before and after passing the disturbed region. The work done by an ideal piston pressing the fluid in towards the disturbed region is $(p+\delta p)(v+\delta v)$, and the work done by the emergent stream upon an ideal piston moving before it is pv, each reckoned per unit of mass, of the fluid. The whole work done on the fluid per unit mass by these ideal pistons is $p\delta v+v\delta p$; add to this δw done by the paddle, and we find that, on the whole, an amount of work equal to $p\delta v+v\delta p+\delta w$ is done on the fluid in passing through the disturbed region. Hence e exeeeds $e+\delta e$ by this amount; that is to say,

$$-\delta e=p\delta v+v\delta p+\delta w \quad . \quad . \quad . \quad . \quad . \quad (17).$$

Now the paddle and plug together aet so as to render the temperatures equal in the tranquil streams at pressures p and $p+\delta p$. But if there were ehange of temperature its analytical expression would be

$$\delta t=\frac{dt}{dv}\delta v+\frac{dt}{dp}\delta p \quad . \quad . \quad . \quad . \quad . \quad (18).$$

Hence δv and δp are so proportioned as to make this vanish. That is to say, we have

$$\delta v=-\frac{\frac{dt}{dp}}{\frac{dt}{dv}}\delta p \quad . \quad . \quad . \quad . \quad . \quad . \quad (19);$$

and we have

$$\delta e=\frac{de}{dv}\delta v+\frac{de}{dp}\delta p;$$

hence (17) divided by δp beeomes

$$\frac{de}{dv}\cdot\frac{\frac{dt}{dp}}{\frac{dt}{dv}}-\frac{de}{dp}=p\frac{-\frac{dt}{dp}}{\frac{dt}{dv}}+v+\frac{\delta w}{\delta p} \quad . \quad . \quad . \quad (20).$$

Using this in (11) we find

$$\frac{t}{\frac{dt}{dv}}=v+\frac{\delta w}{\delta p} \quad . \quad . \quad . \quad . \quad . \quad . \quad (21).$$

Dividing (21) by v, and taking the reciproeal of both members, we have the equation (16) which was to be proved.

§ 52. Now if for any particular fluid at some one given pressure p, with infinitesimal excess δp above this pressure for the higher pressure in the thermodynamie experiment, we find neither heating nor eooling effect in passing through the porous plug, the paddle has nothing to do; that is, $\delta w=0$. If, with always the same pressure p, but with different values of v, that is to say, with the fluid given at different temperatures, but with pressures infinitely nearly the same, we always find the same result, $\delta w=0$, it follows from (16) that for this partieular fluid at the particular pressure of the experiment, and for all the temperatures of the experiment, we have

$$\frac{v}{t}\frac{dt}{dv}=1 \quad . \quad . \quad . \quad . \quad . \quad . \quad (22).$$

Hence by integration

$$t=Cv \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (23).$$

Hence we infer that with this fluid for thermometrie substanee, with the particular pressure of the experiment, and throughout the range of temperatures for which experiment has given us $\delta w=0$, absolute temperature is shown on a seale graduated and numbered in simple proportion to the whole volume of the fluid.

§ 53. If the thermodynamic test repeated for the same fluid at different pressures gives still the same result, we have, for all pressures and temperatures within the range for which the supposed result $\delta w=0$ has been found by the experiment,

$$t=f(p)v \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (24);$$

where $f(p)$ denotes a quantity whieh depends only on the pressure of the fluid and is independent of its density.

§ 54. Joule and Thomson's experiments on the thermal effects of fluids in motion[1] showed that for pressures of from one to five or six atmos hydrogen gas, eommon air, nitrogen, oxygen, and carbonic aeid, all somewhat approximately fulfil the eondition of passing through the porous plug without change of temperature,—hydrogen much more approximately, earbonic aeid mueh less approximately, than any of the others. Hence we infer that absolute temperature is somewhat approximately proportional to the volume of the fluid, if any one of these gases be used as the thermometric fluid in a constant-pressure thermometer. We shall presently see that the requisite eorreetion of this statement for the case of hydrogen is so small as to be almost within the limits of accuracy of the most aecurate thermometrie usage.

§ 55. In the case of common air, nitrogen, oxygen, and carbonic aeid, the experiments showed a slight cooling effect upon the fluid in passing through the porous plug; in the case of hydrogen, a much smaller heating effect. Aceording to the rigorous dynamical form of our statement of § 51, we have no right to measure these heating and eoolIng effeets on any scale of temperature, as we have not yet formed a thermometric scale. And it is interesting to remark that in point of faet the thermodynamic experiment described in that seetion involves the use of a differential thermoscope (§ 13) and not of any intrinsic thermoscope at all; and in respeet to this requisite it may be eontrasted with the thermodynamic investigation of § 49 previously, which involved the use, not of any continuous thermoscope, but only of a single-temperature intrinsic thermoseope (§ 14). Now, instead of reekoning on any thermometrie scale the cooling effect or the heating effeet of passage through the plug, we have to measure the quantity of work (δw) required to annul it, in the ease of the majority of gases; and in the case of hydrogen, instead of reekoning on any thermometric scale the heating effect, we have to measure $-\delta w$ as explained in § 51. The experiments as aetually made by Joule and Thomson simply gave the eooling effeets and heating effects shown by mercury thermometers in the tranquil stream towards and from the plug; but the very thermometers that were used had been used by Joule in his original experiments determining the dynamical equivalent of heat, and again in his later experiments by whieh for the first time the specifie heat of air at eonstant pressure was measured with sufficient aceuraey for our present purpose. Hence by putting together different experiments which had aetually been made with those thermometers of Joule's, the operation of measuring δw, at all events for the case of air, was virtually eompleted. Thus aeeording to our present view the mercury thermometers are merely used as a step in aid of the measurement of δw, and their scales may be utterly arbitrary, provided we know the quantity of work required to raise unit mass of any of the fluids concerned through the partieular differenees of temperature aetually shown by the thermometers in the Joule and Thomson experiment. The best way of doing this of course is to take advantage of the best measurements, that is to say Regnault's, of the thermal capacity of air at constant pressure, and then to calculate aeeording to Joule's own measurement the dynamieal equivalent of the heat required to warm water through one degree of his own thermometers.

§ 56. Let K be the thermal capaeity, pressure eonstant, of the fluid experimented on, J the dynamieal equivalent of the thermal unit, and δt the cooling effeet (reekoned negative when the effeet is *rise* of temperature), as measured by Joule's thermometers. We have

$$\delta w=JK\delta t \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (25).$$

[1] *Transactions Royal Society*, June, 1853, June, 1854, June, 1860, and June, 1862.

Hence (16) becomes

$$\frac{v}{t}\frac{dt}{dv} = \frac{1}{1+\frac{JK}{v}\frac{\delta t}{\delta p}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (26).$$

The experiment showed δt to be simply proportional to δp, not merely for an infinitesimal difference of pressures but for pressures up to 5 or 6 atmos. For the case of hydrogen[1] the heating effect observed amounted, per 100 inches of mercury, to ·100 of a degree centigrade at temperatures of 4° or 5° centigrade, and to ·155 of a degree centigrade at temperatures of from 89° to 93° centigrade. The investigation was not carried out in sufficient detail to give any law of variation of this effect with temperature, and it was not even absolutely proved to be greater for the higher than for the lower temperature. In the circumstances we may take the mean of the results for the higher and lower temperatures, say ·13 per 100 inches of mercury, or ·039 per atmo. Hence if Π denotes the force per unit of area in the pressure called "one atmo," we have

$$\frac{\delta t}{\delta p} = -\frac{\cdot 039}{\Pi},$$

$$\frac{v}{t}\frac{dt}{dv} = \frac{1}{1-\cdot 039\frac{JK}{\Pi v}} \quad . \quad . \quad . \quad . \quad . \quad (27).$$

Hence

$$\frac{dt}{t} = \frac{dv}{v-\cdot 039JK/\Pi},$$

which gives by integration

$$t = C(v-\cdot 039JK/\Pi) \quad . \quad . \quad . \quad . \quad . \quad (28).$$

The arbitrary constant C depends on the unit adopted for temperature. Let this be such that the difference of temperature between freezing and boiling is 100 (which will make our arbitrary scale agree with the ordinary centigrade scale in respect to the difference between these two temperatures). Denote now by t_0 the absolute temperature corresponding to 0° C. The absolute temperature corresponding to 100° C. will be $t_0 + 100$. Denote also by v_0 and v_{100}, for the same two temperatures, the bulks of unit mass of hydrogen at any constant pressure within the limits of Joule and Thomson's experiments, say, from one to five or six atmos. Then by dividing the value of each member of (28) for 0° C. by the difference of its values for 0° and 100°, we find

$$\frac{t_0}{100} = \frac{v_0-\cdot 039JK/\Pi}{v_{100}-v_0} \quad . \quad . \quad . \quad . \quad . \quad (29).$$

Hence

$$t_0 = \frac{100}{E}(1-\cdot 039JK/\Pi v_0) \quad . \quad . \quad . \quad (30);$$

where E denotes the expansion of hydrogen, pressure constant, from 0° to 100° C. in terms of its volume at 0°, that is to say,

$$E = \frac{v_{100}-v_0}{v_0} \quad . \quad . \quad . \quad . \quad . \quad . \quad (31).$$

Let V_0 denote what the volume would be at 0° C. if the pressure were Π instead of the actual pressure p. We have

$$t_0 = \frac{100}{E}\left(1-\frac{V_0}{v_0}\cdot 039JK/\Pi V_0\right) \quad . \quad . \quad . \quad (32).$$

Regnault finds (*Expériences*, vol. ii. p. 122) that the value of $K/\Pi V_0$ for hydrogen agrees within ½ per cent. with its value for common air; and for common air he finds $K = \cdot 238$. Thus with 423·5 for the value of J in metres (§ 9 above) we find $JK = 100\cdot 79$ metres. And Regnault's observations on the density of air give for ΠV_0 (or the height of the homogeneous atmosphere at 0° C.) 7990 metres. Hence for common air, and therefore also for hydrogen, $JK/\Pi V_0 = \cdot 0126$; and thus (32) becomes

$$t_0 = \frac{100}{E}\left(1+c\frac{V_0}{v_0}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad (33),$$

with $c = -\cdot 00049$ for hydrogen. For this gas expanding under constant pressure of one atmo Regnault found (*Expériences*, vol. i. p. 80) $E = \cdot 36613$, which gives $\frac{100}{E} = 273\cdot 13$. Hence (33), with $v_0 = V_0$, gives

$$t_0 = 273\cdot 00 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (34);$$

that is to say:—

Evaluation of ratio of the absolute temperature corresponding to 100° C. to the absolute temperature corresponding to 0° C.

§ 57. We conclude from Regnault's observations on the expansion of hydrogen from 0° to 100° C. under a constant pressure of one atmo, and from the small heating effect discovered in Joule and Thomson's experiments on the forcing of hydrogen through a porous plug, that the absolute temperature of melting ice is 273·00°, if the unit or degree of absolute temperature is so chosen as to make the difference one hundred between the temperatures of melting ice and of water with steam at one atmo of pressure.

[1] Joule and Thomson, *Transactions Royal Society*, June, 1860.

§ 58. An almost identical number for that most important physical constant, the absolute temperature of melting ice, is obtained from observations on common air, and a not very different number from observations on carbonic acid, the only two gases besides hydrogen for which Regnault (*Expériences*, vol. i. p. 90) measured the expansion under constant pressure, and for which Joule and Thomson made their experiment on the thermal effect of passage through a porous plug. For each of these two gases the thermal effect observed was a lowering of temperature, and was found to vary at different temperatures very nearly in the inverse proportion of the square of the temperature C., by mercury thermometer, with 273 added. Hence nearly enough for use in the small term of the denominator of (26) we have, for air and carbonic acid,

$$\frac{\delta t}{\delta p} = A\left(\frac{273}{t}\right)^2\frac{p}{\Pi} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (35),$$

where t denotes as before absolute temperature, and A the amount of the cooling effect per atmo of difference of pressures, on the two sides of the plug, at the temperature of melting ice. The values of A found for common air and carbonic acid are ·275 and 1·388. Regnault (*Expériences*, vol. ii. p. 126) finds $JK/\Pi V_0$ greater for carbonic acid than for common air in the ratio of 1·39 to 1 on the average of temperatures from 0° to 210°. But he found also that the specific heat of carbonic acid varies greatly with the temperature; and taking the mean of the values which he finds for it at 0° and 100°, p. 130, as the proper mean for our present purpose, we find for $JK/\Pi V_0$, a value 1·29 times its value for common air. From these experimental results we find by the mathematical process below (§ 61) still the same approximate formula (33), but with $c = +\cdot 0026$ for common air, and $c = +\cdot 0163$ for carbonic acid. At constant pressure of one atmo Regnault's measurements gave $E = \cdot 36706$ for common air, and $E = \cdot 3710$ for carbonic acid; and dividing 100 by these decimals we find respectively 272·44 and 269·5. The corrections on these numbers by formula (33) to give the absolute temperature of freezing are accordingly +·70 and +4·4, and the corresponding estimates for the required absolute temperature are 273·14 and 273·9. Bringing together the results in the three cases, we see them conveniently in the following table:—

Name of Gas.	Expansion at one atmo according to Regnault. E.	Proper mean[2] cooling-effect of forcing through porous plug per atmo according to Joule and Thomson. M.	Uncorrected estimate of absolute temperature of melting ice. $\frac{100}{E}$.	Correction calculated from cooling-effect. $\frac{100}{E}\times\frac{JK}{\Pi V_0}M$.	Resulting estimate of absolute temperature of melting ice. t_0.
Hydrogen.....	·36613	−0°·039	273·13	−0°·13	273·00
Air.....	·36706	+0°·208	272·44	+0°·70	273·14
Carbonic acid....	·37100	+1°·105	269·5	+4°·4	273·9

[2] Investigated in § 61 below.

The close agreement of the results from hydrogen and common air is very satisfactory, and it is interesting to see it brought about with so large a correction calculated from the Joule and Thomson effect. It is also interesting to see the sevenfold larger correction of nearly 5° bringing so nearly the same result from the 1 per cent. larger expansion of carbonic acid. The ⅓ per cent. discrepance which remains between the results from carbonic acid and from hydrogen is not satisfactory, and requires explanation, particularly when we remark that of five measurements by Regnault (*Expériences*, vol. i. p. 84) of the expansion of carbonic acid under constant pressure of one atmo, all lie within $\frac{1}{5\cdot 7}$ per cent. of the mean number ·3710 which he has given, and we have taken, as his result.

Notwithstanding that the Joule and Thomson correction is so much greater for common air than for hydrogen, the result from common air is probably the most trustworthy of the three, because both Regnault's experiments and Joule and Thomson's were probably more accurate for air than for either of the other two gases. The true result to one place of decimals may therefore be considered as most probably being 273·1°, but the probability that it is nearer 273·1° than 273·0° is scarcely enough to make it worth while to use in any ordinary thermodynamic calculations any other number than 273°, which is exactly that found from hydrogen.

§ 59. The real meaning of our result 273·1° for the absolute temperature of melting ice, expressed without any choice of degrees or units for temperature, is that the ratio of the temperature at which vapor of water has a pressure of one atmo to the temperature at which ice melts is 373·1/273·1. Still another way of saying the same thing, this time eliminating all numerical reckoning of temperature, is (see THERMODYNAMICS) as follows:—

Determination of duty of perfect engine with source and refrigerator at those temperatures.

FOR EVERY HUNDRED UNITS OF HEAT CONVERTED INTO WORK BY A PERFECT THERMODYNAMIC ENGINE, 373·1 ARE TAKEN FROM THE SOURCE, AND 273·1 REJECTED TO THE REFRIGERATOR, IF THE TEMPERATURE OF THE SOURCE BE THAT AT WHICH STEAM OF WATER HAS A PRESSURE OF ONE ATMO, AND THE TEMPERATURE OF THE REFRIGERATOR THAT AT WHICH ICE MELTS.

§ 60. *Integration of differential equation* (26), § 56, *between volume and absolute temperature for a gas, derived from the Joule and Thomson experiment.*

Returning to § 56 we may write equation (26) as follows:—

$$t\frac{dv}{dt} - v = JK\frac{\delta t}{\delta p} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (36).$$

For each of the five gases experimented on, namely, common air, oxygen, nitrogen, carbonic acid, hydrogen, the experiment showed that, for all pressures up to five or six atmos, $\delta t/\delta p$ was sensibly independent of the pressure, but that it varied very considerably with the temperature. Hence, if we put $\delta t/\delta p = \theta/\Pi$, θ, which will thus denote the cooling effect per atmo of differential pressure, is a function of the temperature, and is independent of the whole pressure. With this notation (36) becomes

$$t\frac{dv}{dt} - v = \frac{JK}{\Pi}\theta.$$

This is a linear equation in z with a second member, if for a moment we put $z = \log t$. Integrating it, and replacing t, we find, as the complete integral,

$$v = t\left\{\frac{v_0}{t_0} + \frac{JK}{\Pi}\int_{t_0}^{t}\frac{\theta dt}{t^2}\right\} \quad . \quad . \quad . \quad . \quad . \quad (37).$$

§ 61. *Expansions of different gases, pressure constant, calculated from the Joule and Thomson experiment.* We have from equation (37)

$$\frac{v - v_0}{v_0} = \frac{t - t_0}{t_0}\left\{1 + \frac{JKt_0}{\Pi v_0}\,\frac{1}{1 - \frac{t_0}{t}}\int_{t_0}^{t}\frac{\theta dt}{t^2}\right\} \quad . \quad . \quad (38).$$

For each of the gases experimented on, except hydrogen, θ was found to vary nearly in the inverse ratio of t^2. Putting then $\theta = A(t_0/t)^2$, we find

$$t_0\int_{t_0}^{t}\theta dt/t^2 = \tfrac{1}{3}A\left[1 - \left(\frac{t_0}{t}\right)^3\right].$$

Hence, for these gases at pressures from 0 to 5 or 6 atmos, (38) becomes

$$\frac{v - v_0}{v_0} = \frac{t - t_0}{t_0}\left\{1 + \tfrac{1}{3}A\frac{JK}{\Pi v_0}\left[1 + \frac{t_0}{t} + \left(\frac{t_0}{t}\right)^2\right]\right\} \quad . (39).$$

This shows that the "proper mean cooling effect" (M in the table of § 58) is

$$\tfrac{1}{3}\left[1 + \frac{t_0}{100 + t_0} + \left(\frac{t_0}{100 + t_0}\right)^2\right]A,$$

$$= \tfrac{1}{3}\left(1 + \frac{1}{1{\cdot}3663} + \frac{1}{1{\cdot}3663^2}\right)A = {\cdot}756A,$$

which differs so little from

$$\tfrac{1}{2}\left(1 + \frac{1}{1{\cdot}3663^2}\right)A = {\cdot}769A,$$

the arithmetic mean of the cooling effects at 0° and 100° C., that if we had simply taken the arithmetic mean for each of the other gases, as for want of knowing better we took it for hydrogen, the difference in the result would have been barely perceptible.

§ 62. Modifying (39) or (38) to suit any two temperatures, t, t', we have

$$\frac{v - v'}{v'} = \frac{t - t'}{t'}\left(1 + \frac{JK}{\Pi v'}m\right) \quad . \quad . \quad . \quad . \quad (40),$$

m denoting the proper mean cooling effect per atmo in the Joule and Thomson experiment (to be reckoned as negative in the case of hydrogen or any other gas, if there is any other, in which the experiment shows a heating effect). This "proper mean" may be taken as the arithmetic mean of the values for t and t', unless $t - t'$ considerably exceeds 100.

To reduce (40) to numbers, let V_0 be the volume of unit mass of the gas when at the temperature of melting ice, and under one atmo of pressure. Regnault (vol. ii. p. 303) finds that the value of K/V_0 is within 1 per cent. the same for oxygen, nitrogen, and hydrogen as for common air. He also (vol. ii. pp. 224–226) finds K to be the same for common air at from 1 to 12 atmos; for hydrogen, 1 to 9; for carbonic acid, 1 to 37.

No doubt similar constancy would be found for oxygen and nitrogen. Hence, as above (§ 56), for common air we still have $JK/\Pi V_0 = {\cdot}0126$, and thus (40) becomes

$$\frac{v - v'}{v'} = \frac{t - t'}{t'}\left(1 + \frac{V_0}{v'}{\cdot}0126m\right) \left\{\begin{array}{c}\text{for common air,}\\ \text{oxygen,}\\ \text{hydrogen, and}\\ \text{nitrogen}\end{array}\right\} . \quad (41).$$

If in this formula we take t and t' for the temperatures of 100° C. and 0° C., $(v - v')/v'$ becomes $\frac{100}{273{\cdot}1}$ or ·3662; and we therefore find

$$E = {\cdot}3662\left(1 + \frac{V_0}{v_0}{\cdot}0126m\right) \quad . \quad . \quad . \quad . \quad (42),$$

which agrees with (33) above.

§ 63. The values given by Joule and Thomson's experiment for m are − 0·039° for hydrogen, + 0·208° for air, +0·253° for oxygen, and +0·249° for nitrogen.

From these and from the previous results for carbonic acid (§ 58) we have the following table for calculating the expansions from 0° C. to 100° C. of the gases named:—

Name of Gas.	Expansion under constant pressure (= E).
Hydrogen.....	·3662 (1 − 0·00049 V_0/v_0)
Common air.....	·3662 (1 + 0·0026 V_0/v_0)
Oxygen.....	·3662 (1 + 0·0032 V_0/v_0)
Nitrogen.....	·3662 (1 + 0·0031 V_0/v_0)
Carbonic acid.....	·3662 (1 + 0·0163 V_0/v_0)

. (43).

These formulæ must be exceedingly near the truth for all pressures from 0 to 6 atmos, because within this range, the thermal effects in the Joule and Thomson experiment were very approximately in simple proportion to the differences of pressure on the two sides of the plug. The following table of results calculated from (43) for several pressures of from 0 to 6 atmos is interesting as showing such different expansions for the different cases, determined by thermodynamic theory from Regnault's measurements of specific heats and Joule and Thomson's of their particular thermal effect, with absolutely no direct measurement of expansion except the one for common air at one atmo, shown as the third entry of column 5 in the table. The other five entries of column 5 show a fair amount of agreement between our theoretical results and the only direct measurements by Regnault. More of direct measurement, to allow a more extensive comparison, is very desirable.

Name of Gas.	Ratio of Bulk at 0° C. to Bulk supposing Pressure were 1 atmo at the same temperature. $\frac{v_0}{V_0}$.	Ratio of Density at 0° C. to Density supposing Pressure were 1 atmo at the same temperature. $\frac{V_0}{v_0}$.	Expansion, pressure constant, from 0° to 100° C.	
			According to theory.	According to direct experiments by Regnault.
Hydrogen.....	∞	0	·3662	...
	1	1	·3660	·36613
	1/3	3	·3657	...
	1/3·35	3·35	·3656	·36616
	1/6	6	·3651	...
Common Air.....	∞	0	·3662	...
	1	1	·3672	·36706
	1/3	3	·3691	...
	1/3·38	3·38	·3694	·36954
	1/6	6	·3719	...
Oxygen.....	∞	0	·3662	...
	1	1	·3674	...
	1/3	3	·3697	...
	1/6	6	·3732	...
Nitrogen.....	∞	0	·3662	...
	1	1	·3673	...
	1/3	3	·3696	...
	1/6	6	·3730	...
Carbonic acid....	∞	0	·3662	...
	1	1	·3721	·37099
	1/3	3	·3841	...
	1/3·316	3·316	·3859	·38455
	1/6	6	·4019	...

§ 64. We are now quite prepared to make a practical working thermometer directly adapted to show temperature on the absolute thermodynamic scale through the whole range of temperature, from the lowest attainable by any means to the highest for which glass remains solid. It is

to be remarked that our investigation of § 51, and all the deduced formulæ and relative calculations, are absolutely independent of the approximate fulfilment of Boyle's law by the gases to which we have applied them, and are equally applicable without any approach to fulfilment of Boyle's law; also that the only experimental data on which are founded our special numerical conclusions of §§ 59 to 63 are Regnault's measurements of specific heats under constant pressures, and Joule and Thomson's measurements of the thermal effect of forcing through a porous plug. From these experimental data alone we see by formula (38) of § 61 how to graduate a constant-pressure gas thermometer so that it shall show temperature on the absolute thermodynamic scale. Hence, notwithstanding the difficulty (§ 24 above) which Regnault found in the thermometric use of air or other gases on the system of constant pressure, and his practical preference for the constant-volume air thermometer, it becomes of the highest importance to construct a practical constant-pressure gas thermometer. This we believe may be done by avoiding the objectionable expedient adopted by Pouillet and Regnault of allowing a portion (when high temperatures are to be measured the greater portion) of the whole gas to be pressed into a cool volumetric chamber out of the thermometric chamber proper by the expansion of the portion which remains in; and instead fulfilling the condition, stated, but pronounced practically impossible, by Regnault (*Expériences*, vol. i. pp. 168, 169), that the thermometric gas "shall, like the mercury of a mercury thermometer, be allowed to expand freely at constant pressure in a calibrated reservoir maintained throughout at one temperature." We have accordingly designed a constant-pressure gas thermometer to fulfil this condition. It is represented in the accompanying drawing (fig. 10), and described in the following section.

§ 65. The vessel containing the thermometric fluid, which in this case is to be either hydrogen or nitrogen,[1] consists in the main of a glass bulb and tube placed vertically with bulb up and mouth down; but there is to be a secondary tube of much finer bore opening into the bulb or into the main tube near its top, as may be found most convenient in any particular case. The main tube, which, to distinguish it from the secondary tube, will be called the volumetric tube, is to be of large bore, not less than 2 or 3 centimetres, and is to be ground internally to a truly cylindric form. To allow this to be done it must be made of thick, well-annealed glass like that of the French glass-barrelled air-pumps. The secondary tube, which will be called the manometric capillary, is to be of round bore, not very fine, say from half a millimetre to a millimetre diameter. Its lower end is to be connected with a mercury manometer to show

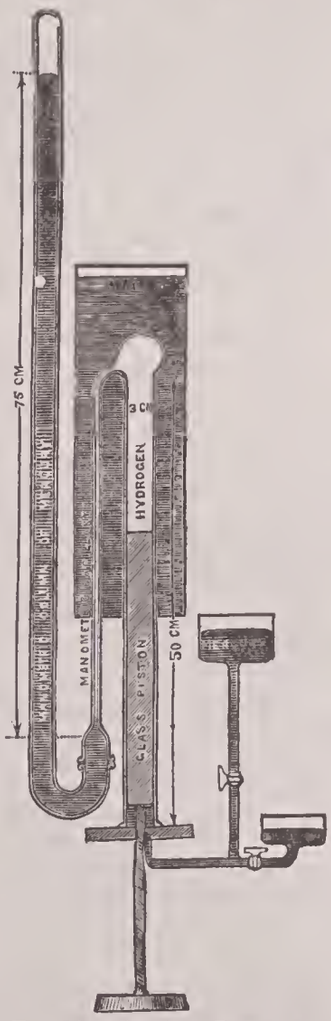


FIG. 10.—Constant-Pressure Hydrogen Thermometer.

if the pressure of the thermometric air is either greater or less than the definite pressure to which it is to be brought every time a thermometric measurement is made by the instrument. The change of volume required to do this for every change of temperature is made and measured by means of a micrometer screw[2] lifting or lowering a long solid glass piston, fitting easily in the glass tube, and caulked air-tight by mercury between its lower end and an iron sole-plate by which the mouth of the volumetric tube is closed. To perform this mercury caulking, when the piston is raised and lowered, mercury is allowed to flow in and out through a hole in the iron sole-plate by an iron pipe, connected with two mercury cisterns at two different levels by branches each provided with a stopcock. When the piston is being raised the stopcock of the branch leading to the lower cistern is closed, and the other is opened enough to allow the mercury to flow up after the piston and press gently on its lower side, without entering more than infinitesimally into the space between it and the surrounding glass tube (the condition of the upper bounding surface of the mercury in this respect being easily seen by the observer looking at it through the glass tube). When the piston is being lowered the stopcock in the branch leading from the upper cistern is closed, and the one in the branch leading to the lower cistern is opened enough to let the mercury go down before the piston, instead of being forced to any sensible distance into the space between it and the surrounding tube, but not enough to allow it to part company with the lower surface of the piston. The manometer is simply a mercury barometer of the form commonly called a siphon barometer, with its lower end not open to the air but connected to the lower end of the manometric capillary. This connection is made below the level of the mercury in the following manner. The lower end of the capillary widens into a small glass bell or stout tube of glass of about 2 centimetres bore and 2 centimetres depth, with its lip ground flat like the receiver of an air-pump. The lip or upper edge of the open cistern of the barometer (that is to say, the cistern which would be open to the atmosphere were it used as an ordinary barometer) is also ground flat, and the two lips are pressed together with a greased leather washer between them to obviate risk of breaking the glass, and to facilitate the making of the joint mercury tight. To keep this joint perennially good, and to make quite sure that no air shall ever leak in, in case of the interior pressure being at any time less than the external barometric pressure or being arranged to be so always, it is preserved and caulked by an external mercury-jacket not shown in the drawing. The mercury in the thus constituted lower reservoir of the manometer is above the level of the leather joint, and the space in the upper part of the reservoir over the surface of the mercury, up to a little distance into the capillary above, is occupied by a fixed oil or some other practically vaporless liquid. This oil or other liquid is introduced for the purpose of guarding against error in the reckoning of the whole bulk of the thermometric gas, on account of slight irregular changes in the capillary depression of the border of the mercury surface in the reservoir.

§ 66. In the most accurate use of the instrument, the glass and mercury and oil of the manometer are all kept at one definite temperature according to some convenient and perfectly trustworthy intrinsic thermoscope (§§ 15 and 16 above), by means of thermal appliances not represented in the drawing but easily imagined. This condition being fulfilled, the one desired pressure of the thermometric gas is attained with exceedingly minute accuracy by working

[1] Common air is inadmissible because even at ordinary temperatures its oxygen attacks mercury. The film of oxide thus formed would be very inconvenient at the surface of the mercury caulking, round the base of the piston, and on the inner surface of the glass tube, to which it would adhere. Besides sooner or later the whole quantity of oxygen in the air must be diminished to a sensible degree by the loss of the part of it which combines with the mercury. So far as we know, Regnault did not complain of this evil in his use of common air in his normal air thermometer (see §§ 24, 25 above), nor in his experiments on the expansion of air (*Expériences*, vol. i.), though probably it has vitiated his results to some sensible degree. But he found it to produce such great irregularities when, instead of common air, he experimented on pure oxygen that from the results he could draw no conclusion as to the expansion of this gas (*Expériences*, vol. i. p. 77). Another reason for the avoidance of air or other gas containing free oxygen is to save the oil or other liquid which is interposed between it and the mercury of the manometer from being thickened or otherwise altered by oxidation.

[2] This screw is to be so well fitted in the iron sole-plate as to be sufficiently mercury-tight without the aid of any soft material, under such moderate pressure as the greatest it will experience when the pressure chosen for the thermometric gas is not more than a few centimetres above the external atmospheric pressure. When the same plan of apparatus is used for investigation of the expansion of gases under high pressures, a greased leather washer may be used on the upper side of the sole in the screw-hole plate, to prevent mercury from escaping round the screw. It is to be remarked that in no case will a little oozing out of the mercury round the screw while it is being turned introduce any error at all into the thermometric result; because the correctness of the measurement of the volume of the gas depends simply on the mercury being brought up into contact with the bottom of the piston, and not more than just perceptibly up between the piston and volumetric tube surrounding it.

the micrometer screw up or down until the oil is brought precisely to a mark upon the manometric capillary.

In fact, if the glass and mercury and oil are all kept rigorously at one constant temperature, the only access for error is through irregular variations in the capillary depressions in the borders of the mercury surfaces. With so large a diameter as the 2 centimetres chosen in the figured dimensions of the drawing, the error from this cause can hardly amount to $\frac{1}{100}$ per cent. of the whole pressure, supposing this to be one atmo or thereabouts.

For ordinary uses of our constant-pressure gas thermometer, where the most minute accuracy is not needed, the rule will still be to bring the oil to a fixed mark on the manometric capillary; and no precaution in respect to temperature will be necessary except to secure that it is approximately uniform throughout the mercury and containing glass, from lower to higher level of the mercury. The quantity of oil is so small that, whatever its temperature may be, the bringing of its free surface to a fixed mark on the capillary secures that the mercury surface below the oil in the lower reservoir is very nearly at one constant point relatively to the glass, much more nearly so than it could be made by direct observation of the mercury surface, at all events without optical magnifying power. Now if the mercury surface be at a constant point of the glass, it is easily proved that the difference of pressures between the two mercury surfaces will be constant, notwithstanding considerable variations of the common temperature of the mercury and glass, provided a certain easy condition is fulfilled, through which the effect of the expansion of the glass is compensated by the expansion of the mercury. This condition is that the whole volume of the mercury shall bear to the volume in the cylindric vertical tube from the upper surface to the level of the lower surface the ratio $(\lambda - \frac{1}{3}\sigma)/(\lambda - \sigma)$, where λ denotes the cubic expansion of the mercury, and σ the cubic expansion of the solid for the same elevation of temperature, it being supposed for simplicity of statement that the tube is truly cylindric from the upper surface to the level of the lower surface, and that the sectional area of the tube is the same at the two mercury surfaces. The cubic expansion of mercury is approximately seven times the cubic expansion of glass. Hence

$$(\lambda - \tfrac{1}{3}\sigma)/(\lambda - \sigma) = (7 - \tfrac{1}{3})/6 = 1{\cdot}111.$$

Hence the whole volume of the mercury is to be about 1·111 times the volume from its upper surface to the level of the lower surface; that is to say, the volume from the lower surface in the bend to the same level in the vertical branch is to be $\frac{1}{9}$ of the volume in the vertical tube above this surface. A special experiment on each tube is easily made to find the quantity of mercury that must be put in to cause the pressure to be absolutely constant when the surface in the lower reservoir is kept at a fixed point relatively to the glass, and when the temperature is varied through such moderate differences of temperature as are to be found in the use of the instrument at different times and seasons.

A sheet-iron can containing water or oil or fusible metal, with external thermal appliances of gas or charcoal furnace, or low-pressure or high-pressure steam heater, and with proper internal stirrer or stirrers, is fitted round the bulb and manometric tube to produce uniformly throughout the mass of the thermometric gas the temperature to be measured. This part of the apparatus, which will be called for brevity the heater, must not extend so far down the manometric tube that when raised to its highest temperature it can warm the caulking mercury to as high a temperature as 40° C., because at somewhat higher temperatures than this the pressure of vapor of mercury begins to be perceptible (see Table V. below), and would vitiate the thermometric use of the pure hydrogen or nitrogen of our thermometer. To secure sufficient coolness of the mercury it will probably be advisable to have an open glass jacket of cold water (not shown in the drawing) round the volumetric tube, 2 or 3 centimetres below the bottom of the heater, and reaching to about half a centimetre above the highest position of the bottom of the piston.

Conclusion of thermometry.

§ 67. It seems probable that the constant-pressure hydrogen or nitrogen gas thermometer which we have now described may give even more accurate thermometry than Regnault's constant-volume air thermometers (§ 24 above), and it seems certain that it will be much more easily used in practice.

We have only to remark here further that, if Boyle's law were rigorously fulfilled, thermometry by the two methods would be identical, provided the scale in each case be graduated or calculated so as to make the numerical reckoning of the temperature agree at two points,—for example, 0° C. and 100° C. The very close agreement which Regnault found among his different gas thermometers and his air thermometers with air of different densities (§ 25 above), and the close approach to rigorous fulfilment of Boyle's law which he and other experimenters have ascertained to be presented by air and other gases used in his thermometers, through the ranges of density, pressure, and temperature at which they were used in these thermometers, renders it certain that in reality the difference between Regnault's normal air thermometry and thermometry by our hydrogen gas constant-pressure thermometer must be exceedingly small. It is therefore satisfactory to know that for all practical purposes absolute temperature is to be obtained with very great accuracy from Regnault's thermometric system by simply adding 273 to his numbers for temperature on the centigrade scale. It is probable that at the temperatures of 250° or 300° C. (or 523 or 573 absolute) the greatest deviation of temperature thus reckoned from correct absolute temperature is not more than half a degree.

§ 68. The thermometric scale being now thoroughly established in theory and practice (§§ 33–69 and §§ 18–30), we are prepared to define, without any ambiguity, the expressions thermal capacity and specific heat with reference to matter at any temperature and in any physical condition.

"Their capacities" and "specific heats."

Definition 1.—The thermal capacity of a body (whether it be a portion of matter homogeneous throughout or of homogeneous substance in two different conditions as liquid and steam, or solid and vapor of solid, or a piece of apparatus consisting of different parts as glass and metals, and containing as the case may be liquids or gases,—subject only to the condition that the whole matter considered is at one temperature) is the quantity of heat required to raise its temperature by one degree on the absolute thermodynamic scale.

Definition 2.—The specific heat of a substance is the thermal capacity of a stated quantity of it. This stated quantity is generally understood to be the unit of mass, unless some other definite quantity is explicitly designated, as for instance the quantity of the substance which occupies unit of volume at some definite pressure and temperature, for instance, one atmo and temperature 273 absolute. It is of no consequence what unit of mass is chosen provided it be the same as that which is used in defining the thermal unit; but, unless the contrary be explicitly stated, we always understand one gramme as the unit of mass and the thermal unit as the quantity of heat required to raise one gramme of water from 273 to 274 (compare § 6 above).

§ 69. There is scarcely any subject upon which more skilled labor in scientific laboratories, chemical and physical, has been spent than the measurement of specific heats, whether of solids, liquids, or gases. An ample and well-arranged table of results is to be found in Clarke's *Constants of Nature*, a compilation of numerical results of scientific experiments made in all parts of the world by various observers and experimenters, a most valuable aid to scientific knowledge given to the world as No. 255 of the *Smithsonian Miscellaneous Collections*. It is most interesting as showing how very differently different substances behave in respect to constancy or variation of specific heat with temperature. Thus it shows that, according to the results of all the experimenters, the specific heats of all the substances experimented on, whether simple or compound, are very nearly constant at all events for ranges between −10° and 200° or 300° C., except the three elementary substances, boron, carbon, silicon. The specific heats of these three have been found by F. Weber to vary greatly with temperature. Thus for diamond he finds the specific heat to be ·1 at 0° C. and ·27 at 206° C., or nearly threefold of the amount at 0°; at − 50° C. the specific heat is ·063; and at + 985° it is ·459 or about seven and a half times the specific heat at − 50° (a curious practical commentary, we may remark in passing, on the doctrine of the calorists on specific heat referred to in § 8 above). The specific heats of carbon in its other forms of graphite and charcoal

through wide ranges of temperature according to the same observer, F. Weber, are particularly interesting and significant. The approximate equality of the product of specific heat into the atomic weight for the simple metals is interesting and important; no less so is the utter want of constancy and uniformity in the corresponding product for other substances, whether simple or compound. If we were to define a metal as a substance for which through the range of temperature from 0° to 250° C. the product of the specific heat into the atomic weight is not less than 5·86 and not greater than 6·93, we should include every substance commonly called a metal, and no substance not commonly called a metal, except phosphorus, and solid sulphur lately fused.

Some important results of Regnault's regarding the specific heats of gases under constant pressure have been already quoted in §§ 56, 58, and 62 above. Further information from experiments aided by thermodynamic theory, regarding specific heats of gases and vapors under constant pressure and of gases in constant volume, will be found under the heading THERMODYNAMICS. To this also, and to the articles MATTER (PROPERTIES OF), LIQUID, and STEAM, the reader is referred for information respecting latent heats of liquefaction of solids and of evaporation of solids and liquids, also respecting the thermal capacity of a portion of homogeneous substance in two different states, such as the water-liquid and water-steam of an ordinary cryophorus or philosopher's hammer, or of the sulphurous acid liquid and steam of a sulphurous acid steam thermometer (§ 43 above).

TRANSFERENCE OF HEAT.

Transference of heat by conduction.

§ 70. When two contiguous portions of matter are at different temperatures, heat is transferred from the warmer to the colder. This process is called conduction of heat.

By radiation.

When two bodies at different temperatures are separated by a transparent medium, such as air, or water, or glass, or ice, heat passes from the warmer to the colder irrespectively of the temperature of the intervening medium, except in so far as its transparency may in some slight degree be affected by the temperature.

Light and radiant heat identical.

Thus the colder of the two bodies becomes actually heated above the temperature of the intervening medium if the warmer be kept above this temperature, and if heat is not otherwise drawn off from the colder body in greater quantity than the heat entering it from the warmer. This process of transference from one body to another body at a distance through an intervening medium is called radiation of heat. The condition of the intervening matter in virtue of which heat is thus transferred is called light; and radiant heat is light if we could but see it with the eye, and not merely discern with the mind, as we do, that it is perfectly continuous in quality with the species of radiant heat which we see with the material eye through its affecting the retina with the sense of light. Thus a white hot poker in a room perfectly darkened from all other lights is seen as a brilliant white light gradually becoming reddish and less bright, until it absolutely fades from vision in a dull red glow. Long after it has ceased to be visible to the eye, the fact that heat is being transferred from it to colder bodies all round it, or above it or below it, is proved by our sense of heat in a hand or face held near it on any side or above it or below it. By considering the whole phenomenon of the white hot mass, without much of experimental investigation, we judge that there is perfect continuity through the whole process, in the first part of which the radiant heat is visible and in the second part invisible to the human eye: and thorough experimental investigation confirms this conclusion. Thus radiant heat is brought under the undulatory theory of light, which in its turn becomes annexed to heat as a magnificent outlying province of the kinetic theory of heat.

§ 71. In this article we confine ourselves to a practical evaluation of rate of gain or loss of heat across the surface of an isolated solid placed in a medium such as air, and enclosed in a solid surface all at one temperature, as is approximately the case with the air and the floor, walls, and ceiling of an ordinary room. A rough approximation to the law of this action, founded on supposing the rate of motion to be in simple proportion to the excess of the temperature of the isolated solid above the temperature of the surrounding medium and enclosure was used by Fourier in those of his solutions in which surface emissivity or, as he called it, "Conductibilité extérieure," is concerned. Without adopting any hypothesis, we define thermal emissivity as the quantity of heat per unit of time, per unit of surface, per degree of excess of temperature, which the isolated body loses in virtue of the combined effect of radiation and convection by currents of air. This definition does not involve the hypothesis of simple proportionality; and the surface emissivity is simply to be determined by experiment for any given temperature of the enclosure, and any given temperature of the isolated body. Dulong and Petit made elaborate experiments on this subject, but did not give any results in absolute measure.

So far as we know the first thoroughly trustworthy experiments giving emissivities in absolute measure were made in the laboratory of the natural philosophy class in the university of Glasgow by Mr. D. Macfarlane, in a series of experiments on the cooling of a copper ball. The results are given in Table VII. The ball experimented on was 4 centimetres in diameter, and was suspended in the interior of a double-walled tin-plate vessel. The space between the double walls of this vessel was filled with water at the temperature of the air, and the interior surface was coated with lampblack. Two thermo-electric junctions, one at the centre of the ball the other in contact with the exterior surface of the enclosure, in circuit with a sensitive mirror galvanometer, served to measure the difference of temperatures between the centre of the ball and the exterior surface of the enclosure. By this arrangement the exterior junction was kept very uniformly at a temperature of 14° C., while the other had the varying temperature of the centre of the ball. Two sets of experiments were made. In one the ball had a bright surface, in the other it was coated with soot from the flame of a lamp, and in both the air was kept moist by a saucer of water placed in the interior of the tinplate enclosure. The results are given in terms of the number of units of heat lost per second, per square centimetre of surface of the copper, per degree of difference between the temperatures of the two junctions.

§ 72. Returning to the conduction of heat, we have first to say that the theory of it was discovered by Fourier and given to the world through the French Academy in his *Théorie Analytique de la Chaleur*,[1] with solutions of problems naturally arising from it, of which it is difficult to say whether their uniquely original quality, or their transcendently intense mathematical interest, or their perennially important instructiveness for physical science, is most to be praised. Here we can but give the very slightest sketch of the elementary law of conduction in an isotropic substance, the mathematical expression for it in terms of orthogonal plane or curved co-ordinates, and a few of the elementary solutions in Fourier's theory.

§ 73. Consider a slab of homogeneous solid bounded by two parallel planes. Let the substance be kept at two different temperatures over these parallel planes by suitable sources of heat and cold. For example, let one side be kept cold by a stream of cold water, or by a large quantity of ice and water in contact with it, and the other kept warm by a large quantity of warm water or by steam blown against it. Whatever particular plans of heater and refrigerator be adopted, care must be taken that the temperature be kept uniform over the whole, or over a sufficiently large area of each side of the slab, to render the isothermal surfaces sensibly parallel planes through the whole of the slab intercepted between the two calorimetric areas, and that the temperature at each side is prevented from varying with time. It will be found that heat must continually be applied at one side and removed from the other, to keep the circumstances in the constant condition thus defined. When this constant condition of surface temperature is maintained long enough, the temperature at every point of the slab settles towards a constant limiting value; and when this limiting value has been sensibly reached by every point of the slab, the temperature throughout remains sensibly constant so long as the surface temperatures are kept constant. In this condition of affairs the temperature varies continuously from one side of the slab to the other; and it is constant throughout each interior plane parallel to the sides; in other words, the isothermal surfaces are parallel planes. Let V and V′ be the temperatures in two of these isothermals

[1] A translation into English by Freeman has been recently published, in 1 vol. 8vo, by the Cambridge University Press, 1879.

and a the distance between them. The quotient $\frac{V-V'}{a}$ is the average rate of variation of temperature per unit of length between these two isothermals. Let Q be the quantity of heat taken in per unit of time at a certain area A on one side, and emitted at the corresponding area of the other side of the slab, measured by proper calorimetrical appliances to these areas, which we shall call the calorimetric areas of the apparatus. It will generally be found that the value of the quotient $(V-V')/a$ is not the same for consecutive isothermal surfaces. For metals it is ascertained by experiment that it increases continuously from the cold side to the hot side of the slab. In other words, as we shall see presently, the thermal conductivity of the substance is not generally the same at different temperatures, and for metals it is smaller the higher the temperature.

§ 74. Circumstances being as described in § 73, the thermal conductivity of the substance between the isothermals v and v' is the value of

$$\frac{Qa}{A(v-v')} \quad . \quad . \quad . \quad . \quad . \quad . \quad (1).$$

It must be remembered that the temperatures v, v' used in this definition are temperatures of the substance itself. Some experimenters have given largely erroneous results through assuming that the temperatures of the two sides of the slab were equal to those of the calorimetric fluids, such as warm water or steam on one side, and iced water or cold water, with its temperature measured by a thermometer, on the other side. To obtain correct results, the actual temperatures at two points in the conducting body itself must be ascertained by aid of suitable thermometers, or thermometers and differential thermoscopes, applied in such a way as not sensibly to disturb the isothermal surfaces. This, so far as we know, has not been done by any experimenter hitherto in attempting to measure thermal conductivity directly by the method indicated in the definition; and therefore if any results obtained by this method hitherto are trustworthy, it is only in a few cases,—cases in which, unless the substance experimented upon has been of such small conducting power, and the stirring of the calorimetric fluids on its two sides so energetic, that we can feel sure that the observed or assumed temperatures of these fluids, or of the portions of them of which the temperatures have been measured by thermometers, have not differed sensibly from the temperatures of the slab at its surfaces in contact with them.

§ 75. What utter confusion has permeated scientific literature, from experiments on thermal conductivity vitiated through non-fulfilment of this condition, is illustrated by results quoted in Everett's *Units and Physical Constants* (London, 1879), among which we find ·19 for the conductivity of copper according to Péclet, and 1·1 according to Ångström (which we now know to be correct). When we look to Péclet's and Ångström's own papers the confusion becomes aggravated. Péclet, in his *Mémoire sur la détermination des coefficients de conductibilité des métaux par la chaleur*,[1] quotes all experiments of Clément, and others more recent of Thomas and Laurent, regarding which he gives certain details. Taking his information no doubt from Péclet's paper, Ångström gives a statement[2] for the conductivity of copper, according to experimenters who had preceded him, which, with the decimal point shifted two places to the left to reduce to C. G. S., is as follows:—

Clément	·00231
Thomas and Laurent	·0122
Péclet	·178

But Ångström did not notice that Péclet had stated the thickness of the plate experimented on by Clément to be between 2 and 3 millimetres. Péclet himself in his next sentence seems to have forgotten this when he compares the figure ·23 which he had calculated from Clément's results, without taking account of the thickness of the plate, with 1·22 which he calculates from Thomas and Laurent's experiments on copper, without stating any thickness for the tube of copper on which (instead of a flat plate) they had experimented. Thus we have no data for finding what their results really were in either Péclet's or Ångström's paper; but Péclet seems to show enough regarding it to let us now feel perfectly sure that it is only a question of whether it is tens or hundreds of times too small. Omitting it then from the preceding statement, completing the correction by multiplying the ·0023 by $2\frac{1}{2}$ (assuming the thickness of the plate to be $2\frac{1}{2}$ millimetres, as Péclet says it was between 2 and 3) to give Clément's result, and appending Ångström's result, which we now know to be correct, we have the following statement for thermal conductivity of copper in C. G. S. units:—

·0057,	according to	Clément.
·178,	"	" Péclet.[3]
1·1,	"	" Ångström.

§ 76. The comparison of these results is highly instructive. Clément's result is two hundred times too small, and Péclet's five times too small. Clément experimented by exposing one side of a plate of copper of a square metre surface and about two and a half millimetres thick to steam at 100° C., and the other side to water at 28° C. It was assumed that the difference of temperatures between the two sides was 72°. The difference really was about ·36 of a degree, as we know from the quantity of heat actually conducted through it in Clément's experiment, indicated by the amount of steam which he found to be condensed into water. In fact, the amount of steam condensed did not differ sensibly from what it would have been if the copper plate had been infinitely thin, or its substance of infinite thermal conductivity. It is important in engineering, and in many of the arts and manufactures involving thermal processes, and particularly in that one of them of greater everyday value to the human race than all the others put together, cookery, to know that for copper or iron boilers, or steam-pipes, or pots or frying-pans, the transmission of heat from radiant burning coal or charcoal, or red or white hot fireclay or other solids, and from hot air in contact with them, on one side, to hot water or steam or oil or melted fat on the other side, or hot liquid or steam on one side and cool air on the other side, is for practical purposes sensibly the same as if the thermal conductivity of the metal were infinite, or its resistance to the transmission of heat nothing. The explanation is obvious to us now with the definite and sure knowledge regarding thermal conductivities of different substances and of matter in different conditions, solid, liquid, and gaseous, gained within the last twenty years. Ångström, Forbes, F. Neumann, and Tait have given, each one of them with thoroughly sufficient experimental evidence to leave no room to doubt the substantial accuracy of his results, absolute values for the thermal conductivities of copper and iron. Clausius and Maxwell have given us thermal conductivities of air and other gases, from their splendid development of the kinetic theory, which are undoubtedly trustworthy as somewhat close approximations to the true values, and which it is quite possible are more accurate than we can hope to see obtained from direct measurements of the conduction of heat through gases. J. T. Bottomley has given a trustworthy and somewhat closely accurate direct measurement of the thermal conductivity of water. From the results of these experimenters' work, reduced to uniform C. G. S. reckoning in our table of thermal conductivities (Table VIII.), we see that the thermal conductivity of iron is 80 times, and that of copper 500 times that of water. The thermal conductivity of iron is 3500 times, and that of copper is 20,000 times that of air. Hence, although the water or air at the very interface of its contact with the metal is essentially at the same temperature as the metal, there must be great differences of temperature in very thin layers of the fluid close to the interface when there is large flux of heat through the metal, and the temperature of the fluid as measured by any practicable thermometer, or inferred from knowledge of the average temperature of the whole fluid, or from the temperatures of entering and leaving currents of fluid, may differ by scores of degrees from the actual temperature of the solid at the interface. It is remarkable that Péclet, while perceiving that Clément's result was largely erroneous on this account, and improving the mode of experimenting by introducing a rotating mechanical stirrer to change very rapidly the fluid in contact with the solid, only multiplied

[1] *Annales de Chimie et de Physique*, Paris, 1841.

[2] In Ångström's own statement the unit quantity of heat is that required to raise 1000 grammes of water 1°. The conduction is reckoned per square metre of the copper plate per second of time, and the unit chosen for the rate of variation of temperature across the plate is 1° per millimetre. To reduce his numbers to the C. G. S. system we must therefore multiply by $10^3 \times 10^{-4} \times 10^{-1} = 10^{-2}$.

[3] This result was published by Péclet in 1853, in a work entitled *Nouveaux documents relatifs au chauffage et à la ventilation.*

Clément's conductivity by 30 instead of by 200, which would have been necessary to annul the error. Notwithstanding his failure to obtain accurate results for metals, we have ventured to include his results for wood, and solids of lower conductivity than wood, in our table, because we perceive that he was alive to the necessity for very energetic stirring of the liquid, and the mechanical means which he adopted for it, though utterly insufficient for the case of even the least conductive of the metals, were probably not so for wood and solids of lower conductivity than wood; and because it is not probable that the complication of heat generated by the stirring (which Ångström suggests as an objection to Péclet's method) was in any case sufficient to produce a sensible influence upon the experimental results.

§ 77. The first correct determinations of thermal conductivities were given by Forbes in his paper on the temperature of the earth, in the *Transactions of the Royal Society of Edinburgh* for 1846, as calculated from his observations of underground temperature at three localities in the neighborhood of Edinburgh—the trap rock of Calton Hill, the sand of the Experimental Garden, and the sandstone of Craigleith Quarry—by an imperfect approximate method indicated by Poisson. A more complete analytical treatment of the observational results, analyzed harmonically and interpreted by application of Fourier's formula (equation (19) of Math. App.) to each term separately by W. Thomson, gave results (quoted in Table VIII. below) for the conductivities, which differed but little from Forbes's approximate determinations.

Estimating and comparing the annual periodic variations of temperature at the depths of the thermometers.

§ 78. It has always seemed to us that the best mode of experimenting on the conductivity of metals must, without doubt, be by an artificial imitation in a metallic bar, of the natural periodic variations of underground temperature, produced by periodically varied thermal appliances at one end of the bar. The effect of loss or gain of heat through the sides (or lateral surface) of the bar (ideally annullable by a coating of ideal varnish impermeable to heat) may be practically annulled by making the period of the variation small enough.

Let k be the thermal conductivity of the substance and c its thermal capacity per unit bulk. Let e be the emissivity (§ 71) of its surface. Let the bar be circular-cylindric, and r the radius of its cross section. At time t, let v be the mean temperature in a cross section at distance x from the end, and v' the surface temperature at the circular boundary of this section, —all temperatures being reckoned as differences from the temperature of the surrounding medium, called zero temporarily for brevity. The heat lost from the circumference of the bar between the cross sections $x-\frac{1}{2}dx$ and $x+\frac{1}{2}dx$ in time dt is $ev'.2\pi r dx dt$, and the heat conducted lengthwise, across the cross section x, in the same time, is $\pi r^2 \frac{dv}{dx}$. Hence we readily find (see Math. App. below) as the equation of conduction of heat along the bar, very approximately if v' differs very little from v (that is to say, if the temperature is very nearly uniform throughout each cross section),

$$c\frac{dv}{dt}=\frac{d}{dx}\left(k\frac{dv}{dx}\right)-\frac{2e}{r}v' \quad . \quad . \quad . \quad . \quad . \quad (1).$$

To estimate v', let v'' be the temperature at the centre of the cross section x, and let $\left(\frac{-dv}{dr}\right)'$ denote the rate of decrease of temperature from within outwards in the substance of the bar close to its surface. We have clearly

$$v''-v'<r\left(\frac{-dv}{dr}\right)';$$

and, because the emission is supplied by conduction from within,

$$ev'=k\left(\frac{-dv}{dr}\right)'.$$

Hence

$$v''-v'<\frac{er}{k}v'.$$

The value of e for a blackened globe hung within a hollow, with blackened bounding surface, is about $\frac{1}{1000}$ according to Macfarlane's experiments (Table VII. below), and considerably less for surfaces with any degree of polish. We may therefore take $\frac{1}{1000}$ as a maximum value for e. The values of k for copper and iron at ordinary temperatures are, in C. G. S., approximately ·95 and ·18. Hence, if $r=5$ cms. (or the diameter of the bar 10 cms., which is more than it is likely to be in any laboratory experiments), we find

$$v''-v'<\frac{v}{880} \text{ for copper,}$$

and

$$<\frac{v}{160} \text{ for iron.}$$

Hence the error will be practically nothing if we take $v'=v$. Thus, and if we suppose k to be independent of temperature, (1) becomes

$$\frac{dv}{dt}=\frac{k}{c}\frac{d^2v}{dx^2}-\frac{2e}{rc}v \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2),$$

or

$$\frac{dv}{dt}=\kappa\frac{d^2v}{dx^2}-hv,$$

which is Fourier's equation for the conduction of heat along a bar or the circumference of a thin ring. Its solution to express simple harmonic variations of temperature produced in an infinitely long bar by properly varied thermal appliances at one end is

$$v=\mathrm{R}e^{-gx}\cos(nt-fx+e) \quad . \quad . \quad . \quad . \quad . \quad (4),$$

n, R, e being arbitrary constants,—the "speed," the semi-range, and the epoch for $x=0$; and f, g constants given by the formulæ

$$\left.\begin{aligned} f&=\sqrt{\frac{1}{2\kappa}}\left\{(n^2+h^2)^{\frac{1}{2}}-h\right\}^{\frac{1}{2}}\\ g&=\sqrt{\frac{1}{2\kappa}}\left\{(n^2+h^2)^{\frac{1}{2}}+h\right\}^{\frac{1}{2}}\end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad (5).$$

For iron and copper the values of κ are respectively ·95 and ·845. Hence, with the previously used values of k for these metals, and with 1/4000 for c, we find $\kappa=1{\cdot}1$ for copper and $\kappa=\cdot2$ for iron; and for either, $h=1/1700r$ nearly enough.

Suppose, for example, $r=2$ cm., this makes $h=1/3400$; and suppose the period to be 32 m. (the greatest of those chosen by Ångström), this makes $n=2\pi$ (60×32), or roughly $n=1/310$ and $h/n=1/17$. Now when h/n is small, we have approximately

$$f=\sqrt{\frac{n}{2\kappa}}\cdot\left(1-\tfrac{1}{2}\frac{h}{n}\right),$$

$$g=\sqrt{\frac{n}{2\kappa}}\cdot\left(1+\tfrac{1}{2}\frac{h}{n}\right);$$

and therefore with the assumed numbers

$$f=\sqrt{\frac{n}{2\kappa}}\left(1-\frac{1}{34}\right), \text{ and } g=\sqrt{\frac{n}{2\kappa}}\cdot\left(1+\frac{1}{34}\right),$$

by which we see that the propagation of the variation of temperature is but little affected by the lateral surface emissivity. Little as this effect is, it is very perfectly eliminated by the relation

$$fg=2\frac{n}{\kappa} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6),$$

which we find from (5).

It is convenient to remark that g is the rate of diminution of the Napierian logarithm of the range, and f the rate of retardation of the epoch (reckoned in radians) per centimetre of the bar. Were there no lateral emissivity these would be equal, and the diffusivity might be calculated from each separately. This was done by William Thomson in his analysis of the Edinburgh underground temperature observations. But in the propagation of periodic variation of temperature along a bar (as of electric potential along the conductor of a submarine cable) lateral emissivity (or imperfect insulation) augments the rate of diminution of the logarithm of the amplitude, and diminishes the rate of retardation of the phase, leaving the product of the two rates unaffected, and allowing the diffusivity to be calculated from it by (6). This was carried out for copper and iron by Ångström in Sweden, and the results communicated to the Royal Swedish Academy in January, 1861. German and English editions of his paper have been published in Poggendorff's *Annalen* for 1863, and the *Phil. Mag.* for 1863 (first half year). The details of the apparatus and of the actual experiments, in which Ångström had the assistance of Thalen, are sufficiently described in this paper,[1] and in a subsequent paper (Pogg. *Annalen* for

[1] The first paper is marred unhappily by two or three algebraic and arithmetical errors. One algebraic error is very disturbing to a careful reader, and might even to a hasty judgment seem to throw doubt on the validity of the experimental use which is made of the formulæ. There is, however, no real foundation for any such doubt. The following little correction suffices to put the matter right. For the general term as printed in Ångström's paper read

$$\varepsilon^{-xg_i\sqrt{i}}\sin\left(\frac{2i\pi t}{\mathrm{T}}-xg_i'\sqrt{i}+\beta'\right),$$

with the following values for g_i, g_i':—

1863, p. 428), to allow us to feel perfect confidence in the very approximate accuracy of the results. Hence we have included them in our table.

§ 79. The question, Does thermal conductivity vary with temperature? was experimentally investigated by Forbes about thirty years ago; and in a first provisional statement of results communicated to the British Association at Belfast in 1852 it was stated that the thermal conductivity of iron is less at high temperatures than at low. Forbes's investigation was conducted by an elaborate method of experimenting, in which the static temperature of a long bar of metal is observed after the example of the earlier experiments of Despretz, with a most important additional experiment and measurement by means of which the static result is reduced to give conductivity in absolute measure, and not merely as in Despretz's experiments to give comparisons between the conductivities of different metals. In 1861 and 1865 Forbes published results calculated from his experiments, including the first determination of thermal conductivity of a metal (iron) in absolute measure, and a confirmation of his old result that the conductivity of iron diminishes with rise of temperature. Forbes's bars have been inherited and further utilized, and bars of copper, lead, and other metals have been made and experimented upon according to the same method, by his successor in the university of Edinburgh, Professor Tait. The investigation was conducted partly with a view to test whether the electric conductivities and the thermal conductivities of different metals, more or less approximately pure, and of metallic alloys are in the same order, and, further, if their thermal conductivities are approximately in the same proportion as their electric conductivities. The following results quoted from his paper on "Thermal and Electric Conductivity" (*Transactions R. S. E.*, 1878) are valuable as an important instalment, but expressly only an instalment, towards the answering of this interesting question:—

"Taking the inferior copper ('Copper C') as unit both for thermal and for electric conductivity, we find the following table of conductivities at ordinary temperatures with the rough results as to specific gravity and specific heat referred to in § 15 above:—

	Thermal.	Electric.
Copper, Crown	1·41	1·729
" C	1·00	1·000
Forbes's iron	0·29	0·264
Lead	0·12	0·149
German silver	0·14	0·117

"The agreement of these numbers is by no means so close as is generally stated; but this is no longer remarkable, for it is well known that the electric conductivity of all pure metals alters very much with the temperature, while we have seen that as regards thermal conductivity there is but slight change with either copper or lead, though there is a large change with iron. This accords with some results of my own on the electric conductivity of iron at high temperatures (*Proc. R. S. E.*, 1872–73, p. 32), and with the results of the repetition of these experiments by a party of my laboratory students."—*Proc. R. S. E.*, 1875–76, p. 629.

§ 80. The absolute values of Tait's results for the five metals of the preceding list are given in C. G. S. units in our general table. As to change of conductivity with temperature there is a discrepance between the results of Ångström's and Tait's experiments. Tait finds but little difference in the conductivity of copper through the wide range of temperatures from 0° to 300° C., and that difference an augmentation instead of a diminution at the high temperatures as shown in the following results (where t is measured from 0° C.):[1]—

Copper, Crown	$0{\cdot}076\ (1 + 0{\cdot}0004t)$
" C	$0{\cdot}054\ (1 + 0{\cdot}00055t)$
Iron	$0{\cdot}015\ (1 - 0{\cdot}00144t)$

On the other hand, Ångström finds for copper from experiments described in his second paper referred to above, at mean temperatures of from 28°·8 to 71°·5 C., results which reduced to C. G. S. are as follows:—

Copper	$\cdot982\ (1 - \cdot001519t)$
Iron	$\cdot199\ (1 - \cdot002874t)$

From the admirable method of experimenting, and the care with which experiments were carried out by himself and Thalen, it is impossible for us to doubt the validity and somewhat closely approximate numerical truth of the result. On account of the discrepance from Tait's results it is desirable that Ångström's method should be carried out for copper through a much wider range of temperatures. This can be done with great ease from the lowest temperature obtainable by freezing mixtures to temperatures up to the melting point of copper, so excellently plastic is Ångström's method. Our proposed extension of it is to be carried out by proper thermal appliances to the end of the bar which Ångström left to itself,—appliances by which in one series of experiments it may be kept constant at − 50° or − 60° C., in others left to itself to take nearly the atmospheric temperature, in others kept at high temperatures limited only by the melting temperature of copper, if the experimenter desires to go so far. We would also suggest that the thermo-electric method first introduced by Wiedemann and Franz in their experiments on the static temperature of bars or wires heated at one end and allowed to lose heat by convection and radiation from their sides (which was rejected, not, we think, judiciously, by Ångström), might be used with advantage instead of the mercury thermometers inserted in holes in the bar in Ångström's apparatus; or that, if thermometers are to be used, air thermometers in which the bulb of the thermometer is itself a very small hole in the bar experimented on, and the tube a fine-bore glass tube fitted to this hole, would be much preferable to the mercury thermometers hitherto employed in, we believe, all experiments except those of Wiedemann and Franz, on the conduction of heat along metallic bars.

Diffusion of heat.

§ 81. Fourier's ninth chapter is entitled "De la Diffusion de la Chaleur." The idea embodied in this title is the spreading of heat in a solid tending to ultimate equalization of temperature throughout it, instead of the transference of heat from one body to another by conduction through the solid considered. Though Fourier makes the special subject of his chapter on "Diffusion" the conduction of heat through an infinite solid, we may conveniently regard as coming under the several designations "Diffusion of Heat" every case of thermal conduction in which the heat conducted across any part of the solid has the effect of warming contiguous parts on one side of it, or of leaving contiguous parts on the other side cooler,—in other words, every case in which the temperature of the body through which the conduction of heat takes place is varying with time, as distinguished from what Fourier calls "Uniform Motion of Heat," or the class of cases in which the temperature at every point of the body is constant.

Investigations of thermal conductivity by "uniform motion of heat."

The experiments of Péclet, Despretz, Forbes and Tait, Wiedemann and Franz, were founded on the uniform conduction of heat across slabs or along bores, and their determinations of relative and absolute conductivities were made by comparing or by measuring absolutely quantities of heat that were *conducted out of the body tested*.

By diffusion of heat.

On the other hand, it is the diffusion of heat that is used in the determinations of thermal conductivity in absolute measure by Forbes and William Thomson from the periodic variations of underground temperature; in those of Ångström, from his experiments on the spreading of periodic variations of temperature through bars of iron and copper, and a series of valuable experiments a year or two later by F. Neumann, applying the same general method to bars of brass, zinc, German silver, and iron; in experiments by F. Neumann on substances of lower conductivity (coal, cast sulphur, ice, snow, frozen earth, gritstone) formed into cubes or globes of 5 or 6 inches diameter, and heated uniformly, and then left to cool in an atmosphere of lower temperature, and from time to time during the cooling explored by thermo-electric junctions imbedded in them to show their

---

$$g_i = \sqrt{\sqrt{\frac{\pi^2}{K^2T^2} + \frac{H^2}{4K^2i^2}} + \frac{H}{2Ki}};$$

$$g'_i = \sqrt{\sqrt{\frac{\pi^2}{K^2T^2} + \frac{H^2}{4K^2i^2}} - \frac{H}{2Ki}};$$

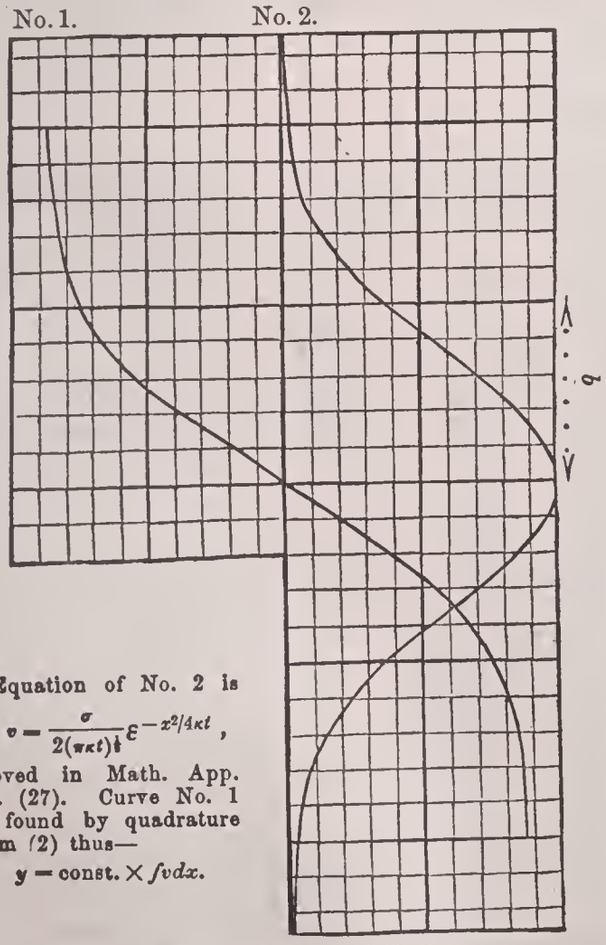
instead of these formulæ without the i, as Ångström gives them. Here we see that $g_i g'_i = \frac{\pi}{KT}$; and it is the product $g_i g'_i$ that Ångström uses in his experimental application, not the separate values of either g_i or g'_i. Hence no error is introduced by his having overlooked that g_i is not equal to g_1 except for $i = 1$.

[1] These results are, like those given above in this section, expressed in terms of the foot and minute, but the unit of heat employed is the amount of heat required to raise the temperature of a cubic foot of the substance by 1°. In other words, these results are "diffusivities" (§ 82) in square feet per minute.

internal distribution; in similar experiments on the cooling of globes of 14 cm. diameter of porphyritic trachyte by Ayrton and Perry in Japan; and in Kirchof and Hansemann's recent experiments,[1] to find the thermal conductivity of iron by the not well-chosen method of suddenly cooling one side of a cube of iron of 14 cm., and observing the temperatures by aid of thermo-electric junctions in several points of the line perpendicular to this side through its middle.

Thermal diffusivity.

§ 82. When the effect of heat conducted across any part of a body in heating the substance on one side or leaving the substance on the other side cooler is to be reckoned, it is convenient to measure the thermal conductivity in terms, not of the ordinary general gramme water-unit of heat, but of a special unit, the quantity required to raise unit bulk of the substance in 1°. In other words, if k be the conductivity in terms of any thermal unit, and c the thermal capacity of unit bulk of the substance, it is kc, not merely k, that expresses the quantity of the substance on which the phenomenon chiefly depends. We therefore propose to give to kc the name of thermal diffusivity (or simply diffusivity when heat is understood to be the subject), while still using the word thermal conductivity to denote the conducting power as defined in § 73, without restriction as to the thermal unit employed. It is interesting and important to remark that "diffusivity" is essentially to be reckoned in units of area per unit of time, that its "dimensions" are L^2D (see DIMENSIONS). Its regular C. G. S. reckoning is therefore in square centimetres per second. In the article DIFFUSION the relation between diffusion of heat and diffusion of matter is explained. We have added diffusion of electricity through a submarine cable, which has been shown[2] to follow the same law as the "linear" diffusion of heat, as Fourier calls the diffusion of heat when the isothermal surfaces are parallel planes. The curves of the following diagram and Tables A, B, and C show in a practically useful way the result in the course of the times noted, of from fractions of a second to thousands of millions of years, of linear diffusion of two different



Equation of No. 2 is

$$v = \frac{\sigma}{2(\pi\kappa t)^{\frac{1}{2}}} \varepsilon^{-x^2/4\kappa t},$$

proved in Math. App. xii. (27). Curve No. 1 is found by quadrature from (2) thus—

$$y = \text{const.} \times \int v dx.$$

FIG. 11.—Diagram of Diffusion.

qualities in an infinite line from an initial condition in which there is sudden transition from one quality to the other, in the thoroughly practical cases specified in the accompanying explanations.

Curve No. 1 shows temperature; or quantity of substance in solution; or potential in the conductor of a submarine cable through which electricity is diffusing. Curve No. 2 shows rate per unit of distance of variation of the temperature, or of the quantity of substance in solution. Vertical ordinates are actual distances through the medium. Horizontal ordinates represent temperature or quantity of diffusing substances in No. 1 curve, and rate of variation of temperature or of diffusing substance or of electric potential in No. 2 curve.

Diffusions.—Table A.

Substance.	Time in Seconds from the commencement of the Diffusion until the Condition represented by the Curves on the Actual Scale ($b = 2$ Centimetres) is reached.
Carbonic acid through air	6·97 seconds.
Heat through hydrogen	·89 of a second.
" " copper	·92 "
" " iron	5·5 seconds.
" " air	6·25 "
" " underground strata	10·00 "
" " wood	770 "
Common salt through water	4320 "
Electricity through Suez-Aden cable	$1{\cdot}087 \times 10^{-16}$ of a second.
" " Aden-Bombay cable	$0{\cdot}739 \times 10^{-16}$ "
" " Persian Gulf cable	$0{\cdot}635 \times 10^{-16}$ "
" " Atlantic cable	$0{\cdot}440 \times 10^{-16}$ "
" " French Atlantic cable	$0{\cdot}396 \times 10^{-16}$ "
" " Direct U. S. cable	$0{\cdot}340 \times 10^{-16}$ "

Diffusions (Secular).—Table B.

Substance.	Time in years from the commencement of the Diffusion until the Condition represented by the Curves on the Scale of $b = 20$ Kilometres, or 1,000,000 times the Actual Scale, is reached.
Carbonic acid through air[3]	2,220,000 years.
Heat through hydrogen	283,000 "
" " copper	293,000 "
" " iron	1,733,000 "
" " air	1,982,000 "
" " underground strata[4]	3,000,000 "
" " wood	244,000,000 "
Common salt through water[5]	1,370,000,000 "

[3] Instructive as to the proportion of carbonic acid in air at different heights, proving its approximate uniformity due to convection, not to diffusion.

[4] Instructive as to geological theories respecting terrestrial temperature.

[5] Instructive as to theories respecting the saltness of the sea.

Table C.

Name of Cable.	Time in Seconds from the commencement of the Diffusion until the Condition represented by the Curves on the Scale of $b = 1000$ Nautical Miles, or 92,615,000 times the Actual Scale, is reached.
Suez-Aden	0·932 of a second.
Aden-Bombay	0·634 "
Persian Gulf	0·545 "
Atlantic	0·377 "
French Atlantic	0·339 "
Direct United States	0·292 "

§ 83. The following tables contain useful information regarding various thermal properties of matter. Every known property of a piece of matter, except its gravity and its inertia, varies with variation of temperature. For further information respecting the effect of variation of temperature in causing changes in properties of matter reference is made to the articles ELASTICITY, ELECTRICITY, MAGNETISM, LIGHT, MATTER (PROPERTIES OF), ETC.

[1] Wiedemann's (late Poggendorff's) *Annalen*, 1880, No. 1.

[2] *Proc. Roy. Soc.*, May, 1855, Wm. Thomson "On the Theory of the Electric Telegraph."

TABLE I.—*Linear Expansions of Solids.*[1]

Name.	Mean Expansion per degree C. through Range stated.	Range.[2]	Authority.
Silver	·00002120	0° to 100°	Muschenbröck.
"	" 1910	0° " 100°	Kupffer.
"	" 1943	0° " 100°	Matthiessen.
Thallium	" 3021	40°	Fizeau.
Sulphur, Sicily	" 6413	40°	Fizeau.
Selenium, cast	" 3680	40°	Fizeau.
Tellurium, "	" 1675	40°	Fizeau.
Lead	" 2799	0° to 100°	Matthiessen.
"	" 2924	40°	Fizeau.
Iron	" 1156	0° to 100°	Borda.
"	" 1190	0° " 100°	Calvert, Johnson, and Lowe.
Steel, annealed	" 1220	0° " 100°	Muschenbröck.
" French cast, tempered	" 1322	40°	Fizeau.
" French cast, annealed	" 1101	40°	Fizeau.
" English cast, annealed	" 1095	40°	Fizeau.
Steel, soft	" 103	.....	Calvert, Johnson, and Lowe.
Cast iron	" 112	0° to 100°	Calvert, Johnson, and Lowe.
Cobalt, red by H. compressed	" 1236	40°	Fizeau.
Nickel, red by H. compressed	" 1279	40°	Fizeau.
Copper	" 178	.....	Borda.
"	" 1866	0° to 100°	Matthiessen.
" native L. Superior	" 169	40°	Fizeau.
" commercial	" 1678	40°	Fizeau.
Ruthenium, semi-fused	" 0963	40°	Fizeau.
Rhodium, semi-fused	" 0850	40°	Fizeau.
Palladium	" 1104	.....	Matthiessen.
" forged	" 1176	40°	Fizeau.
Platinum	" 0857	0° to 100°	Borda.
"	" 0680	0° " 100°	Calvert, Johnson, and Lowe.
"	" 0886	0° " 100°	Matthiessen.
Iridium	" 0700	40°	Fizeau.
Osmium, semi-fused	" 0657	40°	Fizeau.
Zinc	" 2200	0° to 100°	Calvert, Johnson, and Lowe.
"	" 2976	0° " 100°	Matthiessen.
" distilled	" 2918	40°	Fizeau.
Cadmium	" 332	0° to 100°	Calvert, Johnson, and Lowe.
"	" 3159	0° " 100°	Matthiessen.
" distilled	" 3069	40°	Fizeau.
Magnesium, cast	" 2694	40°	Fizeau.
Indium, cast	" 4170	40°	Fizeau.
Arsenic, sublimed	" 0559	40°	Fizeau.
Antimony	" 0980	0° to 100°	Calvert, Johnson, and Lowe.
"	" 1056	0° " 100°	Matthiessen.
Crystal. " along axis	" 1692	40°	Fizeau.
Crystal. " normal to axis	" 0882	40°	Fizeau.
Crystal. " mean value	" 1152	40°	Fizeau.
Bismuth	" 133	0° to 100°	Calvert, Johnson, and Lowe.
"	" 1316	0° " 100°	Matthiessen.
Crystal. " along axis	" 1621	40°	Fizeau.
Crystal. " normal to axis	" 1208	40°	Fizeau.
Crystal. " mean value	" 1346	40°	Fizeau.
Gold, annealed	" 1460	0° to 100°	Muschenbröck.
" "	" 138	0° " 100°	Calvert, Johnson, and Lowe.
" "	" 1470	0° " 100°	Matthiessen.
" cast	" 1443	40°	Fizeau.
Carbon, diamond	" 00000	—38°·8	Fizeau.
" "	" 00562	0°	Fizeau.
" "	" 00852	20°	Fizeau.
" "	" 01286	50°	Fizeau.
" graphite	" 0786	40°	Fizeau.
" gas carbon	" 0540	40°	Fizeau.
" anthracite	" 2078	40°	Fizeau.
Tin	" 2840	0° to 100°	Muschenbröck.
"	" 273	0° " 100°	Calvert, Johnson, and Lowe.
"	" 2296	0° " 100°	Matthiessen.
Aluminium, commercial	" 222	0° " 100°	Calvert, Johnson, and Lowe.
Fluor spar, CaF_2	" 19504	0° " 100°	Pfaff.
Silver iodide, AgI, cylinder, precipitated and compressed—			
Lengthwise	.00000166	40°	Fizeau.
Transversely	" 0122	40°	Fizeau.
Mean value	" 0137	40°	Fizeau.
Mercuric iodide, HgI_2	" 2387	40°	Fizeau.
Lead iodide, PbI_2	" 3359	40°	Fizeau.
Cadmium iodide, CdI_2	" 2916	40°	Fizeau.
Ice, H_2O	·002941	.....	Heinrich.
Hæmatite, Fe_2O_3, along axis	·00000829	40°	Fizeau.
Hæmatite, Fe_2O_3, normal to axis	" 0836	40°	Fizeau.
Magnetic oxide of iron, Fe_3O_4	" 09540	0° to 100°	Pfaff.
Copper oxide, CuO	—·000000095	0°	Fizeau.
" "	" 000000	4°·1	Fizeau.
" "	+·000000136	10°	Fizeau.
" "	" 00597	30°	Fizeau.
" "	" 01059	50°	Fizeau.
Zinc oxide, ZnO, along axis	" 0316	40°	Fizeau.
Zincite, normal to axis	" 0539	40°	Fizeau.
Quartz, SiO_2, along axis	" 0781	40°	Fizeau.
Quartz, SiO_2, normal to axis	" 1419	40°	Fizeau.
Pyrite, FeS_2	" 10084	0° to 100°	Pfaff.
Galena, PbS	" 18594	0° " 100°	Pfaff.
Beryl, longit. axis	" 017214	0° " 100°	Pfaff.
" horiz. axis	—·0000001316	0° " 100°	Pfaff.
Emerald, along axis	+·00000106	40°	Fizeau.
" normal to axis	" 0137	40°	Fizeau.
Topaz, lesser horiz. axis	" 08325	0° to 100°	Pfaff.
Topaz, greater horiz. axis	" 08362	0° " 100°	Pfaff.
Topaz, vertical horiz. axis	" 04723	0° " 100°	Pfaff.
Tourmaline, longit. axis	" 09369	0° " 100°	Pfaff.
Tourmaline, horiz. axis	" 077321	0° " 100°	Pfaff.
Garnet	" 08478	0° " 100°	Pfaff.
Glass tube	" 083333	0° " 100°	Smeaton.
" "	" 08280	0° " 100°	Deluc.
" rod	" 086130	0° " 100°	Dulong and Petit.
"	" 091827	100° " 200°	Dulong and Petit.
"	" 101114	200° " 300°	Dulong and Petit.
" plate	" 0890890	0° " 100°	Dulong and Petit.
" " crown	" 087572	0° " 100°	Lavoisier and Laplace.
" " "	" 089760	0° " 100°	Lavoisier and Laplace.
" " "	" 091751	0° " 100°	Lavoisier and Laplace.
" white French	" 08510	0° " 100°	.....
" tube	" 09498	.....	Hagen.
" soft Thuringian	" 1195	.....	Weinhold.
Wedgewood ware	" 08813	16°·6 to 100°	Daniell.
" "	" 08983	16°·6 " 350°	Daniell.
Bayeux porcelain	" 165	1000° to 1400°	Deville and Troost.
Platiniridium, one-tenth iron	" 0684	40°	Fizeau.
Lead and tin, solder—2 lead, 1 tin	" 2508	0° to 100°	Smeaton.
Lead and antimony	" 2033	16°·6 " 100°	Daniell.
Type metal	" 1952	16°·6 " 264°	Daniell.
Zinc and tin—8 zinc, 1 tin	" 2692	0° " 100°	Smeaton.
Copper and tin—8 copper, 1 tin	" 1817	0° " 100°	Smeaton.
Speculum metal	" 1933	0° " 100°	Smeaton.
Bronze, ¼ tin	" 1844	16°·6 " 100°	Daniell.
" "	" 2116	16°·6 " 350°	Daniell.
" "	" 1737	16°·6 " 957°	Daniell.
Brass, cast	" 1875	0° " 100°	Smeaton.
" wire	" 1930	0° " 100°	Smeaton.
"	" 1783	0° " 100°	Borda.
" English	" 1893	0° " 100°	Roy.
" "	" 1895	0° " 100°	Roy.
"	" 1859	40°	Fizeau.
Pewter	" 2283	.....	Fizeau.
"	" 2033	16°·6 to 100°	Daniell.
"	" 1994	16°·6 " 206°	Daniell.
Paraffin, Rangoon	·00027854	40°	Fizeau.
Soft coal, Charleroi	·00002782	40°	Fizeau.
Ebonite	" 770	16°·7 to 25°·3	Kohlrausch.
"	" 842	25°·3 " 35°·4	Kohlrausch.
Deal wood	Equal to Glass	.....	Roy.

[1] Abridged from Clarke's *Constants of Nature.*

[2] Where only one number is given for the range in this and the following table, the corresponding statement is to be understood as applying through a small range on either side of the number stated.

TABLE II.[1]—*Cubical Expansions of Solids and Liquids.*

Name.	Mean Expansion per degree C.	Range.	Authority.
Bromine	·001016027	−7°	Pierre.
"	·001038186	0°	
"	·001318677	+63°	
Iodine, solid	·000235	...	Billet.
" upon fusion	·1682	...	
" liquid	·000356	...	
Silver	·00005831	0° to 100°	Matthiessen.
Sulphur, native	·000137	0° " 13°·2	Kopp.
"	·000223	13°·2 " 50°·3	
"	·000259	50°·3 " 78°	
"	·000620	78° " 96°·5	
"	·003097	96°·5 " 109°·9	
"	·05002	In melting at 115°.	
Lead	·000089	...	Kopp.
"	·00008399	0° to 100°	Matthiessen.
Iron	·0000355	0° " 100°	Dulong and Petit.
"	·0000441	0° " 300°	
"	·000037	...	Kopp.
Copper	·000055	0° to 100°	Playfair and Joule.
"	·0000767	0° " 100°	
"	·000051	...	Kopp.
"	·00004998	0° to 100°	Matthiessen.
Palladium	·00003312	0° " 100°	
Platinum	·00002658	0° " 100°	
Zinc	·000089	...	Kopp.
"	·00008928	0° to 100°	Matthiessen.
Cadmium	·0000940	...	Kopp.
Mercury	·00017905	0°	Regnault.
"	·00017950	10°	
"	·00018001	20°	
"	·00018051	30°	
"	·00018102	40°	
"	·00018152	50°	
"	·00018203	60°	
"	·00018253	70°	
"	·00018304	80°	
"	·00018354	90°	
"	·00018405	100°	
"	·00018657	150°	
"	·00018909	200°	
"	·00019161	250°	
"	·00019413	300°	
"	·00019666	350°	
"	·0001812	0° to 100°	Matthiessen.
Phosphorus	·000366	8°·3 " 15°·8	Kopp.
Antimony	·000033	...	Kopp.
"	·00003167	0° to 100°	Matthiessen.
Bismuth	·0000400	...	Kopp.
Gold	·00004411	0° to 100°	Matthiessen.
Diamond	·00000354	40°	Fizeau.
Tin	·0000690	...	Kopp.
Water, H_2O	−·000034	0° to 4°	Weidner.
"	·0002500	4° " 50°	Matthiessen.
"	·0004496	4° " 100°	
Ice	·000185	0° " 1°	Plücker and Geisler.
Sulphur dioxide	·00202	5° " 10°	D'Andreéf.
Carbon dioxide, liquid, CO_2	·00475	−10° " 5°	D'Andreéf.
" " "	·00492	− 5° " 0°	
" " "	·00540	0° " 5°	
" " "	·00629	5° " 10°	
" " "	·00769	10° " 15°	
" " "	·00975	15° " 20°	
" " "	·01277	20° " 25°	
" disulphide, CS_2	·0011016	−50° " 0°	Muncke.
" " "	·00119625	0° " 40°	
" " "	·0012517	0° " 70°	
" " "	·0012366	0° " 40°	Horn.
" " "	·0013260	0° " 80°	
" " "	·0014596	0° " 120°	
" " "	·0016608	0° " 180°	
Copper oxide, CuO	·00000279	40°	Fizeau.
Zinc, ZnO	·00001394		
Quartz, SiO_2	·000040	...	Kopp.
Emerald	·00000168	40°	Fizeau.
Beryl	·00000105	0° to 100°	Pfaff.
Topaz	·00002187	0° " 100°	
Tourmaline	·00002181	0° " 100°	
Garnet	·000025434	0° " 100°	
Analcime	·000027783	0° " 100°	
Idocrase	·00002700	0° " 100°	.....
Zircon	·00002835	0° " 100°	.....
Glass, white tube	·00002648	0° " 100°	Regnault.
" " globule	·00002553	0° " 100°	
" green tube	·00002299	0° " 100°	
" " globule	·00002132	0° " 100°	
" Swedish tube	·00002363	0° " 100°	
" " globule	·00002426	0° " 100°	
" hard French tube	·00002142	0° " 100°	
" " " globule	·00002242	0° " 100°	
" crystal tube	·00002101	0° " 100°	
" " globule	·00002330	0° " 100°	
" globe	·00002326	0° " 100°	
" common tube	·00002579	0° " 1°	

[1] Abridged from Clarke's *Constants of Nature*.

TABLE III.—*Expansions of Liquids.*

Pierre, having measured the expansions of many different liquids, embodies the results in the empirical formula $\delta_t = at + bt^2 + ct^3$, where δ_t represents the expansion of unit volume from 0° to t° cent., and a, b, c have the values given in the Table for the different liquids specified. The substances and formulæ in quotation marks are quoted from Dixon's *Heat*, Dublin, 1849.

	Name of Liquid.	Atomic Constitution.	Temperature of Boiling Point.	Observed Pressure of Boiling Point.	Value of Coeff. a.	Value of Coeff. b.	Value of Coeff. c.
				mms.			
1	Oxide of ethyl	$(C_2H_5)_2O$	35°·5	0·7558	0·001 513	0·000 002 36	0·000 000 040 0
2	Ethylic alcohol	C_2H_5HO	78°·3	0·7580	0·001 049	0·000 001 75	0·000 000 001 3
3	Methylic alcohol	CH_3HO	66°·3	0·7590	0·001 186	0·000 001 56	0·000 000 009 1
4	Amylic alcohol	$C_5H_{11}HO$	131°·8	0·7513	0·000 890	0·000 000 66	0·000 000 011 8[1]
					0·000 899	0·000 000 69	0·000 000 010 1[2]
5	Chloride of ethyl	C_2H_5Cl	11°·0	0·7580	0·001 575	0·000 002 81	0·000 000 015 7
6	Bromide of ethyl	C_2H_5Br	40°·7	0·7571	0·001 338	0·000 001 50	0·000 000 016 9
7	Iodide of ethyl	C_2H_5I	70°·0	0·7517	0·001 142	0·000 001 96	0·000 000 006 2
8	Bromide of methyl	CH_3Br	13°·0	0·7590	0·001 415	0·000 003 32	0·000 000 113 8
9	Iodide of methyl	CH_3I	43°·8	0·7502	0·001 200	0·000 002 16	0·000 000 010 1
10	Formiate of ethyl	$C_2H_5CHO_2$	52°·9	0·7520	0·001 325	0·000 002 86	0·000 000 006 6
11	Acetate of ethyl	$C_2H_5C_2H_3O_2$	74°·1	0·7665	0·001 258	0·000 002 96	0·000 000 001 5
12	Butyrate of ethyl	$C_2H_5C_4H_7O_2$	119°·0	0·7465	0·001 203	0·000 000 07	0·000 000 022 6[3]
					0·000 633	0·000 012 76	0·000 000 052 1[4]
13	Acetate of methyl	$CH_3C_2H_3O_2$	59°·5	0·7612	0·001 296	0·000 002 91	0·000 000 004 3
14	Butyrate of methyl	$CH_3C_4H_7O_2$	102°·1	0·7439	0·001 240	0·000 000 63	0·000 000 013 1
15	Terchloride of phosphorus	PCl_3	78°·3	0·7515	0·001 129	0·000 000 87	0·000 017 923 6
16	Torbromide of phosphorus	PBr_3	175°·3	0·7602	0·000 847	0·000 000 44	0·000 000 002 5[5]
					0·000 824	0·000 000 91	0·000 000 000 0[6]
17	Terchloride of arsenic	$AsCl_3$	133°·8	0·7569	0·000 979	0·000 000 97	0·000 000 001 8
18	Bichloride of tin	$SnCl_2$	115°·4	0·7531	0·001 133	0·000 000 91	0·000 000 007 6
19	Tetrachloride of titanium	$TiCl_4$	136°·0	0·7623	0·000 943	0·000 001 35	0·000 000 000 9
20	"Terchloride of silicon"	"$SiCl_3$"	59°·0	0·7601	0·001 294	0·000 002 18	0·000 000 040 9
21	"Terbromide of silicon"	"$SiBr_3$"	153°·4	0·7625	0·000 953	0·000 000 76	0·000 000 000 3
22	Bichloride of ethylene[7]	$C_2H_4Cl_2$	84°·9	0·7619	0·001 119	0·000 001 05	0·000 000 010 3
23	Bibromide of ethylene	$C_2H_4Br_2$	132°·6	0·7569	0·000 953	0·000 001 32	0·000 000 001 1[8]
					0·001 017	0·000 000 10	0·000 000 008 8[9]
24	Bromine	Br	63°·0	0·7600	0·001 038	0·000 001 71	0·000 000 005 4
25	Bisulphide of carbon	CS_2	47°·9	0·7558	0·001 140	0·000 001 37	0·000 000 019 1

[1] From 15° to 80°. [2] From 80° to 131°·8. [3] From 13° to 90°. [4] From 90° to 118° [5] From 0° to 100°. [6] From 100° to 175°·8.
[7] For this liquid t is counted from 20°·09. its point of congelation. [8] From 20°·09 to 100°·16. [9] From 100°·16 to 132°·6.

TABLE IV.—*Density of Water.*

Temp.	Density.	Temp.	Density.	Temp.	Density.
0°	·999884	13°	·999443	35°	·99469
1	·999941	14	·999312	40	·99236
2	·999982	15	·999173	45	·99038
3	1·000004	16	·999015	50	·98821
4	1·000013	17	·998854	55	·98583
5	1·000003	18	·998667	60	·98339
6	·999983	19	·998473	65	·98075
7	·999946	20	·998272	70	·97795
8	·999899	22	·997839	75	·97499
9	·999837	24	·997380	80	·97195
10	·999760	26	·996879	85	·96880
11	·999668	28	·996344	90	·96557
12	·999562	30	·995778	100	·95866

TABLE V.—*Steam Pressures (in Centimetres of Mercury).*

Water.		Mercury.		Sulphur.	
Temp.	Pressure.	Temp.	Pressure.	Temp.	Pressure.
−32°	0·03	0°	·002	390°	27·23
−30	0·04	10	·003	400	32·90
−25	0·06	20	·004	410	39·52
−20	0·09	30	·005	420	47·21
−15	0·14	40	·008	430	56·10
−10	0·21	50	·011	440	66·31
− 5	0·31	60	·016	450	77·99
0	0·46	70	·024	460	91·27
5	0.65	80	·035	470	106·32
10	0·92	90	·051	480	123.27
15	1·27	100	·075	490	142·29
20	1·74	110	·107	500	163·53
25	2·35	120	·153	510	187·16
30	3·15	130	·218	520	213·33
35	4·18	140	·306	530	242·20
40	5·49	150	·427	540	273·92
45	7·14	160	·590	550	308·65
50°	9·20	170°	·809	560°	346·53
55	11·75	180	1·100	570	387·71
60	14·88	190	1·48		
65	18·69	200	1·99		
70	23·31	210	2·63		
75	28·85	220	3·47		
80	35·46	230	4·53		
85	43·30	240	5·88		
90	52·54	250	7·57		
95	63·38	260	9·67		
100	76·00	270	12·30		
105	90·64	280	15·52		
110	107·54	290	19·45		
115	126·94	300	24·22		
120	149·13	310	29·97		
125	174·39	320	36·87		
130	203·03	330	45·09		
135	235·37	340	54·83		
140	271·76	350	66·32		
145	312·55	360	79·77		
150	358·12	370	95·46		
155	408·86	380	113·96		
160	465·16	390	134·67		
165	527·45	400	158·80		
170	596·17	410	186·37		
175	671·75	420	217·75		
180	754·64	430	253·30		
185	845·32	440	293·40		
190	944·27	450	338·44		
195	1051·96	460	388·81		
200	1168·90	470	444·94		
205	1295·57	480	507·24		
210	1432·48	490	576·13		
215	1580·13	500	652·03		
220	1739·04	510	725·34		
225	1909·70	520	826·50		
230	2092·64				

TABLE VI.—*Steam Pressures.*

Temperature.	Essence of turpentine, $C_{10}H_8$	Ethyl Alcohol, C_2H_6O	Benzine, C_6H_6	Methyl Alcohol, CH_4O	Ethyl Iodide, C_2H_5I	Phosphorus Chloride, PCl_3	Carbon Tetrachloride, CCl_4	Chloroform, $CHCl_3$	Acetone, C_3H_6O	Silicon Chloride, $SiCl_4$	Carbon Bisulphide, CS_2	Ethyl Bromide, C_2H_5Br	Ethyl Ether, $C_4H_{10}O$	Boron Chloride, BCl_3	Cyanogen Chloride, $ClCN$	Ethyl Chloride, C_2H_5Cl	Sulphurous Acid, SO_2	Methylic Ether, C_2H_6O	Methyl Chloride, CH_3Cl	Ammonia, NH_3	Sulphuretted Hydrogen, H_2S	Carbonic Acid, CO_2	Nitrous Oxide, N_2O
−30°	..	..	..	·27	..	..	..	..	..	..	..	3·22	..	9·83	6·83	11·02	28·75	57·65	57·90	86·61	..	..	..
−25	..	..	..	·41	..	..	..	..	..	1·97	..	4·41	..	12·57	10·34	14·50	37·38	71·61	71·78	110·43	374·93	1300·70	1569·49
−20	..	·83	·58	·63	..	..	·98	..	..	2·65	4·73	5·92	6·89	15·95	14·82	18·75	47·95	88·20	88·32	139·21	443·85	1514·24	1758·66
−15	..	·51	·88	·93	..	..	1·35	..	..	3·63	6·16	7·81	8·93	20·07	20·36	25·96	60·79	107·77	107·92	173·65	519·65	1758·25	1968·43
−10	..	·65	1·29	1·35	..	..	1·85	..	..	4·65	7·94	10·15	11·47	25·05	27·05	30·21	76·25	130·66	130·96	214·46	608·46	2034·02	2200·80
− 5	..	·91	1·83	1·92	..	..	2·48	..	..	6·05	10·13	13·06	14·61	31·03	35·02	37·67	94·89	157·25	157·87	262·42	706·60	2344·13	2457·92
0	·21	1·27	2·53	2·68	4·19	3·80	3·29	..	..	7·86	12·79	16.58	18·44	38·13	44·41	48·52	116·51	187·90	189·10	318·83	820·63	2690·66	2742·10
+ 5	..	1·76	3·42	3·69	5·41	4·91	4·32	..	..	9·98	16·00	20·72	23·09	46·50	55·40	58·93	142·11	222·99	225·11	383·03	949·08	3075·38	3055·86
10	·29	2·42	4·52	5·01	8·92	6·29	5·60	..	..	12·59	19·85	25·74	28·68	58·29	68·19	69·11	171·95	262·90	266·88	457·40	1089·63	3499·86	3401·91
15	..	3·30	5·89	6·71	8·76	7·98	7·17	..	..	15·77	24·41	31·69	35·38	67·66	83·03	83·26	206·49	307·98	313·41	542·34	1244·79	3964·69	3783·17
20	·44	4·45	7·58	8·87	11·00	10·05	9·10	16·05	17·96	19·59	29·80	38·70	43·28	80·75	100·19	99·62	246·20	358·60	366·69	638·78	1415·15	4471·66	4202·79
25	..	5·94	9·59	11·60	13·69	12·58	11·43	20·02	22·63	24·11	36·11	46·91	52·59	95·73	119·98	118·42	291·60	415·10	426·74	747·70	1601·24	5020·73	4664·14
30	·69	7·85	12·02	15·00	16·91	15·56	14·23	24·75	28·10	29·45	43·46	56·45	63·48	112·75	142·74	139·90	343·18	477·80	494·05	870·10	1803·53	5611·90	5170·85
35	..	10·29	14·93	19·20	20·71	19·14	17·55	30·35	34·52	35·68	51·97	67·49	76·12	131·97	168·87	164·32	401·48		569·11	1007·02	2022·43	6244·73	5726·81
40	1·08	13·37	18·36	24·35	25·17	23·38	21·48	38·93	42·01	42·91	61·75	80·19	90·70	153·52	198·80	191·96	467·02			1159·53	2258·25	6918·44	6335·98
45	..	17·22	22·41	30·61	30·38	28·35	26·08	44·60	50·75	51·23	72·95	94·73	107·42	177·57	232·98	223·07	540·35			1328·73	2495·43	7631·46	
50	1·70	21·99	27·14	38·17	36·40	34·14	31·44	53·50	60·29	60·75	85·71	111·28	126·48	204·22	271·93	257·94	622·00			1515·83	2781·48		
55	..	27·86	32·64	47·22	43·32	40·85	37·63	63·77	72·59	71·54	100·16	130·03	148·11	233·62	316·21	296·84	712·50			1721·98	3069·07		
60	2·65	35·02	39·01	57·99	51·22	48·56	44·74	75·54	86·05	83·72	116·45	151·19	172·50	265·85	366·42	340·05	812·38			1948·21	3374·02		
65	..	43·69	46·34	70·73		57·39	52·87	88·97	101·43	97·37	134·75	174·95	199·89	301·02	423·22	387·85	922·14			2196·51	3696·15		
70	4·06	54·11	54·74	85·71		67·42	62·11	104·21	118·94		155·21	201·51	230·49	339·21	487·32	440·50				2467·55	4035·32		
75	..	66·55	64·32	103·21		78·76	72·57	121·42	138·76		177·99	231·07	264·54	380·48	559·46	498·27				2763·00			
80	6·13	81·29	75·19	123·85			84·33	140·76	161·10		203·25	263·86	302·28	424·83		561·41				3084·31			
85	..	98·64	87·46	147·09			97·51	182·41	188·18		231·17	300·06	343·95	472·01		630·18				3433·09			
90	9·06	118·93	101·27	174·17			112·23	186·52	214·17		261·91	339·89	389·83			704·75				3810·92			
95	..	142·51	116·75	205·17			128·69	213·28	245·28		296·63	388·55	440·18			785·39				4219·57			
100	13·11	169·75	134·01	240·51			146·71	242·85	279·73		332·51	431·23	495·33			872·28				4660·82			
105	..	201·04	153·18	280·63			166·72	275·40	317·70		372·72	483·12	555·62										
110	18·6	236·76	174·41	325·96			188·74	311·10	359·40		416·41	539·40	621·46										
115	..	277·34	197·82	376·98			212·91	350·10	405·00		463·74	600·24	693·33										
120	25·7	323·17	223·54	434·18			239·37	392·57	454·69		514·88	665·80	771·92										
125	..	374·69	251·71	498·06			268·24	438·66	508·62		569.97	738·22											
130	34·9	432·30	282·43	569·13			299·69	488·51	566·97		629·16	811·85											
135	..	496·42	315·85	647·93			333·86	542·25	629·87		692·59	892·19											
140	46·4	567·46	352·07	733·71			370·90	600·02	697·44		760·40	977·96											
145	..	645·81	391·21	830·89			411·00	661·92			832·69												
150	60·5	731·84	433·37	936·13			454·31	728·06			909·59												
155	68.6	825·92	478·65				501·02	798·53															
160	77·5		527·14				551·31	873·42															
165			568·30				605·38	952·78															
170			634·07				663·44																
175							726·69																
180							792·35																
185							863·68																
190							939·90																

TABLE VII.—*Emissivity for Heat of Polished and Blackened Copper Surfaces.*

Difference of Temperature.	Amount of Heat lost per second per square centimetre of the surface per degree of difference of temperatures.		Ratio.
	Polished Surface.	Blackened Surface.	
5°	·000178	·000252	·707
10	·000186	·000266	·699
15	·000193	·000279	·692
20	·000201	·000289	·695
25	·000207	·000298	·694
30	·000212	·000306	·693
35	·000217	·000313	·693
40	·000220	·000319	·693
45	·000223	·000323	·690
50	·000225	·000326	·690
55	·000226	·000328	·690
60	·000226	·000328	·690

TABLE VIII.—*Thermal Conductivities.*

Substances.	Conductivity. k.	Authority.
Copper	0·91	
Iron	0·16	
Air, Oxygen, Nitrogen, Carbonic oxide	0·000049	Clausius and Maxwell, according to kinetic theory.
Carbonic acid	0·000038	Do. do.
Hydrogen	0·00034	Do. do.
Stone, porphyritic trachyte	·00590	Ayrton and Perry, *Phil. Mag.*, 1878, first half year, p. 241.
Underground strata	0·005	Forbes and Wm. Thomson.
Sandstone of Craigleith Quarry	0·01068	Do. do.
Traprock of Calton Hill	0·00415	Do. do.
Sand of Experimental Garden	0·00262	Do. do.
Water	0·002	J. T. Bottomley.
Fir, across fibres	·00026	Péclet, in Everett's *Units and Physical Constants.*
" along fibres	·00047	Do. do.
Walnut, across fibres	·00029	Do. do.
" along fibres	·00048	Do. do.
Oak, across fibres	·00059	Do. do.
Cork	·000029	Do. do.
Hempen cloth, new	0·000144	Do. do.
" " old	0·000119	Do. do.
Writing paper, white	0·000119	Do. do.
Gray paper, unsized	0·000094	Do. do.
Calico (new), of all densities.	0·000139	Do. do.
Wool (carded), of all densities	0·000122	Do. do.
Finely carded cotton wool	0·000111	Do. do.
Eider down	0·000108	Do. do.

TABLE IX.—*Diffusivities (Thermal, Material, and Electric).*

Substance.	Thermal Conductivity. k.	Thermal Capacity of Unit Bulk. c.	Diffusivity. k/c.	Authority.
Copper	0·91	0·845	1·077	
Iron	0·16	0·875	0·185	
Air, Oxygen, Nitrogen, Carbonic oxide	0·0000049	0·000307	0·16	Clausius and Maxwell, according to kinetic theory.
Carbonic acid	0·000038	0·000428	0·088 9	
Hydrogen	0·00034	0·000307	1·12	
Underground strata (rough average)	0·005	0·5	0·01	Forbes and W.Thomson
Wood	0·0005	0·39	0·001 3	
Water	0·002	1·00	0·002 2	J. T. Bottomley.
Traprock of Calton Hill	0·00415	·5283	0·007 86	Forbes and W.Thomson
Sand of Experimental Garden	0·00262	·3006	0·008 72	
Sandstone of Craigleith Quarry	0·01068	·4623	0·023 11	
Gravel of Greenwich Observatory Hill	...	...	0·012 49	Everett, *Units and Phys. Constants*, p. 101.
Stone, porphyritic trachyte.	·00590	0·5788	0·001 028	Ayrton and Perry, *Phil. Mag.*, 1878, first half-year, p. 241.
Material Diffusivities.				
Common salt, through water			0·000 011 61	Fick.
Cane sugar, through water			0·000 003 65	Volt.
Caramel, through water at 10° C			0·000 000 54	Prof. Mach of Prague, Imperial Academy of Sciences of Vienna, January 18, 1879.
Albumen, through water at 13° C			0·000 000 73	
Cane sugar, through water at 9° C			0·000 003 6	
Water and common salt, through water at 5° C			0·000 008 85	
Water and common salt, through water at 9° C			0·000 010 6	
Hydrochloric acid, through water			0·000 020 2	
Potassium chloride, 10% sol. through wat'r			·000 012 7	
Potassium bromide, "		"	·000 013 1	
Potassium iodide, "		"	·000 013 0	
Potassium nitrate, "		"	·000 009 26	
Potassium carbonate, "		"	·000 006 94	
Potassium sulphate, "		"	·000 008 68	
Ammonium chloride, "		"	·000 012 0	
Sodium bromide, "		"	·000 009 95	T. Schuhmeister, *Wiener Sitzungsberichte*, April 3, 1879.
Sodium iodide, "		"	·000 009 26	
Sodium chloride, "		"	·000 009 72	
Sodium nitrate, "		"	·000 006 94	
Sodium carbonate, "		"	·000 004 63	
Sodium sulphate, "		"	·000 007 64	
Lithium bromide, "		"	·000 009 26	
Litbium iodide, "		"	·000 009 26	
Lithium chloride, "		"	·000 008 10	
Calcium chloride, "		"	·000 007 87	
Cupric chloride, "		"	·000 004 98	
Copper sulphate, "		"	·000 002 43	
Zinc sulphate, "		"	·000 002 31	
Magnesium sulphate, "		"	·000 002 24	
Carbonic acid and air			0·142 3	Loschmidt, Imperial Academy of Vienna, 10th March, 1870, quoted from art. DIFFUSION, vol. vii. p. 188.
Carbonic acid and hydrogen			0·555 6	
Oxygen and hydrogen			0·721 4	
Carbonic acid and oxygen			0·140 9	
Carbonic acid and carbonic oxide			0·140 6	
Carbonic acid and marsh gas			0·158 6	
Carbonic acid and nitrous oxide			0·098 3	
Sulphurous acid and hydrogen			0·480 0	
Oxygen and carbonic oxide			0·180 2	
Carbonic oxide and hydrogen			0·642 2	

Electric Diffusivities.

Name of Cable.	Resistance per Nautical Mile in Ohms.[1]	Reciprocal of the Resistance per Centimetre of length in electro-magnetic C. G. S. Measure. k.	Electrostatic Capacity per Nautical Mile in Microfarads.[2]	Electrostatic Capacity per Centimetre of length in electro-magnetic C. G. S. Measure. c.	Diffusivity. k/c.
Suez-Aden	10·42	·0000178	0·3580	$1·93 \times 10^{-21}$	$0·920 \times 10^{16}$
Aden-Bombay	7·02	·0000264	0·3610	$1·95 \times 10^{-21}$	$1·354 \times 10^{16}$
Persian Gulf Cable, 1864.	6·25	·0000296	0·3486	$1·88 \times 10^{-21}$	$1·575 \times 10^{16}$
Atlantic, 1865	4·27	·0000434	0·3535	$1·908 \times 10^{-21}$	$2·274 \times 10^{16}$
French Atlantic, 1869	3·16	·0000586	0·4295	$2·232 \times 10^{-21}$	$2·528 \times 10^{16}$
Direct United States Cable	2·88	·0000643	0·4095	$2·211 \times 10^{-21}$	$2·909 \times 10^{16}$

[1] The ohm, or British Association unit of resistance, is equal to 10^7 electro-magnetic C. G. S. units.

[2] One microfarad is one-millionth of the farad or British Association unit of electrostatic capacity, and is equal to 10^{-15} electro-magnetic C.G.S. units of capacity.

[1] This result has been accidentally printed ·00000116 in some impressions of Vol. VII., p. 188, as it appeared in the original copy. It will be found properly changed in subsequent editions of the American Reprint.—AM. PUBS.

TABLE X.—*Relative Diffusivities of different Substances through Water.*

Approximate times of equal diffusion of different substances.	*Authority.*
Hydrochloric acid.....1	Graham.
Chloride of sodium.....2·33	
Sugar.....7	
Sulphate of Magnesia.....7	
Albumen.....49	
Caramel.....98	

MATHEMATICAL APPENDIX.

Let v be the temperature at any point P specified by ξ, η, ζ according to any system of three sets of plane or curved orthog-

onal surfaces used for co-ordinates. Let $\lambda d\xi$, $\mu d\eta$, $\nu d\zeta$ be the lengths of the edges of the infinitesimal rectangular parallelepiped having P for its centre, and its sides parts of the six surfaces $\xi - \frac{1}{2}d\xi$, $\xi + \frac{1}{2}d\xi$, $\eta - \frac{1}{2}d\eta$, $\eta + \frac{1}{2}d\eta$, $\zeta - \frac{1}{2}d\zeta$, $\zeta + \frac{1}{2}d\zeta$.

The rates of variation of temperature per unit of length in the directions corresponding to the variations of ξ, η, ζ are respectively

$$-\frac{1}{\lambda}\frac{dv}{d\xi}, \qquad -\frac{1}{\mu}\frac{dv}{d\eta}, \qquad -\frac{1}{\nu}\frac{dv}{d\zeta}.$$

Hence the fluxes across three infinitesimal rectangles having their edges parallel to the three pairs of sides of the parallelepiped, and each having its centre at P, are respectively

$$-\frac{k}{\lambda}\frac{dv}{d\xi}\cdot\mu\nu d\eta d\zeta, \quad -\frac{k}{\mu}\frac{dv}{d\eta}\nu\lambda d\zeta d\xi, \quad -\frac{k}{\nu}\frac{dv}{d\zeta}\lambda\mu d\xi d\eta.$$

Hence the excess of the quantities of heat conducted in to the parallelepiped above those conducted out across the three pairs of faces is

$$\left\{\frac{d}{d\xi}\left(k\frac{\mu\nu}{\lambda}\frac{dv}{d\xi}\right)+\frac{d}{d\eta}\left(k\frac{\nu\lambda}{\mu}\frac{dv}{d\eta}\right)+\frac{d}{d\zeta}\left(k\frac{\lambda\mu}{\nu}\frac{dv}{dv}\right)\right\}d\xi d\eta d\zeta\,. \quad (1).$$

The effect of this gain of heat is to warm the matter of the parallelepiped at a rate per unit of time equal to the rate of gain of heat divided by $c\lambda\mu\nu d\xi d\eta d\zeta$, the thermal capacity of the matter.

Hence

$$\frac{dv}{dt}=\frac{1}{c\lambda\mu\nu}\left\{\frac{d}{d\xi}\left(k\frac{\mu\nu}{\lambda}\frac{dv}{d\xi}\right)+\frac{d}{d\eta}\left(k\frac{\nu\lambda}{\mu}\frac{dv}{d\eta}\right)+\frac{d}{d\zeta}\left(k\frac{\lambda\mu}{\nu}\frac{dv}{d\zeta}\right)\right\}. \quad (2).$$

This, for the case of the uniform motion of heat ($dv/dt = 0$), was first given by Lamé, to whom the generalized system of curvilinear co-ordinates for a point is due ("Mémoire sur les Lois de l'Équilibre des Fluides Ethérés," *Journal de l'École Polytechnique*, vol. iii., cahier xxiii.). He deduced it from Fourier's equation [(3) below] in terms of plane rectangular co-ordinates by a laborious transformation. Equation (2) was first given, proved as above, as the direct expression of Fourier's fundamental law of conduction, by W. Thomson (*Cambridge Mathematical Journal*, Nov., 1843).

For plane rectangular co-ordinates we have $\lambda = \mu = \nu = 1$, and if we put x, y, z for ξ, η, ζ in this case, (2) becomes

$$\frac{dv}{dt}=\frac{1}{c}\left\{\frac{d}{dx}\left(k\frac{dv}{dx}\right)+\frac{d}{dy}\left(k\frac{dv}{dy}\right)+\frac{d}{dz}\left(k\frac{dv}{dz}\right)\right\} \quad (3),$$

which is Fourier's celebrated fundamental equation. From it we may deduce by transformation the proper forms of the corresponding equation for polar co-ordinates; but they are more easily got direct from the equation (2) for generalized co-ordinates. Thus for ordinary polar co-ordinates r, θ, ϕ we have, if we take these for ξ, η, ζ respectively,

$$\lambda = 1, \ \mu = r, \ \nu = r\sin\theta.$$

Hence (2) becomes

$$\frac{dv}{dt}=\frac{1}{cr^2}\left\{\frac{d}{dr}\left(kr^2\frac{dv}{dr}\right)+\frac{1}{\sin\theta}\frac{d}{d\theta}\left(k\sin\theta\frac{dv}{d\theta}\right)+\frac{1}{\sin^2\theta}\frac{d}{d\phi}\left(k\frac{dv}{d\phi}\right)\right\} \quad (4).$$

If k be constant, and we put $k/c = \kappa$, this becomes

$$\frac{dv}{dt}=\frac{\kappa}{r^2}\left\{\frac{d}{dr}\left(r^2\frac{dv}{dr}\right)+\frac{1}{\sin\theta}\frac{d}{d\theta}\left(\sin\theta\frac{dv}{d\theta}\right)+\frac{1}{\sin^2\theta}\frac{d^2v}{d\phi^2}\right\} \quad (5);$$

or

$$\frac{du}{dt}=\kappa\left\{\frac{d^2u}{dr^2}+\frac{1}{\sin\theta}\frac{d}{d\theta}\left(\sin\theta\frac{du}{d\theta}\right)+\frac{1}{\sin^2\theta}\frac{d^2u}{d\phi^2}\right\} \quad (6),$$

where $u = vr$ . . . . . .

If again we take for the co-ordinates r, ϕ, z (polar co-ordinates in the plane perpendicular to z being denoted by r, ϕ), we have $\lambda = 1$, $\mu = r$, $\nu = 1$, and so find

$$\frac{dv}{dt}=\frac{1}{c}\left\{\frac{d}{rdr}\left(kr\frac{dv}{dr}\right)+\frac{d}{rd\phi}\left(\frac{k}{r}\frac{dv}{d\phi}\right)+\frac{d}{dz}\left(k\frac{dv}{dz}\right)\right\} \quad (7).$$

For the case of k constant we may take it outside the brackets in each of these equations, as we have already done in (4); thus (2) becomes

$$\frac{dv}{dt}=\frac{k}{c}\left(\frac{d^2v}{dx^2}+\frac{d^2v}{dy^2}+\frac{d^2v}{dz^2}\right) \quad (8);$$

or, with κ for k/c, the diffusivity (§§ 81, 82),

$$\frac{dv}{dt}=\kappa\left(\frac{d^2v}{dx^2}+\frac{d^2v}{dy^2}+\frac{d^2v}{dz^2}\right) \quad (9).$$

It is this restricted form which, with the further restriction that c be constant, is most generally recognized as Fourier's equation of conduction, and it is for it, with these restrictions, that his brilliant solutions were given. These solutions are available for practical use by limiting the range of temperature within which any one solution is continuously applied to a range of temperature within which the values of k and c are each nearly enough constant. We may expect 10° or 20° C. on each side of the mean temperature to be practically not too wide a range for any case, judging from copper and iron (§ 80), the only substances for which hitherto we have any information as to variations of both k and c with temperature.

Each of the following expressions I. . . . XVII. for v satisfies (9) or its equivalent (6), as the reader will readily verify for himself. The special condition corresponding to the peculiar character of the particular solution is specially noted in each case. Fourier solutions.

I. Instantaneous simple point-source; a quantity θ of heat suddenly generated at the point (0, 0, 0) at time $t = 0$, and left to diffuse through an infinite homogeneous solid.

EVERY OTHER SOLUTION IS OBTAINABLE FROM THIS BY SUMMATION.

$$v=\frac{Q\varepsilon^{-r^2/4\kappa t}}{8\pi^{\frac{3}{2}}(\kappa t)^{\frac{3}{2}}} \quad (10),$$

where $r^2 = x^2 + y^2 + z^2$

Verify that $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} v\,dx\,dy\,dz = 4\pi\int_0^{\infty} vr^2dr = Q$; and that $v = 0$ when $t = 0$; unless also $x = 0$, $y = 0$, $z = 0$.

Remark that

$$\frac{dv}{dt}=0 \text{ when } t=\frac{r^2}{6\kappa} \quad (11).$$

II. Constant simple point-source, rate q:

$$v\left[=q\int_{-\infty}^{\infty}dt\frac{\varepsilon^{-r^2/4\kappa t}}{8\pi^{\frac{3}{2}}(\kappa t)^{\frac{3}{2}}}\right]=\frac{q}{4\pi r} \quad (12).$$

The formula within the brackets shows how this obvious solution is derivable from (11).

III. Continued point-source; rate per unit of time, at time t, an arbitrary function, $f(t)$:

$$v=\int_0^{\infty}d\chi f(t-\chi)\frac{\varepsilon^{-r^2/4\kappa\chi}}{8\pi^{\frac{3}{2}}(\kappa\chi)^{\frac{3}{2}}} \quad (13).$$

IV. Time-periodic simple point-source, rate per unit of time at time t, $q \sin 2nt$:

$$v\left[=q\int_0^{\infty}d\chi\sin 2n(t-\chi)\frac{\varepsilon^{-r^2/4\kappa\chi}}{8\pi^{\frac{3}{2}}(\kappa\chi)^{\frac{3}{2}}}\right]$$
$$=\frac{q}{4\pi r}\varepsilon^{-(\kappa n)^{\frac{1}{2}}r}\sin\left[2nt-(\kappa n)^{\frac{1}{2}}r\right] \quad (14).$$

Verify that v satisfies (6); also that $-4\pi r^2\frac{dv}{dr} = q \sin 2nt$ where $r = 0$.

V. Instantaneous spherical surface source; a quantity Q suddenly generated over a spherical surface of radius a, and left to diffuse outwards and inwards:

$$v=Q\frac{\varepsilon^{-(r-a)^2/4\kappa t}-\varepsilon^{-(r+a)^2/4\kappa t}}{8\pi^{\frac{1}{2}}ar(\kappa t)^{\frac{1}{2}}} \quad (15).$$

To prove this most easily, verify that it satisfies (6); and farther verify that

$$4\pi\int_0^{\infty}vr^2dr = Q;$$

and that $v = 0$ when $t = 0$, unless also $r = a$.

Remark that (15) becomes identical with (10) when $a = 0$; remark farther that (15) is obtainable from (10) by integration over the spherical surface.

VI. Constant spherical surface source; rate por unit of time from the whole surface, q:

$$v\left[=q\int_0^{\infty}dt\frac{\varepsilon^{-(r-a)^2/4\kappa t}-\varepsilon^{-(r+a)^2/4\kappa t}}{8\pi^{\frac{1}{2}}ar(\kappa t)^{\frac{1}{2}}}\right]$$
$$=q/4\pi r, \quad \text{where } r>a$$
and $$=q/4\pi a, \quad \text{where } r<a \quad (16).$$

The formula within the brackets shows how this obvious solution is derivable from (13).

VII. Time-periodic spherical surface source; rate per unit of time, at time t, from whole surface, $q \sin 2nt$:

$$v\left[=q\int_0^{\infty}d\chi\sin 2n(t-\chi)\frac{\varepsilon^{-(r-a)/4\kappa\chi}-\varepsilon^{-(r+a)^2/4\kappa\chi}}{8\pi^{\frac{1}{2}}ar(\kappa\chi)^{\frac{1}{2}}}\right]$$
$$=\frac{A}{r}\varepsilon^{-(\kappa n)^{\frac{1}{2}}r}\sin\left[2nt-(\kappa n)^{\frac{1}{2}}r+B\right], \text{ where } r>a,$$
$$=\frac{C}{r}\left\{\varepsilon^{-(\kappa n)^{\frac{1}{2}}r}\sin\left[2nt-(\kappa n)^{\frac{1}{2}}r+D\right]-\varepsilon^{(\kappa n)^{\frac{1}{2}}r}\sin\left[2nt+(\kappa n)^{\frac{1}{2}}r+D\right]\right\}$$
where $r<a$ (17),

where A, B, C, D are constants determined by the conditions that

$$v_{r>a}-v_{r<a}=0,$$

and $$-4\pi a^2\left\{\left(\frac{dv}{dr}\right)_{r>a}-\left(\frac{dv}{dr}\right)_{r<a}\right\}=q\sin 2nt,$$

when the two values of r exceed a and fall short of a by infinitely small differences. Verify that v satisfies (6). Also that v is finite when $r=0$.

VIII. Fourier's "Linear Motion of Heat;" instantaneous plane-source; quantity per unit surface, σ:

$$v=\frac{\sigma\varepsilon^{-x^2/4\kappa t}}{2\pi^{\frac{1}{2}}(\kappa t)^{\frac{1}{2}}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (18).$$

Verify that this satisfies (9) for the case of v independent of y and z, and that

$$\int_{-\infty}^{\infty} v\,dx=\sigma.$$

Remark that (18) is obtainable from (15) by putting $Q/4\pi a^2=\sigma$, and $a=\infty$; or directly from (10) by integration over the plane.

IX. "Linear Motion of Heat;" time-periodic plane-source; rate per unit of area, per unit of time, at time t, $\sigma\sin 2nt$:

$$\left.\begin{aligned} v\left[=q\int_0^{\infty}d\chi\sin 2n(t-\chi)\frac{\varepsilon^{-x^2/4\kappa\chi}}{2\pi^{\frac{1}{2}}(\kappa\chi)^{\frac{1}{2}}}\right] \\ =\frac{\sigma}{(2n)^{\frac{1}{2}}2\pi}\varepsilon^{-n^{\frac{1}{2}}x}\sin(2nt-n^{\frac{1}{2}}x-\tfrac{1}{4}\pi) \text{ where } x>0 \\ =\frac{\sigma}{(2n)^{\frac{1}{2}}2\pi}\varepsilon^{+n^{\frac{1}{2}}x}\sin(2nt+n^{\frac{1}{2}}x-\tfrac{1}{4}\pi) \text{ where } x<0 \end{aligned}\right\} \quad . \quad (19).$$

Verify that v satisfies $\frac{dv}{dt}=\kappa\frac{d^2v}{dx^2}$, which is what (9) becomes when v is independent of y and z; also that

$$-2\pi\frac{dv}{dx}=\sigma\sin 2nt \text{ when } x \text{ is infinitely small positive,}$$

and $$+2\pi\frac{dv}{dx}=\sigma\sin 2nt \text{ when } x \text{ is infinitely small negative.}$$

X. "Linear Motion of Heat;" space-periodic simple harmonic solid source, with plane isothermal surfaces. Initial distribution, $v=V\sin ax$, when $t=0$. Solution for any value of t

$$v\left[=V\int_{-\infty}^{\infty}d\xi\,\sin a(x-\xi)\frac{\varepsilon^{-\xi^2/4\kappa t}}{2\pi^{\frac{1}{2}}(\kappa t)^{\frac{1}{2}}}\right]=V\varepsilon^{-\kappa a^2t}\sin ax \quad . \quad (20).$$

Modifying the integral within the brackets to make it appear as an analytical expression belonging to the general theory of images, for the case of a single infinite row of images, and equating the result to the right-hand member, we see that

$$\frac{1}{4\kappa t}\int_0^{\frac{2\pi}{a}}d\xi\begin{matrix}\sin\\\cos\end{matrix}a(x-\xi)\sum_{i=-\infty}^{i=\infty}\varepsilon^{-\left(\xi+\frac{2i\pi}{a}\right)^2/4\kappa t}=\varepsilon^{-\kappa a^2t}\begin{matrix}\sin\\\cos\end{matrix}ax \quad (21),$$

i being any integer.

It is obvious that for a we may substitute ja in the second member, and in the factor $\begin{matrix}\sin\\\cos\end{matrix}a(x-\xi)$ under the integral sign of the first member, without altering it elsewhere, j being any integer: thus we have

$$\left.\begin{aligned} \frac{1}{4\kappa t}\int_0^{\frac{2\pi}{a}}d\xi\begin{matrix}\sin\\\cos\end{matrix}ja(x-\xi)\mathrm{S}=\varepsilon^{-\kappa j^2a^2t}\begin{matrix}\sin\\\cos\end{matrix}jax \\ \text{where } \mathrm{S}=\sum_{i=-\infty}^{i=\infty}\varepsilon^{-\left(\xi+\frac{2i\pi}{a}\right)^2/4\kappa t} \end{aligned}\right\} \quad . \quad (22).$$

XI. "Linear Motion of Heat;" space-periodic arbitrary solid source, isothermals plane. Initial distribution, $v=f(x)$, when $t=0$, f denoting an arbitrary periodic function, period l, so that $f(x+il)=f(x)$, i being any integer. Two solutions (A), (B).

(A) derived synthetically from (10):

$$v=\frac{1}{2(\pi\kappa t)^{\frac{1}{2}}}\int_0^l d\xi f(x-\xi)\,\mathrm{S} \quad . \quad . \quad . \quad . \quad (23)^1,$$

$$\text{where } \mathrm{S}=\sum_{i=-\infty}^{i=\infty}\varepsilon^{-(\xi+il)^2/4\kappa t} \quad . \quad . \quad . \quad (24).$$

(B) derived analytically and synthetically from (20):

Find A_0, A_1, A_2, ..., B_1, B_2, etc., by the harmonic analysis, to satisfy the condition

$$\left.\begin{aligned} fx=A_0+A_1\cos\theta+A_2\cos 2\theta+\text{etc.} \\ +B_1\sin\theta+B_2\sin 2\theta+\text{etc.} \\ \text{where } \theta=\frac{2\pi x}{l} \end{aligned}\right\} \quad . \quad . \quad . \quad (25).$$

$$\text{Then } v=A_0+\sum_{j=1}^{j=\infty}\varepsilon^{-\kappa\left(\frac{2j\pi}{l}\right)^2t}\left(A_j\cos\frac{2j\pi x}{l}+B_j\sin\frac{2j\pi x}{l}\right) \quad (26).$$

XII. Uniform row of simple instantaneous plane sources. Two solutions (A) and (B).

[1] This is Fourier's (i) of Art. 374 for the case of $f(x)$ a periodic function.

(A), from XI. (A), (23):

$$v=\frac{\sigma}{2(\pi\kappa t)^{\frac{1}{2}}}\sum_{i=-\infty}^{i=\infty}\varepsilon^{-(x+il)^2/4\kappa t} \quad . \quad . \quad . \quad (27).$$

The No. 2 diffusion curve of § 82 is the representation of the first term ($i=0$) of this formula.

(B), from XI. (B), (25) and (26):

$$v=\frac{\sigma}{l}\left\{1+2\sum_{j=1}^{j=\infty}\varepsilon^{-\kappa\left(\frac{2j\pi}{l}\right)^2t}\cos\frac{2j\pi x}{l}\right\} \quad . \quad . \quad (28).$$

The comparison of these two solutions is very interesting physically, and useful arithmetically. To facilitate the comparison, put

$$l/2(\pi\kappa t)^{\frac{1}{2}}=q, \text{ and } x/2(\pi\kappa t)^{\frac{1}{2}}=p \quad . \quad . \quad . \quad . \quad (29);$$

the two solutions become

$$\frac{lv}{\sigma}=q\sum_{i=-\infty}^{i=\infty}\varepsilon^{-\pi(p+iq)^2}=1+2\sum_{j=-\infty}^{j=\infty}\varepsilon^{-\frac{l^2\pi}{q^2}}\cos\frac{2jp\pi}{q} \quad . \quad (30).$$

The equation between the second and third member, virtually due originally to Fourier, is also an interesting formula of Jacobi's, *Fundamenta Nova Theoriæ Functionum Ellipticarum*, as was long ago pointed out by Cayley.[2] Each formula is a series which converges for every value of t however small or however great; the first, (27), the more rapidly the less is t; the second, (28), the more rapidly the greater is t. For the case of $t=l^2/4\kappa\pi$, and $x=0$ (that is, $q=1$ and $p=0$), the two series become identical. For the more comprehensive case of $p=0$, but q unrestricted, the comparison gives the following very curious arithmetical theorem—

$$q\frac{1+2(\varepsilon^{-\pi q^2}+\varepsilon^{-4\pi q^2}+\varepsilon^{-9\pi q^2}+\text{etc.})}{1+2(\varepsilon^{-\pi/q^2}+\varepsilon^{-4\pi/q^2}+\varepsilon^{-9\pi/q^2}+\text{etc.})}=1 \quad . \quad (31).$$

When $t\gtrless l^2/4\kappa\pi$ (or $q\gtrless 1$) the first solution (27) converges with so great suddenness that three terms suffice for most practical purposes; when $t\lesssim l^2/4\kappa\pi$ (or $q\lesssim 1$) the second solution (28) converges with so great suddenness that *one* term (after the constant first term) suffices for most practical purposes. Thus by using the solution (27) for all values of t from zero to something less than $l^2/4\kappa\pi$, and (28) for all values greater than the greatest for which (27) is used, we have an exceedingly rapid convergence and easy calculation to find v for any values of x and t. These formulæ, thus used, have been of great practical value in calculating what is now known as the arrival curve of signals through a submarine cable, and in designing instruments to record it automatically and allow its telegraphic meaning to be read, or without recording it to allow its meaning to be read by watching the motions of a spot of light. It is clear that (27) and (28) express the potential at a point at distance x from one end of a cable of length $\frac{1}{2}l$, at time t from an instant when a quantity $\frac{1}{2}\sigma c$ of electricity has been suddenly communicated to that end of the cable, both ends being always kept insulated after that instant (as is done practically by an exceedingly short contact with one pole of a voltaic battery, the other being kept to earth). The value of v for $x=\frac{1}{2}l$, and for all values of t from 0 to ∞, represents the rise of the potential at the remote end towards the limiting value $\frac{\sigma}{c}$, towards which the potential rises throughout the conductor.

XIII. (X. in three dimensions.) Space triple periodic solid source; in other words $v=V\sin ax\sin\beta y\sin\gamma z$, when $t=0$. Solution for any value of t—

$$\left.\begin{aligned} v\left[=V\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}d\xi d\eta d\zeta\sin\alpha(x-\xi)\sin\beta(y-\eta)\sin\gamma(z-\zeta)\right. \\ \left.\frac{-\xi^2+\eta^2+\zeta^2}{4\kappa t}}{8\pi^{\frac{3}{2}}(\kappa t)^{\frac{3}{2}}}\right]=V\sin\alpha x\sin\beta y\sin\gamma z\varepsilon^{-\kappa(\alpha^2+\beta^2+\gamma^2)t} \end{aligned}\right\} \quad . \quad . \quad (32).$$

Remark that, as an analytical expression for the present case of the general theory of triply-multiple images, the triple integral within the brackets may be written

$$\left.\begin{aligned} V\int_0^{\frac{2\pi}{\alpha}}\int_0^{\frac{2\pi}{\beta}}\int_0^{\frac{2\pi}{\gamma}}d\xi d\eta d\zeta\sin\alpha(x-\xi)\sin\beta(y-\eta)\sin\gamma(z-\zeta)\frac{\mathrm{S}}{8\pi^{\frac{3}{2}}(\kappa t)^{\frac{3}{2}}} \\ \text{where} \\ \mathrm{S}=\sum_{i=-\infty}^{i=\infty}\sum_{j=-\infty}^{j=\infty}\sum_{k=-\infty}^{k=\infty}\varepsilon^{-\frac{\left(\xi+\frac{2i\pi}{\alpha}\right)^2+\left(\eta+\frac{2j\pi}{\beta}\right)^2+\left(\xi+\frac{2k\pi}{\gamma}\right)^2}{4\kappa t}} \end{aligned}\right\} \quad (33)$$

i, j, k, being any positive or negative integers.

XIV. and XV. (X. and XI. in three dimensions.) The for-

[2] *Quarterly Journal of Mathematics* for 1857; Note by Cayley on an article by W. Thomson, entitled "On the Calculation of Transcendents of the form $\int_0^x\varepsilon^{-x^2}f(x)dx$."

mulæ may be written down by inspection; from I., with X. and XI. for guides. The analytical theorem thus obtained, corresponding to (30), in three dimensions, is interesting to pure mathematicians.

XVI. Harmonic solutions. Any distribution of heat, whether in an infinite or in a bounded solid, which keeps its type unchanged in subsiding towards uniformity, when left without positive or negative sources, except such, essentially negative, as are required to fulfil a proper boundary condition, is called a harmonic distribution, provided the temperature does not increase to infinity in any direction. The boundary condition, if the solid is bounded, is essentially that the rate of emission from the surface at every point of it varies in simple proportion to the temperature, and at such a rate per 1° of temperature at each part of the surface as the solution requires. X. and XIII. are examples. The general condition for a harmonic solution is

$$v = f(t)\mathrm{F}(x,y,z) \quad . \quad . \quad . \quad . \quad . \quad . \quad (34);$$

and this tried in (9) gives

$$\frac{1}{f(t)}\frac{df(t)}{dt} = -\kappa\frac{\frac{d^2\mathrm{F}}{dx^2}+\frac{d^2\mathrm{F}}{dy^2}+\frac{d^2\mathrm{F}}{dz^2}}{\mathrm{F}} \quad . \quad . \quad . \quad . \quad (35).$$

The first member being independent of x, y, z, and the second being independent of t, the common value of the two must be independent of x, y, z, t, that is to say, must be an absolute constant. Let it be denoted by $-\rho$; we have

$$f(t) = \mathrm{C}\varepsilon^{-\rho t} \quad . \quad . \quad . \quad . \quad (36),$$

$$\text{and } \frac{d^2\mathrm{F}}{dx^2}+\frac{d^2\mathrm{F}}{dy^2}+\frac{d^2\mathrm{F}}{dz^2}+\frac{\rho}{\kappa}\mathrm{F} = 0 \quad . \quad . \quad . \quad . \quad (37),$$

or in terms of polar co-ordinates, by (6),

$$\left.\begin{aligned}&\frac{d^2\mathrm{U}}{dr^2}+\frac{1}{r^2\sin\theta}\frac{d}{d\theta}\left(\sin\theta\frac{d\mathrm{U}}{d\theta}\right)+\frac{1}{r^2\sin^2\theta}\frac{d^2\mathrm{U}}{d\phi^2}+\frac{\rho}{\kappa}\mathrm{U} = 0\\ &\text{wh}\qquad \mathrm{U} = \frac{\mathrm{F}}{r}.\end{aligned}\right\} \quad (38).$$

Of this we have a spherical harmonic solution,

$$\mathrm{U} = [\mathrm{A}\phi_i(r)+\mathrm{B}\psi_i(r)]\mathrm{S}_i \quad . \quad . \quad . \quad (39),$$

where S_i denotes a spherical surface-harmonic of order i, and $\phi_i(r)$, $\psi_i(r)$, two particular solutions of the equation

$$\frac{d^2u}{dr^2}+\left[\frac{\rho}{\kappa}-\frac{i(i+1)}{r^2}\right]u = 0 \quad . \quad . \quad . \quad . \quad (40).$$

Then (36) and (35) give finally

$$v = \varepsilon^{-\rho t}\frac{\mathrm{A}\phi_i(r)+\mathrm{B}\psi_i(r)}{r}\mathrm{S}_i \quad . \quad . \quad . \quad . \quad (41).$$

This solution is in its generality applicable to an infinite solid occupying all space except a hollow round the origin. The solid may of course be bounded externally also by a finite closed surface. If there be no hollow, A/B must fulfil the condition that $[\mathrm{A}\phi_i(r)+\mathrm{B}\psi_i(r)]/r$ is finite when $r = 0$. If there are two boundaries, concentric spherical surfaces, with their common centre at the origin of co-ordinates, the boundary condition obviously requires uniform emissivity over each, but not necessarily equal for the two. If the two emissivities be denoted by h and h', and the radii of the surfaces by a (outer) and a' (inner), the boundary conditions are

$$\left.\begin{aligned}&\frac{dv}{dr} = -hv, \text{ when } r = a\\ &\text{and } \frac{dv}{dr} = h'v, \text{ when } r = a'\end{aligned}\right\} \quad . \quad . \quad . \quad . \quad (42).$$

From these we may find h and h', so as to let the harmonic character of the solution be fulfilled in the subsidence. Or if h and h' be given, we have in (41) two equations which determine the two unknown quantities A/B and ρ. Eliminating A/B, we thus find a single transcendental equation for ρ, which is proved to have no imaginary or negative roots, and an infinite number of real positive roots, each $> \kappa i(i+1)/r^2$. In the case of $i = 0$, or temperature independent of ϕ and θ, (40) gives

$$u = \mathrm{A}\cos r\sqrt{\frac{\rho}{\kappa}}+\mathrm{B}\sin r\sqrt{\frac{\rho}{\kappa}}.$$

For this case the transcendental equation for determining values for ρ is very simple, and its roots are calculated numerically with great ease. With the further restriction of no central hollow, we must have $\mathrm{A} = 0$, so that u/r may be finite when $r = 0$. This case was fully investigated by Fourier, and very beautifully worked out in his fifth chapter. The more general problem of a solid sphere, with any given initial distribution of temperature, without the restriction of temperature independent of θ and ϕ, was solved first we believe by Poisson in the 11th chapter of his *Théorie Mathematique de la Chaleur*, in terms of the formulæ (36), (38), (40) above.

XVII. The equation of the transference of heat in terms of columnar co-ordinates, (7) above, affords naturally another beautiful case of harmonic solution. Assume

$$v = \varepsilon^{-\rho t}u_i\begin{matrix}\sin\\ \cos\end{matrix} i\phi\begin{matrix}\sin\\ \cos\end{matrix} mz \quad . \quad . \quad . \quad . \quad (43);$$

we find by (7)

$$\frac{d^2u_i}{dr^2}+\frac{1}{r}\frac{du_i}{dr}+\left(\frac{\rho}{\kappa}-m^2-\frac{i^2}{r^2}\right)u_i = 0 \quad . \quad . \quad . \quad (44)$$

The treatment of this equation and its integral (obviously derivable by i differentiations from u_0, which is a Bessel's function) for the full solution of the thermal problem is most interesting, and very instructive and suggestive in respect to pure analysis. It was splendidly worked out for the case of $m = 0$ and $i = 0$ by Fourier in his 6th chapter, "The Motion of Heat in a Solid Cylinder," truly a masterpiece of art. When it was printed in 1821, and published after having with the rest of Fourier's work been buried alive for fourteen years in the archives of the French Academy, and when Bessel found in it so thorough an investigation and so strikingly beautiful an application of the "Besselsche Function," we can imagine the ordinary feeling towards those "qui ante nos nostra dixerunt" reversed into the pleasure of genuine admiration.

HEATH, the English form of a name given in most Teutonic dialects to the common ling or heather, but now applied to all species of *Erica*, an extensive genus of monopetalous plants, belonging to the order *Ericaceæ*. The heaths are evergreen shrubs, with small narrow leaves, in whorls usually set rather thickly on the shoots; the persistent flowers have 4 sepals, and a 4-cleft campanulate or tubular corolla, in many species more or less ventricose or inflated; the dry capsule is 4-celled, and opens, in the true *Ericæ*, in 4 segments, to the middle of which the partitions adhere, though in the ling the valves separate at the dissepiments. The plants are mostly of low growth, but several African kinds reach the size of large bushes, and a Spanish variety, *E. arborea*, occasionally attains almost the aspect and dimensions of a tree.

One of the best known and most interesting of the family is the common heath, heather, or ling, *Calluna vulgaris*, placed by most botanists in a separate genus on account of the peculiar dehiscence of the fruit, and from the colored calyx, which extends beyond the corolla, having a whorl of sepal-like bracts beneath. This shrub derives some economic importance from its forming the chief vegetation on many of those extensive wastes that occupy so large a portion of the more sterile lands of northern and western Europe, the usually desolate appearance of which is enlivened in the latter part of summer by its abundant pink blossoms. When growing erect to the height of a yard or more, as it often does in sheltered places, its purple stems, close-leaved green shoots, and feathery spikes of bell-shaped flowers render it one of the handsomest of the heaths; but on the bleaker elevations and more arid slopes it frequently rises only a few inches above the ground. In all moorland countries the ling is applied to many rural purposes; the larger stems are made into brooms, the shorter tied up into bundles that serve as brushes, while the long trailing shoots are woven into baskets. Pared up with the

FIG. 1.—*Erica cinerea.*

FIG. 2.—*Calluna vulgaris.*

peat about its roots it forms a good fuel, often the only one obtainable on the drier moors. The shielings of the Scotch Highlanders were formerly constructed of heath stems, cemented together with peat-mud, worked into a kind of mortar with dry grass or straw; hovels and sheds for temporary purposes are still sometimes built in a similar way, and roofed in with ling. Laid on the ground, with the flowers above, it forms a soft springy bed, the luxurious couch of the ancient Gael, still gladly resorted to at times by the hill shepherd or hardy deer-stalker. The young shoots were in former days employed as a substitute for hops in brewing, while their astringency rendered them valuable as a tanning material in Ireland and the Western Isles. They are said also to have been used by the Highlanders for dyeing woollen yarn yellow, and other colors are asserted to have been obtained from them, but some writers appear to confuse the dyer's-weed, *Genista tinctoria*, with the heather. The young juicy shoots and the seeds, which remain long in the capsules, furnish the red grouse of Scotland with the larger portion of its sustenance; the ripe seeds are eaten by many birds. The tops of the ling afford a considerable part of the winter fodder of the hill flocks, and are popularly supposed to communicate the fine flavor to Welsh and Highland mutton, but sheep seldom crop heather while the mountain grasses and rushes are sweet and accessible. In recent times ling has been suggested as a material for paper, but the stems are hardly sufficiently fibrous for that purpose. The purple or fine-leaved heath, *E. cinerea*, one of the most beautiful of the genus, abounds on the lower moors and commons of Great Britain and western Europe, in such situations being sometimes more prevalent than the ling. The flowers of both these species yield much honey, furnishing a plentiful supply to the bees in moorland districts; from this heath honey the Picts probably brewed the mead said by Boetius to have been made from the flowers themselves.

It was until recently supposed that no species of heath existed in America; but of late years isolated plants of ling have been found in various parts of New England, Nova Scotia, and Cape Breton, while it has been stated to occur in some abundance in several places in Newfoundland; probably in distant ages it may have had a wider range on the American continent. The whole group, as observed by Bentham, is "eminently Atlantic" in its present distribution,—of nearly 500 known species by far the greater part being indigenous to the western districts of South Africa, and nearly all the remainder limited to Europe and its adjacent islands.

The Cape heaths have long been favorite objects of horticulture. In the warmer parts of Britain several will bear exposure to the cold of ordinary winters in a sheltered border, but most need the protection of the conservatory. They are sometimes raised from seed, but are chiefly multiplied by cuttings "struck" in sand, and afterwards transferred to pots filled with a mixture of black peat and sand; the peat should be dry and free from sourness. Much attention is requisite in watering heaths, as they seldom recover if once allowed to droop, while they will not bear much water about their roots; the heath-house should be light and well ventilated, the plants requiring sun, and soon perishing in a close or permanently damp atmosphere; in England little or no heat is needed in ordinary seasons. The European heaths succeed well in English gardens, only requiring a peaty soil and sunny situation to thrive as well as in their native localities: *E. carnea, mediterranea, ciliaris, vagans*, and the pretty cross-leaved heath of boggy moors, *E. tetralix*, are among those most worthy of cultivation. The beautiful large-flowered St. Dabeoc's heath, belonging to the closely allied genus *Menziesia*, is likewise often seen in gardens.

(C. P. J.)

HEATHCOAT, John (1783–1861), the author of important inventions for facilitating the manufacture of Buckingham or French lace, was born at Duffield near Derby in 1783. During his apprenticeship to a framesmith near Loughborough, he made an improvement in the construction of the warp-loom, so as to produce mitts of a lace-like appearance by means of it. He commenced business on his own account at Nottingham, but finding himself subjected to the intrusion of competing inventors he removed to Hathern. There he diligently prosecuted his experiments, and in 1808 constructed a machine capable of producing an exact imitation of real pillow-lace. This was by far the most expensive and complex textile apparatus till then existing; and in describing the process of his invention, Heathcoat said in 1836, "The single difficulty of getting the diagonal threads to twist in the allotted space was so great that, if now to be done, I should probably not attempt its accomplishment." Some time before perfecting his invention, which he patented in 1809, he removed to Loughborough, where he entered into partnership with Mr. Lacy, a Nottingham manufacturer; but in 1816 their factory was attacked by the Luddites and the lace frames destroyed. The damages were assessed in the King's Bench at £10,000; but as Heathcoat declined to expend the money in the county of Leicester he never received any part of it. Undaunted by his loss, he began at once to construct new and greatly improved machines in an unoccupied factory at Tiverton, Devonshire, propelling them by water-power and afterwards by steam. His claim to the invention of the twisting and traversing lace machine was disputed, and a patent was taken out by a clever workman for a similar machine, which was decided at a trial in 1816 to be an infringement of Heathcoat's patent. He followed his great invention by others of much ability, as, for instance, contrivances for ornamenting net while in course of manufacture and for making ribbons and platted and twisted net upon his machines, improved yarn spinning-frames, and methods for winding raw silk from cocoons. He also patented an improved process for extracting and purifying salt. An offer of £10,000 was made to him in 1833 for the use of his processes in dressing and finishing silk nets, but he allowed the highly profitable secret to remain undivulged. In 1832 he patented a steam plough, which stood foremost in public estimation until superseded by those of Fowler and others. Heathcoat was elected member of parliament for Tiverton in 1832. Though he seldom spoke in the House he was constantly engaged on committees, where his thorough knowledge of business and sound judgment were highly valued. He retained his seat until 1859, and after two years of declining health he died in January, 1861, at Bolham House, near Tiverton.

HEATING. In temperate latitudes the climate is generally such as to necessitate in dwellings, during a great portion of the year, a temperature warmer than that out of doors, and, similarly, tropical plants growing in temperate climates require artificial heat in the house in which they are preserved. Thus heating is required for health and comfort: the object of the application of science is to obtain these with the greatest degree of economy. In its aspect as to health it may be assumed that no system of heating is advisable which does not provide for a constant renewal of the air in the locality warmed. In climates such as that of the United Kingdom, the temperature of living rooms should be maintained at from 54° to 68° Fahr. in the daytime; the night temperature may be lower, but should not fall below 40°; and the humidity of the air as measured by the wet and dry bulb thermometers should show a difference of not less than 4° nor much exceeding 8° between the two thermometers, although with an ample supply of air a greater degree of dryness would probably not be found objectionable.

All heating apparatus depends upon the transference of heat from the fire to the various parts of the building which it is intended to warm, and this transfer may be effected by radiation, by conduction, or by convection. Radiant heat is emitted and absorbed in an accelerating ratio in proportion as the difference of temperature between the radiant and the recipient increases, and, with the same difference of temperature between the recipient and the radiant, the effect of the radiant will be greater according to the increased temperature of the recipient. In other words, the ratio of the emission of heat increases with the temperature. It is thus easier to effect the warming of a given space by means of a highly-heated surface than by a surface emitting a lower temperature.

An open fire acts by radiation; it warms the air in a room by first warming the walls, floor, ceiling, and articles in the room, and these in their turn warm the air. Therefore in a room with an open fire the air of the room is, as a rule, less heated than the walls. In this case the warming of the air depends on the capacity of the surfaces to absorb or emit heat; except that the heat received by the walls may be divided into two parts, one part heating the air in contact with the wall, and the other passing through the wall to the outer surface, where it is finally dissipated and wasted. Fireplaces are sometimes constructed to assist the warming of the air of a room. For instance, in Sylvester's grate iron bars of which one end terminates under the fire are laid so as to form a projecting radiating hearth. The ventilating

fireplace warms the fresh air before its admission into the room by means of gills cast on the back of the grate.

In a close stove, heated to a moderate temperature, the heat, as it passes from the fire, warms the surface of the materials which enclose and are in contact with the fire and with the heated gases. The materials next transfer the heat to the outer surface in contact with the air; and the air is warmed by the agency of this outer surface. If heated to high temperatures a stove gives out radiant heat, which passes through the air to warm the objects on which the rays impinge.

With hot-water pipes, the heat from the water heats the inner surface of the pipe, and this surface transfers its heat to the outer surface through the material of the pipes. The rate at which the heat can pass from the inner to the outer surface, and be thus utilized instead of passing away straight into the chimney, depends on the heat evolved by the fire, on the extent of surfaces exposed to the heat and their capacity to absorb and emit heat, and on the quality of the material between the inner and the outer surface as a good or bad conductor of heat. This passage of heat through a body by conduction varies directly with the quality of material, and with the difference between the temperature of the inner surface exposed to the heat and the outer surface exposed to a cooling influence, and inversely as the thickness between the surfaces. Other things being equal, copper is a better material than iron for conveying the heat from the fire to water or air; and coverings of brickwork, wood, or woollen fabrics are better adapted than iron for retaining the heat. The property which appears more than any other to make materials good non-conductors of heat is their porosity to air, and the retention of the air in their pores.

The direct warming of the air may be effected by stoves with brick or iron flues, or by hot water or steam pipes. The sizes of the heating surfaces for this object must be proportioned to the volume of air required to be warmed for ventilation, and the degree of heat to be maintained, the thickness of the material, and its capacity for absorbing and radiating heat and for transferring heat from one surface to the other. When a large volume of air is supplied and removed for ventilation, rapidity in transferring the heat from the fuel to the air is an important consideration. Brick stoves and flues are worse conductors of heat than iron stoves or flues, but the surface of a brick stove parts with the heat which reaches it somewhat more rapidly than do the surfaces of an iron flue. The slow conducting power of the material and the greater thickness of a brick stove prevent alternations which may take place in the fire from being felt so much as with iron stoves or flues; and therefore the brick stove warms the air more equably, without sudden variations; the air so warmed is free from objectionable elements; and where they can be conveniently applied, it is advisable to use brick stoves for warming air for ventilating purposes.

With an iron flue pipe from a stove, almost the whole heat which any fuel is capable of developing may be utilized by using a sufficiently long pipe, horizontal for the greater part of its length, to convey the products of combustion to the outer air. The heat given out by a stove pipe varies with the temperature from end to end, being of course greatest at the end next the stove, where the emission of heat is very rapid; and the amount of heat given out per square foot will vary at each point as the distance from the stove increases. The proportions also into which the heat divides itself between radiation and convection vary greatly with the temperature. Thus, with a stove pipe heated at the end nearest the stove to a dull red heat of 1230° Fahr., and of sufficient length to allow the heat to be diminished to 150° at the further end, it would be found that at the stove end of the flue pipe 92 per cent. of the total heat emitted by the pipe is given out by radiation to the walls and only 8 per cent. to the air; but at the exit end the heat is nearly equally divided, the walls receiving 55 and the air 45 per cent. Taking the whole length of such a pipe, the walls would receive 74 per cent. and the air 26 per cent. of the heat emitted. But with a flue pipe heated to lower temperatures, the air might receive half the heat or even more. When therefore the object is to heat the walls rather than the air, the temperature of the pipes should be high; and for this purpose stove pipes are more effective than hot-water or low-pressure steam pipes. At high temperatures there will be practically little difference of effect between horizontal and vertical flue pipes, because the heat given out is principally that due to radiation, which is independent of the form and position of the radiant. An adequate proportion of flue pipes to the form and size of the stove involves a large surface for the flue pipe; with a careful observance of proportion, as much as 94½ per cent. of the heat in the fuel has been utilized.

There are, however, several serious objections to iron stoves, especially for small rooms: a long flue pipe is unsightly, and on that account often inadmissible; iron stoves heat rapidly, and easily become red-hot, and the effect produced therefore is unequal. Carbonic oxide, too, has been found in air warmed by iron stoves very highly heated. It is alleged that highly-heated iron may take oxygen from the carbonic acid in the air in contact with its surface, and thus reduce the acid to carbonic oxide.

Whenever iron stoves or cockles are used for heating air, care should be taken to prevent the iron from attaining a high temperature, and with this object all iron stoves should have a lining of fire-brick, so as to prevent the fire from coming in direct contact with the iron; such an arrangement preserves greater regularity in the heating of the air. This object may be also attained by giving the stove a large surface in proportion to the fire by means of flanges or gills to carry off the heat as fast as it is generated. Iron coated with a surface of glazed enamel would enable the heat to pass rapidly from the fire to the surface, while the enamel surface would emit the heat more rapidly than the iron surface.

Hot-water pipes for warming air are free from many of the objections arising from the direct application of heat to iron, because the heat can be regulated with exactness.

A high temperature may be obtained from water without generating steam by heating it under pressure. In Perkins's high pressure system a continuous iron tube, about 1 inch diameter, is filled with water; about one-sixth of the length of the tube is coiled and placed in a furnace, and the remainder, forming the heating surface, is heated by the circulation of the water. At the highest level to which the tube is carried it is enlarged so as to allow of a space for expansion of the heated water equal to 5 per cent. of the contents of the small tube.

Pipes may be heated by either hot water or by steam. The higher the temperature, the greater is the comparative effect in warming air; therefore with a small heating surface, steam pipes are more efficient than hot-water pipes, and steam at a high pressure more efficient than low-pressure steam. The efficient action of hot-water pipes depends upon the upward flow of the heated and expanded water as it passes from the boiler, the passage being made as direct as possible, and so protected as to lose little heat between the boiler and the place where the heat is to be utilized. The return pipe, which brings back the water after it has been cooled down by the abstraction of heat in warming the air, should be passed into the bottom of the boiler as directly and in as uniform a line from the place where the heat has been used as possible. The velocity of flow in the pipes will depend upon the temperature at which the water leaves the boiler, the height to which the heated water has to rise, and the temperature at which it passes down the return pipe back into the boiler. The efficiency of a hot-water apparatus will be regulated by these conditions, by the size of the pipe, and by such other conditions as affect the flow of water in pipes. When the boiler or source of heat is very near the level of the pipes for heating the air, the average temperature which can be obtained in the pipes will be lower than when the vertical column is long. The heating surface must be regulated with reference to this difference of level. It may further be assumed that with small pipes, the temperature being constant, the velocity of flow in the pipe necessary to furnish a given amount of heat will vary in the ratio of the length of the pipe. When the water circulates through the pipes by virtue of the difference of temperature of the flow and return currents only, it is impossible to count upon a greater mean temperature of the pipes than from 160° to 180°, because above that temperature the water in the boiler begins to boil. To obtain a sufficient velocity of circulation for long distances, or with small differences of level, a forced circulation may be resorted to. This has been done by Messrs. Easton and Anderson at the county lunatic asylum at Banstead, in the following manner. The whole hot-water service is supplied from boilers placed at one end of the asylum buildings, which extend to a distance of several hundred yards. There are two pipes: one of them, which may be called the flow-pipe, is connected directly with the boiler, terminating at the point furthest from the boiler in a dead end; the other, which may be termed the return pipe, is parallel to the first, and terminates at one end in a cistern which is placed about 6 feet above, and supplies the boiler. At the other end furthest from the cistern the second pipe also terminates in a dead end. At each pavilion or place to which hot water is required to be conveyed, there is a connection between the two pipes, which can be closed or opened at will; when it is opened, the water can pass from the flow to the return pipe. In the second, or return pipe, near the point where it ascends to the cistern, is placed a rotatory pump, or fan-wheel, which is always kept revolving. When the openings are all closed between the two pipes, this pump or fan simply slips through the water; but as soon as the return pipe obtains a supply of water from any of the openings between it and the flow pipe, a circulation is established.

The following diagram, resulting from Mr. Anderson's experiments, published in the *Journal of the Institution of Civil Engineers* for 1877, shows the total units of heat given out by cast-iron and wrought-iron pipes per square foot of surface per hour

for various differences of temperature applicable either to hot-water or steam pipes. Suppose, for example, it is required to know how much heat will be given out by 4-inch cast-iron or 2-inch wrought-iron pipes at 190° in a room, the temperature of which is 60°; the difference of temperature is 130°, and corresponding to this will be found 232·7 units for 4-inch pipes and 356 units for 2-inch wrought-iron pipes per square foot per hour.

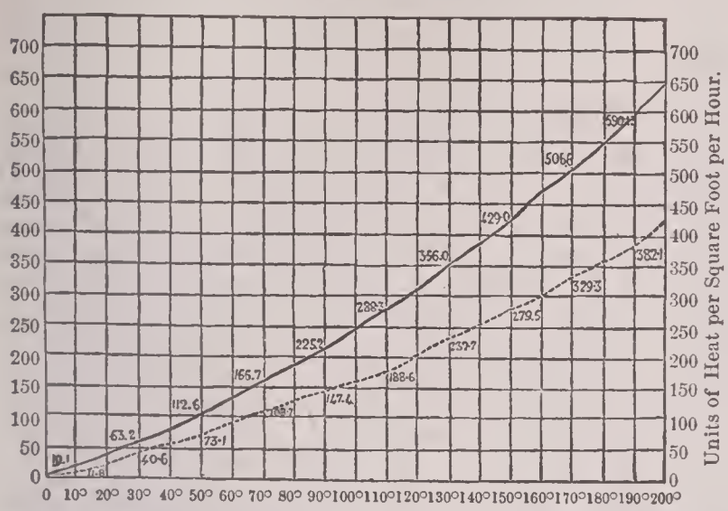


Diagram for ascertaining the heat given out by 4-inch cast-iron and 2-inch wrought-iron pipes at various differences of temperature. The dotted line shows the 4-inch, and the solid line the 2-inch pipes.

The amount of heating surface to be afforded with hot-water pipes depends mainly upon the volume of air to be admitted and removed, and the temperature desired to be maintained, but in any given building there are other circumstances to be taken into account, viz., the position, aspect, subsoil, temperature of locality, thickness of walls, size and form of windows, and other influences affecting the temperature of the incoming air, or causing loss of heat. An empirical rule has been laid down that in a dwelling-house 1 square foot of heating surface is required for every 65 cubic feet of space to be warmed, and in a greenhouse 1 square foot to every 24 cubic feet. This empirical rule does not take into account the sanitary considerations as to the renewal of air.

Steam-heated pipes present important advantages in some cases over hot-water pipes for heating purposes, because of the higher temperature to which the pipes can be raised, their consequent smaller size, and the facility of conveying the heat to a distance. Steam heating may be applied directly; and the waste steam from an engine is also applicable for heating.

The direct application of steam heating on a large scale has been made at Lockport, New York. About 200 houses in the city are heated from a central supply through about 3 miles of piping, radiating from a boiler-house, which contains two boilers 16 feet by 5 feet, and one boiler 8 feet by 8 feet. These boilers are fired during the winter to a pressure of 35 lb to the inch, with a consumption of 4 tons of anthracite coal in twenty-four hours. The boiler pressure of 35 lb in winter and 25 lb in summer is maintained through a total length of 3 miles of piping up to the several points of consumption, where there is a cut-off under the control of the consumers. The first 600 feet of mains from the boilers are 4 inches in diameter. There are 1400 feet of 3-inch pipes, 1500 feet of 2½-inch pipes, and 2000 feet of 2-inch pipes. The supply pipes from these mains to the houses are 1½ inches in diameter, and within each house ¾-inch pipes are used. In addition to the cut-off tap from the main under the control of the consumer, there is a pressure valve regulated to a 5-lb pressure under the control of the company; and beyond this is an ingeniously constructed meter, which indicates, not only the total consumption in cubic feet of steam, but also the quantity of steam in each apartment. At each 100 feet of main an expansion valve, like an ordinary piston and socket, is inserted, allowing an expansion in each section of 100 feet of 1¾ inches for the heat at 35-lb pressure. No condensation occurs in the mains. They are covered with a thin layer of asbestos paper next the iron, then a wrapping of Russian felt, and finally manilla paper, and the whole is encased in timber bored out three-quarters of an inch larger than the felt-covered pipes, and laid along the street like gas-pipes. The distribution of heat in the apartments is by means of radiators consisting of inch pipes, 30 inches long, placed vertically either in a circle or as a double row, and connected together at top and bottom, with an outlet pipe for the condensed water, which escapes at a temperature a little below boiling, and is sufficient for all the domestic purposes of the house, or it may be used as accessory heating power for horticultural and other purposes. The steam has also been applied at a distance of over half a mile from the boilers for motive power, and two steam engines of 10-horse and 14-horse power are worked from the boilers at a distance of half a mile with but a slightly increased consumption of fuel. The laid-on steam is also used for cooking purposes, for boiling, and even for baking. As in the case of gas supply, the steam supply company lay their pipes up to the houses, the consumer paying for all internal pipes, fittings, and radiators. In a moderately-sized eight-roomed house the expense of these amounted to $150, and in larger houses with costlier fittings to $500.

Boulton's system of heating with exhaust or waste steam is devised to cause the steam from a steam engine to travel long distances without any back pressure on the engine. It is especially applicable to drying rooms in which 150° Fahr. has been obtained by a large heating surface; for a lower temperature less heating surface is required. The capacity of heating by exhaust steam is nearly in a ratio with the fuel expended in the boiler. There is some cooling in passing through the engine, and in the conveyance along the pipes to the rooms to be heated, but this loss is comparatively small if the pipes and the cylinder are covered with a good non-conductor, and the condensed water is taken back hot into the boiler. Thus, if the steam be taken from the boiler direct to the pipes at five atmospheres, the temperature would be 307°, and if a comparative capacity of steam were allowed to pass through the engine to create power, and discharged into the pipes at one atmosphere, it would decrease in temperature to 213°; but it would increase in bulk according to the expansion; and thus to obtain nearly the same temperature in the room the heating surface should be increased.

With an engine of 17-inch cylinder and 25-horse power nominal, the exhaust steam has been made to travel 200 yards in a direct line, as well as to pass into various branches, amounting in the aggregate to about 2386 yards (or 1⅓ miles) of 1½-inch pipes. After this it warms the water for the boiler, and the steam is not all used up. The whole efficiency of the system depends upon so arranging the pipes as to prevent back pressure. Mr. Boulton assumed that one-horse power if properly applied should warm about 30,000 cubic feet of space, subject to reductions for window space, wall space, the number of cubic feet of air allowed to escape for ventilation, and other considerations, and lays down the following empirical rule, viz.:—1 square foot of steam pipe is allowed for each 6 square feet of glass in the window, 1 for every 6 cubic feet of air escaping for ventilation per minute, and 1 for every 120 feet of wall, roof, or ceiling, adding about 15 per cent. for contingencies.

Wrought-iron pipes 1½-inch bore are the most economical for steam, as they afford a large heating surface with small area. In heating living rooms by steam, the high temperature of the pipes affords one of the advantages of an open fire, viz., warmth by radiation, and combines with this the advantage which hot-water pipes possess of directly warming the air. (D. G.)

HEAVEN. See ESCHATOLOGY, vol. viii. p. 475.

HEBBEL, FRIEDRICH (1813–1863), a German poet and dramatist, was born of peasant parents at Wesselburen, in Schleswig-Holstein, 18th March, 1813. In his fourteenth year he obtained a humble clerkship in his native parish, but already his ambition was soaring towards higher things. At an early period he began to practise poetical composition, and several of his poems published in the *Modezeitung* at Hamburg awakened such interest that several gentlemen procured him in his twenty-second year the means of preparing himself in Hamburg for the university. He afterwards studied philosophy and history at Heidelberg and Munich. In 1841 he returned to Hamburg, where he published his first tragedy, *Judith*. In a journey which he made to Copenhagen in 1842 he formed the acquaintance of Thorwaldsen and Oehlenschläger, and acquired the more substantial advantage of a travelling annuity from the king of Denmark. He accordingly visited Paris, after which he went to Italy, where he remained several years, staying principally at Rome, Pisa, and Palermo. Having in the spring of 1846 stopped at Vienna on his way home to Germany, he made the acquaintance of the actress Christine Engehaus, whom he married in May of the same year. His marriage led him to take up his permanent residence in Vienna, and probably deepened his interest in dramatic composition, which from that time chiefly occupied his attention. He died in 1863. His principal dramas are *Genoveva*, 1843; *Maria Magdalena*, 1844; *Julia*, 1851; *Agnes Bernauer*, 1855; and *Die Nibelungen*, 1862. They exhibit considerable skill in the portraiture of character, great glow of passion, and a true feeling for dramatic situations, but their poetic effect is marred by frequent extravagances which border on the grotesque, and by the intro-

duction of incidents the unpleasant character of which is not sufficiently relieved. In many of his smaller poems his undoubted poetic gifts found a truer and more artistic utterance.

His collected works appeared at Hamburg in 12 vols. (1865–68). His biography by Emil Kuh was published at Vienna in 1877.

HEBE, in Greek mythology, is a personification of the blooming freshness and youth of nature. Originally she appears almost identical with the pure Greek Aphrodite (as distinguished from the Oriental goddess). Hebe is the daughter of Zeus and Hera, as Aphrodite of Zeus and Dione; but Dione and Hera are only two names for the same goddess. Like Aphrodite, Hebe is called the most beautiful of the gods (Pind., *N.*, 10, 17). In Sicyon and Phlius Hebe is called Dia, a regular epithet of Aphrodite. In Phlius, where Hebe was worshipped on the citadel in a temple where no image of her was allowed and to which right of asylum was attached, a festival called κισσοτόμοι was celebrated to her every year; and ivy was sacred also to Aphrodite. It is in accordance with the close resemblance between Aphrodite and Core that Hebe also has many points of analogy with the latter, to whom she is compared by Gerhard and Welcker (*Gr. Gött*, i. 369). According to the custom for the unmarried daughters of a family, Hebe acts in the Homeric poems as a sort of attendant to the gods and especially to her own mother Hera. She offers the cup to the gods, just as on earth the women, and especially the youngest daughter, did to guests and to warriors departing or returning. She bathes Ares (*Il.*, v. 905), as Polycaste does Telemachus. She harnesses the horses for Hera (*Il.*, v. 722). She appears very often in connection with the worship of Hera. A statue of her by Naucydes stood beside the Hera of Polyclitus in the Heræum at Argos. Praxiteles placed statues of her and Athene beside that of Hera in the temple at Mantinea, and Kekulé (*Hebe*) maintains that the artistic conception of Hebe which prevailed in the finest period of Greek art was a slight modification of that of Hera, and he believes that a bust, now in private possession, is the single remaining example of its kind. Welcker's opinion that the so-called Farnese Flora is really a Hebe has not been generally accepted. In later art she is often represented, like Ganymedes, caressing the eagle; and it is possible that the epithet Ganymeda, by which she was called in Phlius, is not really ancient, but arises from the supposed analogy of her office with that of Ganymedes. The meaning of the word Hebe tended to transform the goddess into a mere personification of the eternal youth that belongs to the gods, and this conception is frequently met with. Then she becomes identical with the Roman Juventas, who is simply an abstraction of an attribute of Jupiter Juventus, the god of increase and blessing and youth. By a most transparent allegory it was said that Juventas and Terminus alone of all the gods refused to give way when the temple of Jupiter Capitolinus was being built. Perhaps the most interesting point about Hebe is her connection with Heracles. When he was received among the gods and reconciled to Hera, Hebe was given him in marriage. This legend appears only in a doubtful line of Homer (*Od.*, xi. 603); but Hesiod (*Th.*, 950) and Pindar (*N.*, 10, 17) also know it. They were worshipped together in the Cynosarges at Athens, and represented side by side on the Amyclæan throne. The apotheosis of Heracles and his marriage with Hebe became a favorite subject with poets and painters. Many instances occur on vases, though several of those enumerated by Kekulé are otherwise explained by other writers on art.

HEBER, Reginald (1783–1826), a distinguished prelate and hymn-writer, was born at Malpas in Cheshire in 1783. He early showed remarkable promise, and was entered in November, 1800, at Brasenose College, Oxford, where he proved a distinguished student, carrying off prizes for a Latin poem entitled *Carmen Seculare*, an English poem on *Palestine*, and a prose essay on *The Sense of Honor*. In November, 1804, he was elected a fellow of All Souls College; and, after finishing his distinguished university career, he made a long tour on the Continent. He was admitted to holy orders in 1807, and was then presented to the family living of Hodnet in Shropshire. In 1809 Heber married Amelia, daughter of Dr. Shipley, dean of St. Asaph. He was appointed Bampton lecturer for 1815, prebendary of St. Asaph in 1817, preacher at Lincoln's Inn in 1822, and bishop of Calcutta in January, 1823. Before sailing for India he received the degree of D. D. from the university of Oxford. In India Bishop Heber labored indefatigably, not only for the good of his own diocese, but for the spread of Christianity throughout the East. Animated by apostolic zeal, he undertook numerous tours in India, consecrating churches, founding schools, and discharging other Christian duties. Such devotion to his work in a trying climate told severely on his health. At Trichinopoly he was seized with an apoplectic fit when in his bath, and expired on 3d April, 1826.

Heber was a man of profound learning, refined literary taste, and great practical energy. His Christian character manifested all the beauty and simplicity of the days of the early church. As a poet he has attained a high place. His *Palestine* is generally considered the best prize poem ever written at Oxford. Heber's fame rests mainly on his hymns, which, as literary compositions, rank among the best in the English language. Those beginning as follows may be instanced:—"Lord of mercy and of might;" "Brightest and best of the sons of the morning;" "By cool Siloam's shady rill;" "Lo, He comes in clouds descending;" "The Lord of might from Sinai's brow;" "Jesus Christ is risen to-day;" "Holy, holy, holy, Lord God Almighty;" "From Greenland's icy mountains;" "Thou art gone to the grave! but we will not deplore thee." Heber's hymns and other poems are distinguished by finish of style, pathos, and soaring aspiration; but they lack originality, and are rather rhetorical than poetical in the strict sense.

Heber was a voluminous author, as may be seen from the following works:—*Palestine; a Poem, to which is added the Passage of the Red Sea*, 1809; *Europe: Lines on the Present War*, 1809; *The Personality and Office of the Christian Comforter asserted and explained*, being the Bampton Lectures for 1815; *The Whole Works of Bishop Jeremy Taylor, with a Life of the Author, and a Critical Examination of his Writings*, 1822; *Hymns written and adapted to the Weekly Church Service of the Year, principally by Bishop Heber*, 1827; *A Journey through India*, 1828; *Sermons preached in England*, and *Sermons preached in India*, 1829; *Parish Sermons*, 1837.

For further information about Heber see his *Life*, by his widow, 1830, which also contains a number of Heber's miscellaneous writings; *The Last Days of Bishop Heber*, by Thomas Robinson, A.M., archdeacon of Madras, 1830; and *Memorials of a Quiet Life*, by Augustus J. C. Hare, 1874.

HEBERDEN, William (1710–1801), a practical physician of some celebrity, was born in London in the year 1710. In the end of 1724 he was sent to St. John's College, Cambridge, where he obtained a fellowship about 1730, became master of arts in 1732, and took his degree in physic in 1739. He remained at Cambridge about ten years longer as a practitioner of physic, and gave an annual course of lectures on materia medica. In 1746 he became a fellow of the Royal College of Physicians in London; and two years afterwards he left Cambridge to establish himself in London, where he was elected a fellow of the Royal Society in 1769, and was employed in a very extensive medical practice for more than thirty years. Latterly he passed his summers at a house which he had taken at Windsor, but he continued his practice during the winter for some years longer. In 1778 he was made an honorary member of the Royal Society of Medicine at Paris. He died 17th May, 1801.

Heberden's first publication seems to have been a short essay on the incongruous composition of the mithridate and theriac, entitled *Antitheriaca* (1745). He also wrote several papers for the Royal Society, which were published in its *Transactions*; and he was one of the principal contributors to the first three volumes of the *Medical Transactions*, published, in a great measure at his suggestion, by the College of Physicians. He is, however, best known by his *Commentaries on the History and Cure of Diseases*, the result of careful notes made in his pocket-book at the bedside of his patients. In accordance with his directions the work was published posthumously in 1802; prefixed to it is a short notice of his life.

HÉBERT, Jacques René (1755–1794), a French revolutionist, surnamed from the newspaper he edited "Le Père Duchesne," was born of obscure parents at Alençon in 1755. He came at an early age to Paris, where he lost more than one situation through malversation, and was in abject poverty when the occurrence of the French Revolution opened up to him a career in which he obtained considerable temporary success and permanent notoriety. Having shown

great readiness and proficiency in a style of writing and of oratory which appealed to the worst feelings of the revolutionary mob, he soon acquired great influence in the clubs, and was chosen to oppose the constitutional paper *Le Père Duchesne* by editing a revolutionary paper of the same name. The scurrilous and extravagant language of the new print exactly coincided with the sentiments of the class to whom it was addressed, and it contributed not a little to several of the worst and most violent manifestations of the revolutionary spirit. It had a very beneficial influence on the fortunes of its editor, who after the 10th August, 1792, was one of the chief members of the revolutionary commune, and on the 2d September was appointed substitute to the *procureur syndic*. On the 24th May, 1793, an order was sent out for his arrest by the more moderate party of the commune on the ground that he was plotting their assassination, but on account of a formidable outbreak of the mob he was set at liberty, and when he appeared again at the commune he was presented with a civic crown. Having been appointed a member of the commission to examine Marie Antoinette, he with unsurpassed moral baseness foully accused her of a crime too scandalous to be mentioned. Along with several of his colleagues he invented the worship of the goddess "Reason," and subsequently he organized a party of ultra-revolutionists known as the Hébertists or *enragés*. The faction were, however, arrested by the committee of public safety, and on the 24th March, 1794, were led forth to execution. Hébert behaved with great cowardice at his trial, and died amid the jeers and insults of the mob over whose passions he had at one time exercised such sway and to whom he owed his promotion to power.

He was the author of *Vitres cassées par le véritable Père Duchesne*, 1791; *Vie privée de l'abbé Maury*, 1790; *Petit carême de l'abbé Maury*, 1791; *Nouvelle lanterne magique*, 1792.

HEBREW LANGUAGE AND LITERATURE. The name *Hebrew* (Latin *Hebræus;* Greek ἑβραῖος) is a transcription of *'ebrâyâ*, the Aramaic equivalent of the original Old Testament word עִבְרִי, *'ibrî*, pl. *'ibrîm*, which is the proper Gentile name of the people who also bore the collective name of Israel or Children of Israel (B'nê Israel). The name of Israel with its sacred associations in the patriarchal history is that by which the Old Testament writers prefer to designate their nation; and this circumstance, combined with the fact that the Sacred Text frequently employs the term Hebrews where foreigners are introduced as speaking or spoken to (*e.g.*, Exod. ii. 6; 1 Sam. iv. 6, 9; Gen. xl. 15; Ex. iii. 18), has led to the conjecture that the name of Hebrews (men from the other side, *scil.* of the Euphrates) was originally given to the descendants of Abraham by their Canaanite neighbors, and continued to be the usual designation of the Israelites among foreigners, just as the Magyars are known to other Europeans as Hungarians (foreigners), as we call the High-Dutch Germans (warriors), or as the Greeks gave the name of Phœnicians to the people that called themselves Canaanites.[1] A closer view of the case does not confirm this conjecture. The name of Israel is often found in the Old Testament in the mouth of foreigners, and the whole *usus loquendi* is explained by the observation that the Gentile noun corresponding to the collective "Israel" is regularly "Hebrew" and not "Israelite," the latter word being rare and apparently of late formation.[2] Nor has the word Hebrew been hitherto found in the early monuments of other Eastern nations; for the identification proposed by Chabas which finds the Hebrews in the hieroglyphic Apuriu is more than doubtful.[3] On the other hand the name of Israel appears on the stone of Mesha king of Moab, and perhaps has been deciphered on Assyrian monuments.[4]

The form *'ibrî* is, in the language of Semitic grammarians, a relative noun, presupposing the word *'Eber* as the name of the tribe, place, or common ancestor, from whom the Hebrews are designated. Accordingly we find Eber as a nation side by side with Assyria in the obscure poetical passage Num. xxiv. 24, and Eber as ancestor of the Hebrews in the genealogical lists of Gen. x., xi. Here we must apparently distinguish two records.[5] According to Gen. xi. (and Gen. x. 24) Eber is the great-grandson of Shem through Arphaxad, and ancestor of Terah through Peleg, Reu, Serug, and Nahor. These are not to be taken as the names of individual men. Several of them are designations of places or districts near the upper waters of the Euphrates and Tigris, and among other circumstances the place at the head of the series assigned to the district of Arrapachitis (Arphaxad), through which a migration from Ararat to the lands occupied by the Semites in historical times would first pass, suggests the probability that the genealogy is not even meant to exhibit a table of ethnological affinities, but rather presents a geographical sketch of the early movements of the Hebrews, who are personified under the name of Eber. If this is so we can hardly venture to assert (with some scholars) that the author of the list (the Levitical Elohist) extended the name of Hebrews to all descendants of Terah.[6] The case is different with another and apparently older record of which a fragment seems to be preserved in Gen. x. 21, 25–30. Here there is no intermediate link between Shem and Eber. Sons of Shem and sons of Eber appear to be coextensive ideas, and to the latter are reckoned not only the descendants of Peleg (Aramæans, Israelites, Ishmaelite Arabs, etc.), but the South Arabian tribes of Joktan. We possess no information which casts light on this wide conception of the sons of Eber, and in the ordinary language of the Old Testament Hebrew and Israelite are strictly synonymous.

Compare, however, the interesting conjectures of Sprenger, *Alte Geographie Arabiens* (Bern, 1875), p. 294, who identifies Peleg with Falag in Central Arabia, and finds in the record a witness to the truth of the view that Arabia is the original centre of the Semitic dispersion, a view which is shared by other scholars, as Hitzig (*Geschichte Israels*, pp. 26, 39), and Schrader (*Z. D. M. G.*, 1873, pp. 397–424). In this connection it is perhaps worth while to note the Arabic Gentile name 'Obrî, belonging to 'Obra, a minor division of the Joktanic tribe of the Azd (*Lubb-il-lubâb*, ed. Veth, p. 175).

When it is recognized that Eber in Genesis is not an actual personage but an ethnological or geographical abstraction, we are thrown back on etymological conjecture as to the origin of the name of Hebrews. 'Eber means the further bank of a river, from a root meaning *to cross*. Hence in Gen. xiv. 13 the Septuagint renders Abram the Hebrew by ὁ περάτης, "the crosser."[7] Grammatically more accurate, while resting on the same etymology, is the rendering of Aquila, ὁ περαίτης, "the man from the other side" of the Euphrates, which is the explanation of Jewish tradition (*Brêshit Rabba*, and Rashi) and still generally adopted. It is, however, far from satisfactory, and almost of necessity depends on the theory that the name was fixed upon the Hebrew immigrants by the earlier inhabitants of Canaan.[8] A modified form of the etymology takes 'eber in the Arabic sense of a river bank, and makes the Hebrews "dwellers in a land of rivers" (Steiner in the *Bibel-Lex.*, ii. 613). This goes well with Peleg (watercourse), as in Arabia we have the district Falag, so named because it is furrowed by waters (Sprenger, *Geog. Arab.*, p. 234).[9]

The name "Hebrew Language."—By the Hebrew language we understand the ancient tongue of the Hebrews in Canaan —the language in which the Old Testament is composed, with the exception of the Aramaic passages (Jer. x. 11; Ezra iv. 8–vi. 18; vii. 12–26; Dan. ii. 4–vii. 28). But we do not find that this language was called Hebrew by those who spoke it. It is the *lip*, *i. e.*, speech *of Canaan*, Isa. xix. 18, or, as spoken in Southern Palestine, יְהוּדִית *Jewish* (2 Kings xviii. 26; Neh. xiii. 24). The later Jews call it the *holy tongue* in contrast to the *profane* Aramaic dialect (commonly though improperly enough called Syro-Chaldaic) which long before the time of Christ had super-

[1] See especially Gesenius, *Geschichte der Hebräischen Sprache und Schrift*, pp. 9 *seq.*; most recently Kautzsch in Riehm's *Handwörterbuch*.

[2] In 2 Sam. xvii. 25 Israelite must be corrected to Ishmaelite, as in the parallel passage 1 Chron. ii. 17.

[3] Chabas, *Mélanges Egyptologiques*, i. 42; Ebers, *Aegypten und die Bücher Mosis*, i. 316; Brugsch-Bey, *Geschichte Aegyptens*, 582 (Eng. trans., ii. 128–9); Birch, *Egypt*, p. 128.

[4] Schrader, *Keilinschriften und Geschichtsforschung* (Giessen, 1878), pp. 359, 536, gives the latest arguments for this not undisputed reading.

[5] See De Goeije in the *Theol. Tijdschrift*, 1870, p. 243; and Wellhausen in *Jahrbb. f. D. Theol.*, 1876, p. 395.

[6] The Terahites, according to other testimonies, are Aramæans (Gen. xxii. 20 *seq.;* Deut. xxvi. 5), but our Elohist, who can hardly have written before the captivity, makes Aram a separate offshoot of Shem, having nothing to do with Eber (Gen. x. 22, 23).

[7] Compare Jerome, *Quæst. Hebr.*, on the passage, and Theodoret, *Qu. LXI. in Gen.*

[8] Compare Ewald, *Gesch. Israels* (3d ed). i. 407 *seq.* (Eng. trans., i. 284), where also other etymologies are noticed.

[9] Complete ignorance of Hebrew made it possible for early Christian writers to derive the name of the Hebrews from Abraham. See Bochart's *Phaleg*, lib. ii., cap. 14. Other guesses will be found in the *Onomastica*.

seded the old language as the vernacular of the Jews. This change had already taken place at the time when the expression "in Hebrew" (ἑβραϊστί) first occurs (Prologue to Sirach); and both in the Apocrypha and in the New Testament the ambiguous term, naming the language after those who used it, often denotes the contemporary vernacular, not the obsolete idiom of the Old Testament. But the other sense was admissible (*e. g.*, Rev. ix 11, and so frequently in Josephus), and naturally became the prevalent one among Christian writers who had little occasion to speak of anything but the Old Testament Hebrew.[1] In modern usage it is incorrect to call the Jewish Aramaic Hebrew; though uneducated Jews apply the name even to the corrupt German and Spanish jargons which they are accustomed to write and print in Hebrew characters.

Character and Philological Relations of Hebrew.—Hebrew is a language of the group which since Eichhorn has generally been known as Semitic, and of which Arabic and Ethiopic (Southern Semitic), the various dialects of Aramaic, and the language of the Assyrian and Babylonian cuneiform inscriptions are the other chief representatives. From its geographical position as the language of Palestine between the Aramæans of the north and the Arabs of the south, Hebrew has been called Middle Semitic. Or Aramaic Assyrian and Hebrew may be grouped together as Northern Semitic in contrast to Arabic and Ethiopic. The affinities of the Semitic languages are so close that they may fairly be compared with a sub-group of the Indo-Germanic family —for example, with the Teutonic languages. The fundamental unity of the Semitic vocabulary is easily observed from the absence of compounds (except in proper names) and from the fact that almost all words are derived from their roots in definite patterns (*measures*) as regular as those of grammatical inflection. The roots regularly consist of three consonants (seldom four or five), the accompanying vowels having no radical value, but shifting according to grammatical rules to express various embodiments of the root idea. The triliteral roots are substantially common to the whole Semitic group, subject to certain consonantal permutations, of which the most important are strikingly analogous to those laid down by Grimm for the Teutonic languages.

There are four sounds in Arabic unknown to Hebrew and Aramaic, and for which the former regularly has a sibilant, the latter a lingual—in one case a deep guttural. This guttural (ʿ), and the palatal letters which in the following table are represented by *d*, *ṣ*, *ṭ*, *ẓ*, are peculiar Semitic sounds.

Arabic.		Hebrew.		Aramaic.
th ث	=	*sh* שׁ	=	*t* ת
dh ذ	=	*z* ז	=	*d* ד
ẓ ظ	=	*ṣ* צ	=	*ṭ* ט
ḍ ض	=	*ṣ* צ	=	ע [also *ṣ*]

On the last equation see Lagarde, *Semitica*, i. 22; Nöldeke in *Z. D. M. G.*, xxxii., 405; and on the permutation of consonants in general, Merx, *Gram. Syr.*, § 24; Stade in *Morgenl. Forschungen* (1875), p. 179 *seq.* Whether the Arabic or Aramaic forms are the older is disputed. No one maintains that the Hebrew forms are original.

Derivation from the roots and inflection proceed partly by the reduplication of root letters and the addition of certain preformatives and afformatives (more rarely by the insertion of formative consonants in the body of the root), partly by modifications of the vowels with which the radicals are pronounced. Almost every root expresses in its origin something that can be grasped by the senses, and the mechanism by which words are formed from the root is adapted to present sensible notions in a variety of *nuances* and in all possible embodiments and connections, so that there are regular forms to express in a single word the intensity, the repetition, the production of the root idea—the place, the instrument, the time of its occurrence, and so forth. Thus the expression of intellectual ideas is necessarily metaphorical, almost every word being capable of a material sense or at least conveying the distinct suggestion of some sensible notion. For example, the names of passions depict their physiological expression; "to honor" means also "to make heavy," and so on. The same concrete character, the same inadequacy to convey purely abstract thoughts without a substratum appealing to the senses, appears in the grammatical structure of the Semitic tongues,—for example, in the absence of the neuter gender, in the extreme paucity of particles, in the scanty provision for the subordination of propositions, which deprives the Semitic style of all involved periods and reduces it to a succession of short sentences linked by the simple copula *and*. The fundamental element of these languages is the noun, and in the fundamental type of sentence the predicate is a noun set down without any copula and therefore without distinction of past, present, or future time. The finite verb is developed from nominal forms (participial or infinitive), and is equally without distinction of time. Instead of tenses we find two forms, the perfect and the imperfect, which are used according as the speaker contemplates the verbal action as a thing complete or as conditional, imperfect, or in process. It lies in the nature of this distinction that the imperfect alone has moods. In their later stages the languages seek to supply the lack of tenses by circumlocutions with a substantive verb and participles. Other notable features common to the Semitic tongues are the use of appended suffixes to denote the possessive pronouns with a substantive, or the accusative of a personal pronoun with a verb, and the expression of the genitive relation by what is called construction or annexation, the governing noun being placed immediately before the genitive, and if possible slightly shortened in pronunciation so that the two words may run together as one idea. A characteristic of the later stages of the languages is the resolution of this relation into a prepositional clause.

These and other peculiarities are sufficient to establish the original unity of the group, and entitle us to postulate an original language from which all the Semitic dialects have sprung. Of the relation of this language to other linguistic stems, especially to the Indo-Germanic on the east and the North-African languages on the west, we cannot yet speak with certainty; but it appears that the present system of triliteral roots has grown out of an earlier biliteral system which, so far as it can be reconstructed, must form the basis of scientific inquiry into the ultimate affinities of the Semitic group.[2]

Before the rise of comparative philology it was a familiar opinion that Hebrew was the original speech of mankind. Taken from the Jews, and as already expressed in the Palestinian Targum on Gen. xi. 1, this opinion drew its main support from etymologies and other data in the earlier chapters of Genesis, which, however, were as plausibly turned by Syriac writers in favor of their own tongue.[3] Till quite recently many excellent scholars (including Ewald) have claimed for Hebrew the greatest relative antiquity among Semitic tongues. But though Hebrew has by far the oldest literature, this does not prove that its structure comes nearest to the original Semitic language. And it is now generally recognized that in grammatical structure the Arabic, shut up within its native deserts till the epoch of Islam, preserved much more of the original Semitic forms than either Hebrew or Aramaic. In its richer vocalization, in the possession of distinct case-endings, in the use for feminine nouns of the afformative *t*, which in the northern dialect has passed through *h* (originally audible as in Egyptian Arabic) into a mere vowel, in the more extensive range of passive and modal forms, and in other refinements of inflection, Arabic represents no later development, but the original wealth and primitive subtlety of Semitic speech, as appears not only from fragmentary survivals in the other dialects but from an examination of the process of decay which has brought the spoken Arabic of the present day into a grammatical condition closely parallel to the Old Testament Hebrew.

[1] The term "Hebrew language" seems to have originated with the Greeks or Hellenists. Philo, however, calls the language of the Old Testament Chaldee (*De Vita Mosis*, ii. 5, 6; *cf.* Jerome on Dan. i.). On the use of the expression "Hebrew language" in the Talmud, see Berliner, *Beiträge zur heb. Gr.* (Berlin, 1879), p. 5.

[2] Renan, *Histoire des Langues Sémitiques*, sketches the history of research in this direction. Noteworthy are the remarks of Lagarde, *Symmicta*, p. 121. On survivals from the biliteral stage, see Nöldeke, *Mandäische Gram.*, p. 96.

[3] Theodoret (*Quæst. in Gen.*), xl., Barhebræus, and others cited by Assemani, *Bib. Or.*, iii. 314. The same opinion appears among the Babylonian Jews (Rab in *Synh.*, 38b). Conversely, Jacob of Sarug concedes the priority of Hebrew (see *Z. D. M. G.*, xxv., p. 520). The Arabs, whose language is in many points older than either, yield priority to Hebrew (Abulfeda, *H. A.*, p. 18), or to Syriac (Tabari, i., 220; Abu 'Isa in Abulfeda, p. 148), the language of the race to which they owed their first knowledge of letters.

But while Arabic is in many respects the elder brother, it is not the parent of Hebrew or Aramaic. Each member of the group had an independent development from a stage prior to any existing language, though it would seem that Hebrew did not branch off from Aramaic so soon as from Arabic, while in its later stages it came under direct Aramaic influence.

Among the points in which Hebrew differs both from Arabic and Aramaic may be mentioned the consonantal relations already spoken of, the system of tone long vowels, the use of Waw consecutive, the ה of the causative and reflexive stems and of the article, and the compensation for omitting the reduplication of gutturals and *r* by lengthening a preceding vowel.[1] Again, Hebrew agrees with Arabic against Aramaic in possessing a prefixed article, in the use of the Nifal (Arab. VII.), and in other minor points. But in more notable features Hebrew and Aramaic agree against Arabic, as in the absence of broken plurals, the place of the accent, the aspiration of certain letters whenever they are preceded by a vowel sound, and the substitution of *y* for *w* as the first radical of roots. To give further details would carry us too far into comparative grammar. Speaking generally, it may be said that Hebrew is less copious in vocabulary than Arabic (in which tongue, however, the abundance of synonyms is largely due to an artificial combination of several dialects), and less rich in subtle distinctions of grammatical form and refinements of syntax. On the other hand, Hebrew is much superior to Aramaic in flexibility of structure, in fulness of vowels, and in all the qualities which adapt a language for poetical expression.

Geographical Sphere and History of Hebrew as a Spoken Language.—The Hebrew spoken by the Israelites in Canaan was separated only by very minor differences (like those of our provincial dialects) from the speech of neighboring tribes. We know this for the Moabite language from the stone of Mesha; and the indications furnished by proper names, as well as the acknowledged affinity of Israel with these tribes, make the same thing probable for Ammon and Edom. More remarkable is the fact that the Phœnicians and Canaanites, with whom the Israelites acknowledged no brotherhood, spoke a language which, at least as written, differs but little from Biblical Hebrew. This observation has been used in support of the very old idea that the Hebrews originally spoke Aramaic, and changed their language in Canaan. But an exacter study of the Phœnician inscriptions shows differences from Hebrew which suffice to constitute a distinct dialect, and combine with other indications to favor the view that the descendants of Abraham brought their Hebrew idiom with them from Haran. And in this connection it is important to observe that the old Assyrian, which preceded Aramaic in regions with which the book of Genesis connects the origins of Abraham, is in many respects closely akin to Hebrew.[2] As the origin of Hebrew is lost in the obscurity that hangs over the early movements of the Semitic tribes, so we know very little of the changes which the language underwent in Canaan. The existence of local differences of speech is proved by Judges xii. 6; but the attempt to make out in the Old Testament records a northern and a Judæan dialect, or even besides these a third dialect for the Simeonites of the extreme south,[3] has led to no certain results. In general it may be said that the Biblical text supplies inadequate data for studying the history of the language. Semitic writing, especally a purely consonantal text such as the Old Testament originally was, gives an imperfect picture of the very grammatical and phonetic details most likely to vary dialectically or in course of time. The later punctuation (including the notation of vowels), and even many things in the present consonantal text, represent the formal pronunciation of the Synagogue as it took shape after Hebrew became a dead language—for even the Septuagint has often a more primitive pronunciation of proper names. This modern system being applied to all parts of the Old Testament alike many archaisms were obliterated or disguised, and the earlier and later writings present in the received text a grammatical uniformity which is certainly not original. It is true that occasional consonantal forms inconsistent with the accompanying vowels have survived—especially in the books least read by the Jews—and appear in the light of comparative grammar as indications of more primitive forms. These sporadic survivals show that the correction of obsolete forms was not carried through with perfect consistency; but we are never safe to argue as if we possessed the original form of the texts.

In the Pentateuch, for example, the form הוּא stands not only for הוּא (3d personal pron. masc.) but for הִיא (the feminine). And hence a favorite argument was drawn for the superior antiquity of this part of the Old Testament. But the same thing is found elsewhere (Frensdorff, *Mass. Wörterb.*, p. 233), especially in Babylonian codices of the prophets (Geiger, *Urschrift*, p. 236; *Z. D. M. G.*, xxviii. 676). The feminine can never by any possibility have been pronounced *hu*, but the old orthography was probably הא for *hu* and *hi* alike (Nöldeke in *Bibel-Lexikon*, *ut supra*, after Levy).

The chief historical changes in the Hebrew language which we can still trace are due to Aramaic influence. The Northern Israelites were in immediate contact with Aramæan populations and some Aramaic loan-words were used, at least in Northern Israel, from a very early date. At the time of Hezekiah Aramaic seems to have been the usual language of diplomacy spoken by the statesmen of Judah and Assyria alike (2 Kings xviii. 26). After the fall of Samaria the Hebrew population of Northern Israel was partly deported, their place being taken by new colonists most of whom probably had Aramaic as their mother-tongue. It is not therefore surprising that even in the language of Judea increasing signs of Aramaic influence appear before the Exile.[4] The fall of the Jewish kingdom accelerated the decay of Hebrew as a spoken language. Not indeed that the captives forgot their own tongue in Babylon, as older scholars supposed on the basis of Jewish tradition. The Exilic and post-Exile prophets do not write in a lifeless tongue, and Hebrew was still the language of Jerusalem in the time of Nehemiah (ch. xiii.) in the middle of the 5th century B. C.[5] But after the Exile the petty people of the Jews were in daily intercourse with a surrounding Aramæan population, and the Aramaic tongue, which was the official language of the western provinces of the Persian empire, began to take rank as the recognized medium of polite intercourse and letters even among tribes of Arabic blood—the Nabatæans whose inscriptions in the Hauran are written in Aramaic. Thus Hebrew as a spoken language gradually yielded to its more powerful neighbor, and the style of the latest Old Testament writers is not only full of Aramaic words and forms but largely colored with Aramaic idioms, while their Hebrew has lost the force and freedom of a living tongue (Ecclesiastes, Esther, some Psalms, Daniel). The Chronicler no longer thoroughly understood the Old Hebrew sources from which he worked, while for the latest part of his history he used a Jewish Aramaic document, part of which he incorporated in the book of Ezra. Long before the time of Christ Hebrew was the exclusive property of scholars, and its further history is that of a merely literary language.

The Literary Development of Hebrew.[6]—The Semitic peoples possessed the art of writing and an alphabetical character from a date so remote as to be lost in the mists of antiquity. This character was formerly known as Phœnician, its invention being ascribed to that people (Tac., *Ann.*, xi. 14). In reality it was the common property of all Semitic nations between Assyria and Egypt—an alphabetic character in contact on the east and on the west with more complicated syllabic or hieroglyphic systems, from one or other of which it may possibly have been derived.

De Rougé's theory that the alphabet was derived by the Phœnicians from the Egyptian hieratic writing obtained much currency a few years ago (see ALPHABET), but has rather lost ground since the appearance in 1874 of the long expected *Mémoire sur l'origine Égyptienne de l'alphabet Phénicien.* See the criticism in Lagarde's *Symmicta*, p. 113 *seq.* A newer theory by Deecke (*Z. D. M. G.*, xxxi. 102 *seq.*) derives the alphabet from the cuneiform characters, and makes the Aramæans its authors, for which there is ancient tradition in Pliny, Diodorus, and Clemens Alexandrinus. Deecke dates the invention from the 9th century B. C., when the Assyrians first established themselves in Aram. This is certainly wrong, for, apart from other

[1] The verbal prefixes *ha*, *hith*, appear in Palestinian Aramaic, and the Aramaic dialects also exhibit some cases of a lengthened vowel before *r* (Nöldeke, *Mand. Gram.*, p. 17). On the other hand, the transcription of the LXX. shows that Hebrew once could double *r*.

[2] See Stade's essay on the relation of Phœnician and Hebrew, *Morgenländische Forschungen*, (1875), with Nöldeke's criticism, *Z. D. M. G.*, xxix. 325; also the latter's articles, "Sprache, hebräische," in *Bibel-Lexikon*, v. 362 *seq.*

[3] Böttcher, *Lehrb. d. Hebr. Sprache* (1866), i. 13 *seq.*

[4] Details in Ryssel, *De Elohistæ Pentateuchi Sermone* (Leipsic, 1878), the most important collection of materials since Gesenius, *Geschichte der hebr. Spr. und Schrift* (1815).

[5] An argument to the contrary drawn by Jewish interpreters from Neh. viii. 8 rests on false exegesis.

[6] As we possess no books in classical Hebrew except the Old Testament, the reader is referred for several aspects of this topic to the sketch of the Old Testament literature in the article BIBLE.

arguments, the stone of Mesha is not a product of the first days of alphabetic writing. Against the derivation of the Semitic alphabet from any hieroglyphic system, see Levy, *Phönizische Studien*, i. 49 *seq.* The best comparative table of Semitic alphabets is that by Euting in the English translation of Bickell's *Outlines of Heb. Gram.* (Leipsic, 1877). On the history of Hebrew writing, especially in its bearing on the history of the Biblical text, see Wellhausen in Bleek's *Einleitung*, 4th ed. (1878), with Nöldeke's remarks, *Z. D. M. G.*, xxxii. 591 *seq.*

This ancient alphabet consists of twenty-two consonants, of which one at least (ע) stood in Hebrew for two distinct sounds, still separated in the Septuagint pronunciation. The vowels were supplied by the reader—which is not so difficult in Semitic languages, where vocalization constitutes no difference of root. In certain cases the weaker consonants served as *matres lectionis* to indicate cognate vowel sounds and preclude ambiguity of pronunciation; but in the old writing this usage was far less extensive than in our Hebrew MSS., and hardly applied except to diphthongs and to a,—or less often î, û—at the end of words.[1] This old character with its scanty indications of vowels continued to be used by the Hebrews throughout the flourishing period of their literature and for some time after the Exile, till at length they gradually adopted a newer form of letters (the square or, as the Talmud calls it, the Assyrian character) which was developed among the Aramæans and spread with the increase of Aramaic influence. Jewish tradition ascribes the introduction of the square character to Ezra (*Synh.*, 21b 22a; Jerome, *Prol. Gal.*); but the Samaritans, who did not receive the Pentateuch from the Jews till about 400 B. C., must have got it in the old letter which they still retain in a corrupted form. The square letter probably did not prevail till a good deal later, the earliest Jewish inscription in which it appears being of the date 176 B. C. (published by De Vogué, *Rev. Arch.*, 1864), while the coins of Judea retain the old character still later. The transformation was complete before the time of Christ, for Mat. v. 16 alludes to the new form of *Yod* (jot).[2] By this time too the use of *matres lectionis* must have become more ample. The later introduction of vowel points and accents belongs to the history of the study of Hebrew as a dead language. The forms of the old Semitic alphabet are most suitable to be cut on stone, and indicate a special adaptation for monumental inscriptions (*cf.* the two tables of the Decalogue). Between the beginnings of such inscriptions and the general use of writing for literary purposes a considerable period might intervene. The earliest products of Hebrew authorship seem to have been lyrics and laws, which would circulate in the first instance from mouth to mouth without the use of written copies. We have notice of early written collections of lyrics prior to our present historical books—the *Book of the Wars of Jehovah* (Num. xxi. 14) and the *Book of Jashar* (Josh. x., 2 Sam. i.). We have no clue to the age of the former book, but the lines quoted from it are plainly of great antiquity. The *Book of Jashar* is not earlier than the time of Solomon; for a fragment from it referring to the building of the temple has been recovered from the Septuagint of 1 Kings viii. (Wellhausen in Bleek, *ut supra*, p. 236). The earliest date of written law books is uncertain. It may fairly be made a question whether Moses left in writing any other laws than the commandments on the tables of stone. Even Ex. xxiv. 4 and xxxiv. 27 may in the original context have referred to the ten words alone. And it is certain that ancient law was handed down by oral tradition and local custom to a much later date. The prophets frequently allude to the oral decisions of the priests as a source of law, and the practice of appealing to the local customs of certain towns is alluded to in 2 Sam. xx. 18 (as restored by Ewald from the LXX.)—"Ask at Abel and at Dan whether the genuine old statutes of Israel have lost their force." In like manner the story of the early fortunes of the nation down to the time of David often presents characteristics which point to oral tradition as its original source. Yet written history began comparatively early. A scribe was attached to the royal court from the reign of David downwards; and the older parts of the books of Samuel, which must have been written not long after the time of that king (see DAVID), are framed in a masterly style, which shows that the art of composition in prose was already thoroughly understood. So too the best written and most brilliant part of the narrative of the Pentateuch—the combined history of the Jehovist and the non-Levitical Elohist—appears to be unquestionably earlier than the rise of prophetic literature in the 8th century B. C. In this narrative—itself the product of more than one writer—are included several collections of old laws, so that we have between the time of David and the age of Amos and Hosea a flourishing historical and legal literature, in which and in lyrical collections like the *Book of Jashar* were embodied many poems, legends, and other remains, transmitted, whether orally or by writing, from a much earlier date. To the same period may be assigned the most interesting and graphic histories in the book of Kings, the splendid episode of Elijah, and other remains of Ephraitic history; and to these must probably be added the main stock of the Song of Solomon, though this lyric drama has suffered much from interpolation, and presumably was not written down till a comparatively late date and from imperfect recollection, so that its original shape is very much lost. It is mainly from the admirable prose narratives, to which nothing in later books can be compared, that we must judge of the first bloom of Hebrew literature under the ancient kingdoms of Judah and Ephraim, before the convulsions that accompanied the advance of Assyria and prior to the influence of written prophecy. It is a literature eminently fresh and vivacious, full of exact observation of nature and of men, always drawing directly from life, and working on the reader not by elaborate description but by dramatic presentation of character and action. The authors are too intent upon the story to interpose their own comments or point a moral, but they tell their tale with sympathy and often with an undercurrent of dry humor. It can hardly be said that the writings of this period have a specifically religious purpose. Reflecting with admirable veracity the actual life of the nation they are full of the relation between Israel and Jehovah, because that relation was constantly present to the people as a very real fact without which the history could not be told. It is to this circumstance that we owe the preservation of so large a mass of early prose, which was taken over and incorporated in their works by later historians who wrote with a distinctly religious purpose; while on the other hand the early lyric collections have disappeared, all but a few fragments, presumably because their tone was prevailingly secular. That the Hebrews once possessed a poetry of high merit drawn from the themes of ordinary life appears, not only from the book of Canticles and such relics as the Song of the Well (Num. xxi. 17, 18), but from the names of popular airs preserved in the titles of the Psalms. Thus we learn from Isa. lxv. 8 that the title *Al-Taschith* (Ps. lvii.) is taken from a vintage song of which the first line was "Destroy it not, for a blessing is in it." These popular songs, then, survived the Exile and long continued to live in the mouths of the people. But they were without interest to the later guardians of Israel's literature, and fell into oblivion when Hebrew ceased to be the vernacular of the nation. A last echo of the festal songs of the Jewish maidens in the Talmud (*Mishna Ta'anît*, iv. 8, and the corresponding Gemara) shows only the total decay of the popular muse.

In this earliest period—the age of popular literature, as we may call it, modelled upon the songs and histories that circulated orally through the country—there is a remarkable preponderance of writings connected with the northern kingdom, and these include the narratives that are fullest of human interest and the poetry richest in color and imagination, such as the loves of Jacob and Rachel, the history of Joseph, the life of Elijah, the pictures of nature in the Canticles. The political and social superiority of Ephraim before the conflict with Assyria is reflected in the literature. A new epoch begins with the rise of written prophecy in the 8th century. By this time writing and literary knowledge were widely diffused (Isa. viii. 1; xxx. 8; x. 19).[3] Amos, himself an excellent stylist, in whose

[1] The stone of Mesha is the earliest evidence. Lagarde, *Griech. Uebers. d. Proverbien* (1863), p. 4, observed that the LXX. translated from a Hebrew copy without *matres lectionis*. This is put rather too barely, but is very near the truth. Compare Wellhausen, *ut supra*, and *Text der BB. Samuelis* (1871); Nöldeke, *Z. f. Wissensch. Theol.* (1873), p. 120; Chwolson in *Travaux de la 3me section du Congrès international des Orientalistes*, pt. ii.

[2] A papyrus of the British Museum, showing the square letter as it was written in Egypt a little before the time of Christ, has been facsimiled by the Palæographical Society (*Or. Ser.*, 1877).

[3] In the 7th century written instruments were used in sales of property (Jer. xxxii. 10), and in divorce cases they are recognized in Deut xxiv. 1.

book only perverse ingenuity can trace marks of rusticity ("imperitum sermone," says Jerome), was a simple herdsman in the wilderness of Judah. Yet it appears that the origin of written prophecy was due less to the spread of education than to the rise of a new school of men whose whole method and aims were in conflict with the official prophetic societies, the unworthy successors of Samuel and Elijah.

In the terrible struggle with Nineveh, when the kingdom of Ephraim perished and Judea seemed lost beyond hope, the new prophecy, clear of vision when all were blinded, calm in its unshaken faith of ultimate victory, and pursuing with unfaltering steadfastness a great purpose of righteousness, established a spiritual and intellectual ascendency which is stamped on the whole literature of the Assyrian and Chaldæan periods. In the book of Deuteronomy the ancient ordinances of Israel were rewritten in the prophetic spirit, and the reformation carried out by Josiah on the basis of this book is the decisive proof of the influence of the written word as the organ of prophetic ideas. The same influence can be traced in other directions,—in psalms that express the type of individual faith, and in the historical books as they were finally shaped after the fall of Jerusalem, when the old popular narrative was filled out and continued in a spirit of prophetic pragmatism, and with the direct object of enforcing prophetic teaching. The Exile, which robbed Israel of every other inheritance, gave increased value and authority to the written word, and in the author of Isa. xl.-lxvi. we find a prophet who no longer appears in person before his audience but does his whole work by the pen. There are other short prophecies of the Babylonian age, as Isa. xiii., xiv., which seem to have been first published as anonymous broadsides—a characteristic change from the method of the former prophets, who wrote only what they had first spoken to the people. The earliest written prophecy is nervous rhetoric of the old pregnant Hebrew style interspersed with bursts of song. Even before the Exile this style had undergone a change; the prophecies of Jeremiah have lost something of the old force, while they display a subtler habit of reflection and a pathos which has its origin in the conflict of a sensitive and shrinking temperament with the overpowering sense of prophetic duty. Jeremiah was much occupied with the dark problems of providence and the meaning of the sufferings of the faithful in Israel, a topic which goes beyond the sphere of the earlier prophecy, but forms a chief theme of Isa. xl.-lxvi., and from a different point of view is taken up and discussed in the book of Job. The last-named book is the highest utterance of another characteristic form of Hebrew literature, the Chokma, that is, wisdom of practical philosophy in parabolic, epigrammatic, and poetic form. The earliest distinct trace of literary cultivation of this philosophy, which from its nature must at first have passed unwritten from mouth to mouth, is the collection of ancient proverbs by scholars in the service of Hezekiah (Prov. xxv. 1). Along with the simple epigrammatic proverbs which continued to be a favorite vehicle of Jewish thought long after Hebrew had given way to Aramaic, the earliest form of Hebrew wisdom seems to have been the fable about plants and trees (Jud. xi., 2 Kings xiv. 9, *cf.* 1 Kings iv. 33), so different from the animal fables of Kalilag and Damnag or Sindbân, which the later Semitic literature borrowed from India. The further development of the Chokma ran parallel with the progress of prophecy, and though it is generally maintained that Jeremiah quotes the book of Job it is perhaps more likely that the contrary is the case, and that the latest and most meditative phase of prophecy was absorbed into the poetry of the Chokma. The brief revival of spoken prophecy after the Exile lacks the old fire, and presents no notable literary feature except the use of somewhat fantastic symbolic imagery, the prototype of the later apocalyptic literature.

The decadence of prophecy and the synchronous systematization of the ceremonial law on lines first drawn by Ezekiel, mark the commencement of the third and last period of Hebrew literature. The age of religious productivity was past, and the narrow limits and political nullity of the new Jewish setttlement under the Persians presented no favorable conditions for a fresh development of truly national literature. The scribes took the place of the prophets, and the growth of traditionalism imposed increasing restrictions on original thought. The freshest and best products of this period are the post-Exile psalms, the hymns of the second temple, which occupy a large part of the Psalter, and, though generally inferior to the older lyrics in the highest poetical qualities, are often full of the charm of genuine feeling and sweet utterance, and sometimes rise to a sublime energy of devotion and faith. With these psalms the graceful prose idyll of Ruth has a natural affinity. The other writings of the last age are on the whole much inferior. As the language decayed, the graces of the older prose style were lost. The memoirs of Ezra and Nehemiah, the colorless narrative of the Chronicles, and even the book of Esther, are singularly destitute of literary merit.

Yet letters were sedulously cultivated. The *Midrash*, or sermonizing treatment of the old history which holds so large a place in later Jewish literature, had come in before the time of the Chronicler, who quotes a work of the kind by name—the Midrash of the Book of Kings (2 Chron. xxiv. 27, *cf.* xiii. 22). Along with this came the beginnings of Haggada, the formation of parables and tales attached to historical names, of which the book of Jonah is generally taken as an early example, and which attains much greater dimensions in the apocryphal additions to the Hagiographa. And so at the close of the Old Testament period the author of Ecclesiastes could speak of the weariness of much study and the endless sterility of bookmaking. His judgment was confirmed by posterity, for of these many books scarcely a trace remains.

The Cultivation of Hebrew as a Dead Language.[1]—We have seen that when the latest books of the Old Testament were written Aramaic had already supplanted Hebrew as the language of common life. But the knowledge of the ancient idiom was kept alive not merely by the study of the sacred books but by the continued use of Hebrew for literary purposes. Several books of the Apocrypha appear to be translated from Hebrew originals — Sirach, Judith, 1 Mac. — the last according to the express testimony of Jerome. It is even probable that the Old Testament canon contains elements as late as the epoch of national revival under the Maccabees (Daniel, certain Psalms), for Hebrew was the language of religion as well as of scholarship. As for the scholars, they affected not only to write but to speak in Hebrew; but they could not resist the influence of the Aramaic vernacular, and indeed made no attempt to imitate the classical models of the Old Testament, which neither furnished the necessary terminology for the new ideas with which they operated, nor offered in its forms and constructions a suitable vehicle for their favorite processes of legal dialectic. Thus was developed a new scholastic Hebrew, "the language of the wise" (לשון חכמים), preserving some genuine old Hebrew words which happen not to be in the Bible, and supplying some new necessities of expression by legitimate developments of germs that lay in the classical idiom, but thoroughly interpenetrated with foreign elements and as little fit for higher literary purposes as the Latin of the mediæval schoolmen. The chief monument of this dialect is the body of traditional law called the Mishna, which is formed of materials of various dates, but was collected in its present form about the close of the 2d Christian century. The doctors of the subsequent period still retained some fluency in the use of Hebrew, but the mass of their teaching preserved in the Gemara is Aramaic.[2] The language of the Mishna has been described by Geiger, *Lehr- und Lesebuch zur Sprache der Mischnah* (Breslau, 1845); L. Dukes, *Die Sprache der Mischna* (Esslingen, 1846) and *Zur rabbinischen Sprachkunde* (Vienna, 1851); J. H. Weiss, *Mishpat L'shôn ham-Mishna* (Vienna, 1867).

During the Talmudic period nothing was done for the grammatical study of the old language, but there was a traditional pronunciation for the synagogue, and a traditional interpretation of the sacred text. The earliest monument of Jewish interpretation is the Septuagint, but the final form of traditional exegesis is embodied in the Targums or Aramaic paraphrases, especially in the more literal Targums of Onkelos and Jonathan, which are often cited by the Talmudic doctors. Many things in the language of the Old Testament were already obscure, and the meaning of words was discussed in the schools, sometimes by the aid

[1] On this topic compare in general Wolfii *Bibliotheca Hebræa*, 1715–1733; Bartolocii *Bibliotheca Magna Rabbinica*, 1675–1693; Imbonati *Bibliotheca Latino-Hebraica*, 1694; Diestel, *Geschichte des A. T. in der Christlichen Kirche*, 1869; R. Simon, *Histoire Critique du V. T.*, 1678.

[2] See Bacher *Die Aggada der Babylonischen Amoräer* (Strasburg, 1879), for many illustrations of the Hebrew scholarship of the Gemarists.

of legitimate analogies from living dialects,[1] but more often by fantastic etymological devices such as the *Notarikon*, or use of analogies from shorthand.

The real service rendered to Hebrew philology by the Talmudic doctors consists not in what they produced but in the knowledge which they preserved from the time when the idiom of the Old Testament was a living tongue. The exaggerated value which their casuistic exegesis attached to every syllable and every letter of the sacred books resulted in a finical preservation, not indeed of the original text, but of the text which had become authoritative, and which is hardly later than the 1st Christian century. And fortunately for later scholarship the period immediately subsequent to the close of the Talmud (about 600 A. D.) devised in the vowel points and accents a means for preserving not merely the consonants of this text but the exact pronunciation and intonation of the synagogue. The idea of this system of punctuation appears to have been taken from a similar usage adopted in Syriac MSS.; the complete development of the idea as we find it in our present Hebrew Bibles must have been reached by successive steps which we cannot now trace. The current punctuation is the work of the Palestinian schools; another system resting on the same foundations was developed in Babylon, and is known from the MSS. of the Petersburg library collected by Firkowitsch, and also from copies brought from Yemen. The difference between the two systems lies more in the notation than in the pronunciation, and neither punctuation can claim absolute priority.[2] The work of the punctuators was perhaps completed in the 7th century. After a time the vowel signs came to be thought as old as the text, but a juster view was revived by Elias Levita (1472–1549),[3] and, after the great controversy in the 16th century between Cappellus and Buxtorf, finally gained universal recognition.[4] With the work of the punctuators is associated the collection by the Massorets of a great mass of notes designed to preserve and illustrate by statistics exceptional phenomena of the Old Testament text,[5] a work which may be viewed as the first step towards scientific study of Hebrew philology.

With all this the old traditional scholarship continued to decline till the 10th century, when a revival of Hebrew study under the influence of Mahometan learning took place among the Arabic-speaking Jews (Saadia of the Fayyum, Menahem ben Sarug, etc.).[6] Then, early in the 11th century, came the acknowledged fathers of mediæval Jewish philology,—the grammarian Judah surnamed Hayyug, discoverer of the system of triliteral roots,[7] and the lexicographer Abulwalîd Merwân ibn Ganâh (Rabbi Jonah), who made excellent use of Arabic analogies as well as of the traditional material.[8] A succession of able scholars continued their work, of whom the most famous are Abraham ben Meïr of Toledo, surnamed Ibn Ezra (1092–1167), a man of great originality and freedom of view; Solomon Isaaki of Troyes, called Rashi and sometimes by error Jarchi, *i. e.*, of Lunel (died 1105), whose writings are a storehouse of traditional lore; and David Kimchi of Narbonne, called Radak (*circ.* 1200), whose commentaries, grammar, and lexicon exercised an enormous and lasting influence, and were the chief fountain of knowledge for the Christian Hebraists of the 16th century. Our own authorized version, for example, bears the stamp of Kimchi on every page.

[1] See B. Rosh hash-Shana, 26b; Delitzsch on Ps. lv. 23 and Isa. xiv. 23.

[2] The Babylonian punctuation can be best studied in Strack's facsimile (St. Petersburg, 1876) of the St. Petersburg codex of the prophets of 916 A. D. Notable in this system is the absence of a sign for seghol (ê), which is replaced by *i* or *a*. See also Pinker's *Einl. in d. Babylonisch-heb. Punctationssystem* (Vienna, 1863), and for other literature, Wellhausen-Bleek, p. 614, to which add Derenbourg, *Revue Critique*, June 21, 1879.

[3] See his *Massoreth ham-Massoreth*, re-edited by Dr. Ginsburg, 1867.

[4] The history of the controversy has been written by G. Schnedermann, *Die Controverse des Ludovicus Cappellus mit den Buxtorfen* (Leipsic, 1879).

[5] On the Massorah see especially Jacob b. Hayyîm's preface to the Venice Rabbinical Bible (reprinted and translated by Dr. Ginsburg, London, 1867), Levita's *Massoreth ham-Massoreth*, and Buxtorf's *Tiberias* (Basel, 1620). Besides the Massorah as printed by J. b. Hayyîm in the Venice Bible, which is superior to all reprints, we have in print *Ochlah w'Ochlah* (ed. Frensdorf, Hanover, 1864), and the first part of the *Massorah Magna* (ed. Frensdorf, 1876). A new edition of the Bible with Massorah, from an extensive collation of MSS., is now being printed at Vienna by Dr. Ginsburg.

[6] The connecting link between the Massorets and the grammarians is Rabbi Aaron ben Mosheh ben Asher, whose *Dikduke hat-Tamim* has been published by Baer and Strack (Leips. 1879).

[7] See his *Two Treatises*, edited by Nutt, London, 1870.

[8] His *Book of Roots*, in Arabic, edited by Neubauer, Oxford, 1875.

On the Jewish scholars and their works consult Wolf and Bartolocci, also De Rossi, *Dizionario Storico degli Autori Ebrei*, Parma, 1802; on Ibn Ezra in particular, the *Introduction* to Friedländer's translation of his *Com. on Isaiah* (London, 1873), and the same writer's *Essays on the Writings of Ibn Ezra* (London, 1877); on the French Rabbins, *Histoire Lit. de la France*, vol. xvi., but especially vol. xxvii. (1877); on Rashi, Zunz's *Gesammelte Schriften*, iii. 100, and a biography by the same scholar, translated into German by Bloch (1840). In the later Middle Ages Jewish learning was cramped by a narrow Talmudical orthodoxy; but a succession of sound scholars held their ground till Elias Levita and others of his age transmitted the torch to the Christian universities.

Up to the revival of letters there was no productive Hebrew scholarship among Christians. In the Greek and Latin Church the few fathers who, like Origen and Jerome, knew something of the language were wholly dependent on their Jewish teachers, and have value for us only as depositaries of Hebrew tradition. Nor was it otherwise in the East. The Syriac version of the Old Testament is permeated by the influence of the synagogue where it is not guided by the Septuagint, and the homilies of Aphraates are a mine of Jewish tradition. In the Middle Ages some knowledge of Hebrew was preserved in the church by converted Jews and even by Christian scholars, of whom the most notable were the Dominican controversialist Raymundus Martini and the Franciscan Nicolaus de Lyra, through whose popular commentaries the exegesis of Rashi was conveyed to Luther and largely influenced his interpretation of Scripture.[9] But there was no continuous tradition of Hebrew study apart from the Jews, and in the 15th century, when the revival of independent scholarship kindled the desire to add a third learned tongue to Latin and Greek, only the most ardent zeal could conquer the obstacles that lay in the way. Orthodox Jews refused to teach those who were not of their faith, and on the other hand the bigotry of ignorant churchmen desired nothing better than the entire suppression of Jewish learning. Even books were to be had with the greatest difficulty, at least north of the Alps. In Italy things were somewhat better. Jews expelled from Spain received favor from the popes. Study was facilitated by the use of the Hebrew printing press, which was at work at Reggio as early as 1475, while the whole Hebrew Bible appeared at Soncino in 1488.[10] The cause of learning found its champion among the northern humanists in John Reuchlin (1455–1522), whose *Rudimenta* (Pforzheim, 1506) opened the door to students, while his victorious contest with Pfefferkorn and the Cologne obscurantists established the claim of Hebrew studies on scholarship and the church.

The new learning spread fast. Sebastian Münster in Heidelberg, and Paul Büchlein (Fagius) at Isny, Strasburg, and Cambridge, were worthy pupils of the famous and liberal Jewish scholar Levita. France drew teachers from Italy. Santes Pagninus of Lucca was at Lyons; and the trilingual college of Francis I. at Paris, of which Vatablus and Le Mercier soon became the ornaments, attracted among other foreigners Giustiniani, bishop of Nebbio, the editor of the Genoa Psalter of 1516. In Rome the Jewish convert Felix Pratensis taught by invitation of Leo X., whose name and that of the more famous convert J. b. Hayyîm live mainly in connection with the great Rabbinical Bibles that issued from the Bomberg press at Venice. In Spain, the old home of Jewish scholarship, Hebrew learning was promoted by Cardinal Ximenes, the patron of the Complutensian Polyglot. Printing presses were multiplied, and the great humanist printers, as Froben at Basel and Étienne at Paris, competed with Italy in the production of Hebrew books. In brief, before the middle of the 16th century the place of Hebrew studies was secure throughout learned Europe, while in Protestant countries opposition to the authority of the Vulgate combined with scholarly interest to make the study of the original text of Scripture appear indispensable. Thus in Scotland the establishment of a

[9] See Siegfried's essay in Merx's *Archiv*, i. 428, ii. 38.

[10] De Rossi, *Annales Hebræo Typographici Sec. XV.*, Parma, 1795. A lively picture of the difficulties that lay in the way of Hebrew study is found in the *Autobiography* (ed. Riggenbach, 1877) of Conrad Pellican, who contributed to Reisch's *Margaritha Philosophica* the first imperfect Hebrew grammar composed by a Christian (Strasburg, 1504, reprinted in facsimile by Nestle, Tübingen, 1877). See also Geiger's *Johann Reuchlin* (Leipsic, 1871). Reference may also be made to the same author's *Studium der Heb. Spr. in Deutschl. vom Ende des 15ten bis zur Mitte des 16ten Jahrhunderts* (Breslau, 1870), and Jourdain's *De l'enseignement de l'hebreu dans l'université de Paris* (1863).

trilingual course in the universities is contemplated in the first *Book of Discipline*.[1]

For a time the best Christian scholars leaned mainly on the Rabbins. But in the larger air of humanism a more independent type of learning soon arose, of which Le Mercier in the 16th and Drusius in the beginning of the 17th century may be taken as representatives. The importance of the ancient versions was recognized, and their study was fostered by the publication of the Polyglots.

In the 17th century the cognate dialects were cultivated with great vigor and success by men like Selden, Castell, and Pococke in England, De Dieu in Holland, Bochart in France, Ludolf and Hottinger in Germany; and these studies bore fruit both for the Hebrew grammar and for the lexicon. Rabbinic learning was not forgotten, and found its chief ornament in the elder Buxtorf at Basel, who was also the author of grammars and a handy lexicon which long remained favorite manuals in England and on the Continent.[2]

At the same time a critical spirit arose, which involved Hebrew philology in the meshes of theological controversy. The battle as to the age of the vowel points has already been referred to. It was part of a larger question as to the integrity of the received Hebrew text, and the legitimacy of text criticism, which received dogmatic importance from the prevalence of extreme theories of verbal inspiration in the Protestant Church. Thus the Protestant Cappellus found his main support in the Catholic Church (Morinus, R. Simon), while the authority of the Massoretic text and punctuation was elevated to a dogma in the *Formula Consensus Helvetica* (1675), not without protest from the wiser Protestantism of France. The critical school had also its extravagances, and an undue depreciation of tradition was one of several false principles that it would be tedious to enumerate, which came into vogue in the latter part of the 17th century, and long continued to impede the progress of scientific Hebrew philology. In the beginning of the 18th century Semitic studies had their chief seat in Holland, where Albert Schultens took up the comparative method with fresh energy, and applied it to Hebrew on a scale which gave a new shape to the study of the language.[3] Schultens laid emphasis on the limited extent of the Old Testament literature, which makes it an inadequate record of the phenomena of the Hebrew language, and proposed to supply these defects by a large use of the dialects, mainly of the Arabic, in which he had wide and accurate reading. His *Institutiones ad fundamenta Linguæ Hebrææ* (1737) mark an advance on previous grammars, and in his commentaries is accumulated an enormous mass of material of the highest value for the lexicographer. Schultens founded an influential school, of which Schroeder was the chief ornament; but his method was easily abused, and fell into discredit in the hands of arbitrary expositors like Venema. After Holland, Germany became the chief seat of Hebrew studies. In Halle, where the influence of Francke directed special attention to Biblical learning, there sprang up contemporaneously with the Dutch school a school of Hebraists—earnest, laborious, and thorough, but somewhat jejune and deficient in æsthetic sympathy,—of which the Michaelis family were the chief representatives. J. D. Michaelis (1717–1791) exercised a sort of sovereignty in Hebrew letters, and the stamp of Halle has left a permanent impress on the German schools, though a more sympathetic and emotional type of scholarship, beginning with Herder and Eichhorn, became dominant under the influence of Ewald.

By the epoch-making labors of Silvestre de Sacy (1758–1838), which first placed Oriental learning and especially Semitic grammar on a broad and thoroughly scientific footing, a new impulse was given to Hebrew philology, which since that time has moved with the advance of general Semitic studies, and can hardly again fall into devious paths. The great teachers of Hebrew in the present century have been two Germans, Gesenius and Ewald,—the former excelling in method and lucidity of exposition, the latter in range of view and creative fertility of ideas. Among the direct or indirect disciples of these great scholars may be reckoned almost every Hebraist in Europe, and to them is mainly due the revival in England of a branch of learning which had almost become extinct through the prevailing dilettantism of last century.

Helps to the Study of Hebrew.—Grammars.—The principal modern methods are those of Gesenius, Ewald, and Olshausen. Gesenius's larger work, his *Lehrgebäude der hebräischen Sprache* (Leipsic, 1817), is still useful for occasional reference. His smaller grammar has passed through innumerable editions, and in its most recent shape, as reeast by Rödiger and finally by Kautzsch (1878), holds its ground as one of the best books for learners. Davies's version of Rödiger's Gesenius is the best of several English translations (1869–1876). The method of Gesenius is mainly empirical. Much more philosophic, but less simple and sometimes arbitrary in its refinements, is the *Ausführliches Lehrbuch* of Ewald (8th ed., Göttingen, 1870), of which the "Syntax" has been translated into English by Kennedy (1879). The shorter *Sprachlehre für Anfänger* (4th ed., 1874; Eng. trans. by Smith, 1870) is valuable but too difficult for ordinary beginners. Olshausen's *Lehrbuch* (Brunswick, 1861) is incomplete, the syntax having never appeared; but it is, on the whole, the best and most scientific exposition of the Hebrew grammatical forms. Two elementary grammars on Olshausen's system have been translated into English—Bickell's *Grundriss* (Leipsic, 1869–1870; English by Curtiss, 1877) and Land's *Hebreeuwsche Grammatica* (Amsterdam, 1869; English by Poole, 1876). The latter work has some peculiarities which detract from its utility, and neither Bickell nor Land supplies a proper syntax. Müller's *Schulgrammatik* (Hallo, 1878) is also mainly on Olshausen's method with the addition of an excellent syntax. In English A. B. Davidson's *Introductory Hebrew Grammar* (3d. ed., Edin., 1878) may be commended to beginners as a good practical method and easy introduction to the larger scientific grammars. Of other more extensive works may be named Böttcher's *Ausführliches Lehrbuch*, posthumously edited by Mühlau (Leipsic, 1866–68), a huge book serving as a sort of grammatical concordance to the Old Testament; Luzzatto's Italian *Grammatica* (Padua, 1853–69), which is valuable from the thorough Jewish scholarship of the author, the Latin grammar of Roorda, and in English the works of Kalisch (1862–63) and Green (New York, 1861). Among useful monographs on special points of grammar may be named Philippi, *Wesen und Ursprung des Status Constructus* (Weimar, 1871); S. R. Driver, *The Use of the Tenses in Hebrew* (Oxford, 1874); Giesebrecht, *Die Hebräische præposition Lamed* (Halle, 1876); Davidson, *Outlines of Hebrew Accentuation* (1861). For comparative purposes, in the absence of a comparative system of the Semitic languages, which is hoped for from Renan, the hints in Wright's *Arabic Grammar* will be found most valuable.

Lexicons.—Far superior to all other lexicons is the *Thesaurus* of Gesenius, completed by Rödiger (Leipsic, 1829–1858). Gesenius published also a *Handwörterbuch*—of which the 8th ed. by Mühlau and Volck (Leipsic, 1877–78) contains a good deal of new matter not always improvement—and a *Lexicon Manuale* in Latin (2d ed. by Hoffmann, 1847), of which there is an English translation. The *Handwörterbuch* of Fürst (2d ed., 1863; Eng. trans. by S. Davidson, 1871; 3d ed. by Ryssel, 1876) proceeds on very faulty etymological principles and must be used with great caution. On Hebrew synonyms Pappenheim's *Yrîôt Sh'lômôh* (1784–1811) is the principal work.

Concordances.—The *Concordantiæ* of Buxtorf (1632) were reprinted by Beer (1863). Fürst's *Concordance* (1840) contains a good deal of supplementary matter, part of which is of little use. For the particles the (incomplete) concordance of Noldius (1679; ed. Tympius, 1734) is useful.

In addition to modern books the advanced student will sometimes find it useful to recur to older works, especially to the Jewish grammarians and lexicographers, but these need not be detailed here.

For the later Hebrew of the period of the Mishna, and for the new words and technical terms in the scholastic Hebrew of the Middle Ages, the best lexicon is Buxtorf's *Lexicon Chaldaicum Talmudicum et Rabbinicum* (1640). The recent reprint is not so good. A new lexicon by Levy has been in the course of publication since 1875 (*Neu-hebräisches und Chaldäisches Wörterbuch*). The beginner will find the *Lexicon breve Rabbinico-philosophicum* appended to Buxtorf's small *Lexicon Hebraicum* very useful, and may also consult the treatises in Reland's *Analecta Rabbinica* (1702). In reading Rabbinical Hebrew it is well to have Selig's *Compendia Vocum Hebraico-Rabbinicarum* (1780). The similar work of Buxtorf is less full.

On the whole subject of this article consult Gesenius, *Geschichte der hebräischen Sprache und Schrift* (Leipsic, 1817);

[1] The first Hebrew grammar published in Scotland is that of John Row, moderator of the school of Perth, and afterwards minister at Aberdeen (Glasgow, 1644). The preface bears date 1637. With the grammar appeared a Χιλιάς *Hebraica*.

[2] To obtain an idea of the way in which Hebrew was taught in the 17th century one may read the *Diatriba* of Caspar Sefoppius, in *H. Grotii et aliorum dissertationes de studiis instituendis* (Amst., 1645).

[3] On Schultens, his method and school, see C. Sepp, *Johannes Stinstra en zijn Tijd* (Amst., 1865). The Dutch schools of the 16th and 17th centuries are well described by the same author, *Het godgeleerd Onderwijs in Nederland gedurende de 16de en 17de Eeuw* (Leyden, 1873–74).

Renan, *Histoire générale des langues Sémitiques* (4th ed., Paris, 1864). (W. R. S.)

HEBREWS, EPISTLE TO THE. The New Testament writing usually known under this name, or less correctly as the Epistle of Paul the Apostle to the Hebrews, bears in the oldest MSS. no other title than the words Πρὸς Ἑβραίους, "To the Hebrews." This brief heading embraces the whole information as to the origin of the epistle on which Christian tradition is unanimous. Everything else—the authorship, the address, the date—was unknown or disputed in the early church, and continues to form matter of dispute in the present day. But as far back as the latter part of the 2d century the destination of the epistle "to the Hebrews" was acknowledged alike in Alexandria, where it was ascribed to Paul, and in Carthage, where it passed by the name of Barnabas, and no indication exists that it ever circulated under another title.[1] At the same time we must not suppose, as has sometimes been done, that the author prefixed these words to his original manuscript. The title says no more than that the readers addressed were Christians of Jewish extraction, and this would be no sufficient address for an epistolary writing (xiii. 22) directed to a definite circle of readers, a local church or group of churches to whose history repeated reference is made, and to which the author had personal relations (xiii. 19, 23). The original address, which according to custom must have stood on the outside of the folded letter, was probably never copied, and the early and universal prevalence of the present title, which tells no more than can be readily gathered from the epistle itself, seems to indicate that when the book first passed from local into general circulation its history had already been forgotten. With this it agrees that the early Roman Church, where the epistle was known about the end of the 1st century, and where indeed the first traces of the use of it occur (Clement, and *Shepherd of Hermas*), had nothing to contribute to the question of authorship and origin except the negative opinion that the book is not by Paul. Caius and the Muratorian fragment reckon but thirteen epistles of Paul; Hippolytus (like his master Irenæus of Lyons) knew our book and declared that it was not Pauline. These facts can hardly be explained by supposing that at Rome during the 2d century the book had dropped out of notice, and its history had been forgotten. Clement, Hermas, Hippolytus form a tolerably continuous chain, and the central Church of Rome was in constant connection with provincial churches where, as we shall presently see, the epistle had currency and reputation. Under these circumstances an original trustworthy tradition could hardly have been lost, and it must appear highly questionable whether the author and address of the book were known at Rome even in the time of Clement. The earliest positive traditions of authorship to which we can point belong to Africa and Egypt, where, as we have already seen, divergent views were current by the end of the 2d century. The African tradition preserved by Tertullian (*De Pudicitia*, c. 20), but certainly not invented by him, ascribes the epistle to Barnabas. Direct apostolic authority is not therefore claimed for it; but it has the weight due to one who "learned from and taught with the apostles," and we are told that it had more currency among the churches than "that apocryphal shepherd of the adulterers" (the Shepherd of Hermas). This tradition of the African Church holds a singularly isolated position. Later writers appear to know it only from Tertullian, and it soon became obsolete, to be revived for a moment after the Reformation by the Scottish theologian Cameron, and then again in our own century by the German critics, among whom at present it is the favorite view. Very different is the history of the Egyptian tradition, which can be traced back as far as a teacher of the Alexandrian Clement, presumably Pantænus (Euseb., *Hist. Eccl.*, vi. 14). This "blessed presbyter," as Clement calls him, sought to explain why Paul did not name himself as usual at the head of the epistle, and found the reason in the modesty of the author, who, in addressing the Hebrews, was going beyond his commission as apostle to the Gentiles. Clement himself takes it for granted that an epistle to the Hebrews must have been written in Hebrew, and supposes that Luke translated it for the Greeks. Thus far there is no sign that the Pauline authorship was ever questioned in Alexandria. Origen rests on the same tradition, which he refers to "the ancient men." But he knows that the tradition is not common to all churches. He feels that the language is un-Pauline, though the admirable thoughts are not second to those of the unquestioned apostolic writings. And thus he is led to the view that the ideas were orally set forth by Paul, but that the language, arrangement, and some features of the exposition are the work of a disciple. According to some this disciple was Clement of Rome; others named Luke; but the truth, says Origen, is known to God alone (Euseb., vi. 25, *cf.* iii. 38). It is not surprising that these limitations of the tradition had less influence than the broad fact that Origen accepted the book as of Pauline authority. From the time of Origen the opinion that Paul wrote the epistle became more and more prevalent in the East. In the West this view was still far from established in the 4th century. But it gained ground steadily; even those who, like Jerome and Augustine, knew the variations of tradition were unwilling to press an opposite view; and in the 5th century the Pauline authorship was accepted at Rome, and practically throughout Christendom, not to be again disputed till the revival of letters and the rise of a more critical spirit.

That the received view called for revision could not indeed be questioned when men began to look at the facts of the case. The vacillation of tradition and the dissimilarity of the epistle from the style and thoughts of Paul were brought out with great force by Erasmus in his concluding annotation on the book, where he ventures the conjecture based on a passage of his favorite Jerome, that Clement of Rome was the real author. Luther (who suggests Apollos) and Calvin (who thinks of Luke or Clement) followed with the decisive argument that Paul, who lays such stress on the fact that his gospel was not taught to him by man but by direct revelation (Gal. i.), could not have written Heb. ii. 3, 4, where the author classes himself among those who received the message of salvation from the personal disciples of the Lord on the evidence of the miracles with which God confirmed their word. The force of tradition seemed already broken, but the wave of reaction which so soon overwhelmed the freer tendencies of the first reformers brought back the old view. Protestant orthodoxy again accepted Paul as the author, and dissentient voices were seldom heard till the revival of free Biblical criticism in last century. As criticism strengthened its arguments, theologians began to learn that the denial of tradition involves no danger to faith, and at the present moment, in spite of the ingenious special pleading of Hofmann (*Die Heilige Schrift N. Ts.*, vol. v., Nördlingen, 1873), scarcely any sound scholar will be found to accept Paul as the direct author of the epistle, though such a modified view as was suggested by Origen still claims adherents among the lovers of compromise with tradition.

The arguments against the Alexandrian tradition are in fact conclusive. It is probably unfair to hamper that tradition with Clement's notion that the book is a translation from the Hebrew, a monstrous hypothesis which has received its *reductio ad absurdum* in the recent attempt of J. H. R. Biesenthal to reconstruct the Hebrew text (*Das Trostschreiben des Apostels Paulus an die Hebräer, kritisch wiederhergestellt*, etc., Leipsic, 1878). But just as little can the Greek be from Paul's pen. The un-Pauline character of the style, alike in the words used and in the structure of the sentences, strikes every scholar as it struck Origen and Erasmus. The type of thought is quite unique. The theological ideas are cast in a different mould; and the leading conception of the high priesthood of Christ, which is no mere occasional thought but a central point in the author's conception of Christianity, finds its nearest analogy not in the Pauline epistles but in John xvii. 19. The Old Testament is cited after the Alexandrian translation more exactly and exclusively than is the custom of Paul, and that even where the Hebrew original is divergent. Nor is this an accidental circumstance. There is every appearance that the author was a Hellenist whose learning did not embrace a knowledge of the Hebrew text, and who derived his metaphysic and allegorical method from the Alexandrian rather than the Palestinian schools.[2]

The force of these arguments can be brought out only by the accumulation of a multitude of details too tedious for

[1] See the full refutation of supposed exceptions to the uniformity of this tradition in Zahn's article "Hebräerbrief" (Herzog-Plitt, *R. E.*, vol. v. p. 657).

[2] For the Alexandrian elements in the epistle consult the list of passages in Hilgenfeld's *Einleitung* (Leipsic, 1875), p. 384, note. A large mass of valuable material is collected in J. B. Carpzov's *Sacra Exercitationes in Ep. ad Heb. ex Philone Alexandrino* (Helmstadt, 1750).

this place, but the evidence from the few personal indications contained in the epistle is easily grasped and not less powerful. The argument from ii. 3, 4, which appeared decisive to Luther and Calvin, has already been referred to. Again, we read in xiii. 19 that the writer is absent from the church which he addresses, but hopes to be speedily restored to them. This expression is not to be understood as implying that the epistle was written in prison, for xiii. 23 shows that the author is master of his own movements.[1] The plain sense is that his home is with them, but that he is at present absent, and begs their prayers for a speedy return. But Paul, if he could say that he had a home at all, had it not in a community of Jewish Christians. The external authority of the Alexandrian tradition can have no weight against such difficulties. If that tradition was original and continuous, the long ignorance of the Roman Church and the opposite tradition of Africa are inexplicable. But no tradition was more likely to arise in circles where the epistle was valued and its origin forgotten. In spite of its divergencies from the standard of Pauline authorship, the book has manifest Pauline affinities, and can hardly have originated beyond the Pauline circle, to which it is referred, not only by the author's friendship with Timothy (xiii. 23), but by many unquestionable echoes of the Pauline theology, and even by distinct allusions to passages in Paul's epistles.[2]

In an uncritical age these features might easily suggest Paul as the author of a book which was read in MSS. immediately after the recognized epistles of that apostle, and which contained nothing in its title to distinguish it from the preceding books with similar headings, "To the Romans," "To the Corinthians," and the like.[3] A similar history, as Zahn has pointed out, attaches to the so-called second epistle of Clement to the Corinthians.

When we see that the tradition which names Paul as author does not possess an authentic historical basis, we are necessarily carried on to deny historical authority to the subsidiary conjectures or traditions which speak of Luke and Clement of Rome. The history of the Alexandrian tradition shows that these names were brought in merely to lessen the difficulties attaching to the view that Paul wrote the book exactly as we have it. The name of Luke seems to be a conjecture of the Alexandrian Clement, for it has no place in the tradition received from his master. And Origen attaches no importance to either name. Some had mentioned one, and some the other, but God alone knows the truth. We have no reason to think more highly of these suggestions than Origen did. Indeed, no Protestant scholar now proposes the name of Clement, whose extant epistle to the Corinthians shows his familiarity with the epistle to the Hebrews, and at the same time excludes the idea that he composed it. The name of Luke has still partisans — most notably Delitzsch, who has carefully collected linguistic parallels between our epistle and the Lucan writings (*Commentar zum Hebräerbrief*, Leipsic, 1857; English translation, Edinburgh, 1868–70). The arguments of Delitzsch are generally met with the objection that our author must have been a born Jew, which from his standpoint and culture is in the highest degree probable, though not perhaps absolutely certain. In any case we cannot suppose that Luke wrote the epistle on Paul's commission, or that the work is substantially the apostle's; for such a theory takes no account of the strongly-marked individuality of the book in thought and method as well as expression. And the theory that Luke was the independent author of the epistle (Grotius and others) has no right to appeal to antiquity, and must stand entirely on the very inadequate grounds of internal probability afforded by language and style.

If Alexandria fails us, can we suppose that Africa preserved the original tradition? This is a difficult question. The intrinsic objections to authorship by Barnabas are not important. The so-called Epistle to Barnabas was not written by our author, but then it is admittedly not by Barnabas. The superior elegance of the style of our epistle as compared with that of Paul is not inconsistent with Acts xiv. 12; nor is there, as we shall see presently, any real force in the once favorite objection that the ordinances of the temple are described with less accuracy than might be looked for in Barnabas, a Levite and one who had resided in Jerusalem. On the other hand it is hard to believe that the correct account of the authorship of our book was preserved only in Africa, and in a tradition so isolated that Tertullian seems to be its only independent witness. How could Africa know this thing and Rome be ignorant? Zahn, who is the latest exponent of the Barnabas hypothesis, argues that in the West, where the so-called epistle of Barnabas was long unknown, there was nothing to suggest the idea of Barnabas as an author; that the true tradition might perish the more readily in other parts of the church after the name of Barnabas had been falsely attached to another epistle dealing with the typology of the ceremonial law; and finally, that the false epistle of Barnabas, which was first so named in Alexandria, may there have carried off the true title of the epistle to the Hebrews after the latter was ascribed to Paul. That is not plausible, and it is more likely that an epistle which calls itself *λόγος παρακλήσεως* (Heb. xiii. 22) was ascribed to the *υἱὸς παρακλήσεως* (Acts iv. 36) in the same way as Ps. cxxvii. was ascribed to Solomon, "the beloved of the Lord" (2 Sam. xii. 24, 25), from the allusion cxxvii. 2, than that this coincidence of expression affords a confirmation of the Barnabas hypothesis. In short, the whole tradition as to the epistle is too uncertain to offer much support to any theory of authorship, and if the name of Barnabas is accepted it must stand mainly on internal evidence.

Being thus thrown back on what the epistle itself can tell us, we must look at the first readers, with whom, as we have already seen, the author stood in very close relations. It is generally agreed that the church addressed was composed of Hebrews or Christians of Jewish birth. We are not entitled to take this simply on the authority of the title, which is hardly more than a reflection of the impression produced on an early copyist. But it is plain that the writer is at one with his readers in approaching all Christian truth through the Old Testament. He and they alike are accustomed to regard Christianity as a continuous development of Judaism, in which the benefits of Christ's death belong to the ancient people of God and supply the shortcomings of the old dispensation (iv. 9; ix. 15; xiii. 12). With all the weight that is laid on the superiority of Christianity, the religion of finality, over Mosaism, the dispensation which brought nothing to its goal, the sphere of the two dispensations is throughout treated as identical, without any allusion, such as could hardly have been avoided in addressing a Gentile church, to the way in which strangers and foreigners (Eph. ii. 19) had been incorporated with the people of God. Schurer indeed (*Stud. u. Krit.*, 1876, p. 776) has sought such an allusion in vi. 1, 2, where faith in God and belief in the resurrection and the judgment, points common to Judaism and Christianity, are reckoned to the elementary doctrine of Christ; and he concludes that the readers addressed were Gentile converts of a Judaizing type. But taken with the context these verses imply only that the Hebrews required to be warned against losing hold even of these first principles of revealed truth which lie in the Old Testament (v. 12). From all this we are not perhaps entitled to conclude that the church addressed contained no Gentile members, but it is plain that they were not sufficiently numerous and independent in their way of thought to affect the general type of Christianity in the community. To some writers the emphatic "all" in xiii. 24, the admonitions x. 25, xiii. 17, have suggested the possibility that the Hebrews addressed were but part, and a somewhat discontented part, of a larger community in which Gentile elements had a considerable place. But this appears a strained conclusion (Phil. iv. 21; 1 Th. v. 26) distinctly contrary to the general tone of the epistle, which moves altogether outside of the antithesis between Jewish and Gentile Christianity. We must think not of a party but of a church, and such a church can be sought only in Palestine or in one of the great centres of the Jewish dispersion. That the epistle was

[1] In x. 34 the true reading is not "of me in my bonds," but "on them that were in bonds," *τοῖς δεσμίοις συνεπαθήσατε*. The false reading, which was that of Clement of Alexandria, is probably connected with the tradition that Paul is author.

[2] An unambiguous proof that our author had read the epistle to the Romans seems to lie in x. 30. This is the one Old Testament citation of the epistle which does not follow the Septuagint (Deut. xxxii. 35); but it is word for word from Rom. xii. 19. Further signs of dependence on Romans and Corinthians (which require sifting) have been collected by Holtzmann in Schenkel's *Bibel-Lexikon*, ii. 620, and Hilgenfeld's *Zeitschrift*, lx. 4 *seq.*

[3] The place of the epistle in MSS. varies. The order of our Bible is that of the Latin Church, the oldest Greek codices placing it before the pastoral epistles. But the Latin order, which expresses the original uncertainty of the Pauline tradition, was formerly current even in the East.

addressed to Palestine, or more specifically to Jerusalem, has been a prevalent opinion from the time of Clement of Alexandria, mainly because it was assumed that the word Hebrews must naturally mean Jews, whose mother-tongue was Aramaic. But the term has this restricted sense only when put in contrast to Hellenists. In itself, according to ordinary usage, it simply denotes Jews by race, and in Christian writings especially Jewish Christians. And there are several things in the epistle that seem to exclude Palestine, and above all Jerusalem. The Hellenistic culture of the writer and the language in which he writes furnish one argument. Then the most marked proof of Christian love and zeal in the church addressed was that they had ever been assiduous in ministering to the saints (vi. 10). This expression may conceivably have a general sense (1 Cor. xvi. 15?), but it is far more likely that it has the specific meaning which it generally bears in the New Testament, viz., the collection of alms for the church in Jerusalem. At any rate it was clearly understood in the first age of Christianity that the Judæan Church took alms and did not give them, receiving in temporal things an acknowledgment for the spiritual things they had imparted (Rom. xv. 27). In fact the great weight laid in the epistles of Paul on this—the only manifestation of the catholicity of the church then possible (Gal. ii. 10)—alone explains the emphasis with which our author cites this one proof of Christian feeling. Again, the expressions in ii. 3 already referred to imply that the readers did not include in their number direct disciples of Jesus, but had been brought to Christ by the words and miracles of apostolic missionaries now dead (xiii. 7). This conversion, as it appears from x. 32, was a thing of precise date immediately followed by persecution (note the aorists φωτισθέντες—ὑπεμείνατε); so that we cannot think of a second generation in the Palestinian Church, but are referred to some part of the Diaspora. Against these difficulties, which have led some of the latest defenders of the Palestinian address, as Grimm (who in Hilgenfeld's *Zeitschr.* 1870, proposes Jamnia) and Moulton (*New Testament Commentary for English Readers*, vol. iii., 1879), to give up Jerusalem altogether, while others, as Riehm, suppose that the Hellenists of Jerusalem (Acts vi. 1) are primarily addressed, it is commonly urged that the readers are exposed to peculiar danger from the persecutions and solicitations of unbelieving Jews, that they are in danger of relapsing into participation in the Jewish sacrifices, or even that they appear to have never ceased to follow the ceremonial observances that had their centre in the temple ritual. The capital argument for this is drawn from xiii. 13, where the exhortation to go forth to Jesus without the camp is taken as an injunction to renounce fellowship with the synagogue and with the ceremonies and ritual of Judaism. But this exegesis rests on a false view of the context, which does not include verse 9, and expresses by a figure that Christians (as the priests of the new covenant) have no temporal advantage to expect by their participation in the sacrifice of Christ, but must be content to share his reproach, renouncing this earthly country for the heavenly kingdom (*cf.* xi. 16, 25–27 with xiii. 14; Phil. iii. 20). Altogether, this view of the situation of the first readers of the epistle appears distorted or exaggerated. It is obvious that our Hebrews were familiar with the law, and had a high regard for the ordinances of temple worship. In particular it appears that they had not fully understood how the mediatorial functions of the Old Testament were superseded by the mediatorship of Christ. But their ritualism seems to have been rather theoretical than practical. Had they been actually entangled in the daily practice of superseded ordinances, the author, whose insight into the true worth of these ordinances is clear, and whose personal relations to the Pauline circle are obvious, could hardly have been so nearly one of themselves as appears in xiii. 19, and at any rate could not have failed to give an express precept on the subject. But, on the contrary, he is in thorough sympathy with the type of doctrine on which their church was formed (xiii. 7); the easy way in which he touches on the "meats and drinks and divers washings" of Judaism seems to show that on this head he could count on carrying his readers along with him; and xiii. 9 hardly refers to sacrifices or to Levitical laws of clean and unclean, but rather to some such form of asceticism (*cf.* ver. 4) as is spoken of in Rom. xiv. Nowhere does our author speak a warning against participation in sacrifices; nowhere does he touch on the burning questions that divided the Pharisaic Christians of Jerusalem from the converts of Paul. The practical lesson which he draws from his doctrine is that his readers ought to use with diligence the specifically Christian way of access to God (x. 19 *seq.*); and the only positive fault which he mentions in this connection is a disposition to neglect the privilege of social worship (x. 25). This again is plainly connected, not with an inclination to return to the synagogue, but with a relaxation of the zeal and patience of the first days of their Christian profession (vi. 4 *seq.*; x. 32 *seq.*; xii. 1 *seq.*), associated with a less firm hold than they once had of the essentials of Christian faith, a less clear vision of the heavenly hope of their calling (iii. 12; iv. 11; v. 12). The apostle fears lest they fall away not merely from the higher standpoint of Christianity into Judaizing practices, but from all faith in God and judgment and immortality (iii. 12; vi. 1 *seq.*).[1]

For the solution of the problem of the epistle it is of the highest importance to form an exacter conception of the causes and nature of this unhealthy condition of the church. Their first conversion had been followed by direct persecution, which their faith had triumphantly overcome. But these days were long gone by (x. 32). It does not appear that a like severity of trial had again fallen upon them. But there were persecutions at least in other parts of the church (xiii. 3, 23). The times were troubled, and from day to day there were many trials and many reproaches to sustain. The dull and long-continued strain of conflict with surrounding wickedness was harder to bear than a sharp onslaught of the enemy (ch. xii.). They were weary of enduring, weary of hope deferred, and so the bonds of their Christian unity were loosened, their brotherly love weakened (xiii. 1 *seq.*), and they began to doubt the verity of those heavenly good things which their first faith had so vividly realized. In such circumstances it was natural that the writer should lay stress on the contrast between the eternal and the transitory, the things of faith and the things of sight, the heavenly Zion and the earthly pilgrimage. But the remarkable feature of the epistle is that this contrast is drawn out in the form of a threefold argument to show the superiority of Christianity over the old dispensation, inasmuch as Christ is superior (1) to the angels, (2) to Moses, (3) and chiefly to the Levitical priesthood and its mediatorship. In each of these relations, it is argued, the old covenant, which is earthly, temporal, and without finality, contains within itself the evidence of its own imperfection, and points to the time when it shall be superseded by a new covenant in which every reality and every hope is heavenly, eternal, or, as we should say, ideal. It is the form of this argument which mainly gives force to the common impression that the Hebrews addressed were in danger of seeking access to God by the superseded methods of the old dispensation—in short that the epistle is a warning against an Ebionite tendency to Christian Pharisaism. But to such a tendency, as we have seen, the practical admonitions of the epistle by no means point. To some scholars accordingly, and particularly to Reuss (*Histoire de la Théologie Chrétienne*, liv. vi. chap. 1; *Les Épîtres Catholiques*, Paris, 1878), the theoretical part of the book has seemed disproportionate to the practical and personal conclusion, and it has been proposed to regard the whole as a theological system with an epistolary appendix. Doubtless this view contains an element of truth. In a far higher measure than the Pauline epistles, and in a sense which thoroughly well agrees with the position of the author as no apostle but an apostolic convert, the book presents the marks of theological reflection on the established data of the faith. Yet it is impossible to ignore the fact that a special and practical motive runs through the whole book. The author never loses sight of a definite circle of readers, and the vast scope of his argument, which is at once felt in the dignity of the opening verses, so unlike the commencement of an ordinary letter, appears to be directly suggested by some historical circumstance affecting his readers and himself, but nowhere explicitly set forth in the epistle, which brought the trial of their faith into close connection with the question of the permanence of the temple and its ritual. Now we have seen reason to believe that these Jewish Christians were not Palestinians of an Ebionite type but men of the Hellenistic dispersion,

[1] The statement of Renan, *L'Antechrist*, pp. xiv., 215, 219, that some had already fallen away and that the question of their readmission was being agitated, seems to be part of the ingenious historical romance in which he has enveloped the whole origin of the epistle.

with a possible tendency to ascetic mysticism, and almost certainly of such a habit of thought as enabled them readily to sympathize with the typological method of our author. Among men of this type there was no great danger of a relapse into practical ceremonialism. They would rather be akin to the school of Judaism characterized by Philo (*De Migr. Abr.*, c. xvi.; ed. Mangey, i. 450), who neglected the observance of the ceremonial laws because they took them as symbols of ideal things. Occupying this position before their conversion, their adoption of the Christian faith would not have forced upon them any close examination of the relation of the new dispensation to the old law. But it appears from Philo that the men who spiritualized away the Sabbath, the great feasts, even circumcision itself, were not prepared to think lightly of the sacred ritual of the temple. The holy hill of God, the meeting-place of heaven and earth, with its stately service and its ancient memories, had too central a place in the religion of the old covenant to seem indifferent to the freest thinker. And so our Hebrews, whose acceptance of Christ had not shaken their sense of the continuity of the people of God and their Old Testament privileges, might readily retain the feeling that the ritual of the temple was still what it was of old—a visible and necessary pledge of God's approach to His people and His acceptance of their worship. So long as things ran their old course such a feeling would hardly affect the even tenor of their Christian life. But when the death struggle of Judea against Rome drew the sympathy of every Hebrew heart, when the abomination of desolation stood in the holy place, when the holy and beautiful house was burned up with fire, and when, with all this, terror and distress filled the whole Roman empire and still the Lord delayed His coming, it was not strange that something like despair of God's help should assail our Hebrews, and that all the hopes of the people of God should seem threatened in the overthrow of the ancient pledge of Jehovah's nearness to Israel.

Now it has generally been argued that the epistle to the Hebrews, which describes the temple services in the present tense, must necessarily have been written before they ceased to be performed. But it has been shown in the most conclusive manner, from the use of similar presents in Rabbinical writers as well as in Josephus and elsewhere, that this argument goes for nothing; and the most recent writers, since Holtzmann's discussion of the subject in Schenkel's *Bibel-Lexikon*, ii. 623 *seq.*, generally admit that the epistle may have been written after the fall of the temple. And if this be so it can hardly be questioned that the most natural view of the apostle's argument, as it comes to a point in such passages as viii. 13, ix. 9, is that the disappearance of the obsolete ritual of the old covenant is no blow to Christian faith, because in Christ ascended into glory the church possesses in heavenly verity all that the old ritual presented in mere earthly symbol. It was the ruin of the Jewish state and worship which compelled Christianity to find what is offered in our epistle—a theory of the disappearance of the old dispensation in the new.

Many attempts have been made to determine which of the centres of the Diaspora was the seat of our Hebrews. Hofmann suggests Antioch; Ewald, Ravenna;[1] but Rome and Alexandria are the places for and against which most has been said. One argument for Alexandria on which great stress has been laid must certainly be dismissed. Wieseler (*Untersuchung über den Hebräerbrief*, ii^te Hälfte, Kiel, 1861), combining the arguments against a Palestinian address with the impression, which we have seen to be without sufficient foundation, that the readers lived in the neighborhood of a Jewish temple, seeks them among the Egyptian Jews who frequented the schismatical temple of Leontopolis (Tel-el-Yahûdîa) in the upper Delta. And he tries to show that in his description of the temple and the functions of the high priests our author diverges from the Judæan pattern and follows peculiarities of the Egyptian temple. But this argument rests on a series of improbable assumptions. The supposed peculiarities of Onias's temple are proved by arbitrary exegesis from passages of Philo, who apparently never thought of that temple at all. Nor can it be shown that it had ever such a reputation as to play the part which Wieseler assigns to it. And our author's supposed ignorance of the Jerusalem ritual is not made out. In the true text of x. 11 the high priest is not mentioned, and in vii. 27 what is asserted of the high priest is, not that he offered daily sacrifice, but that he was in daily need of atonement. It is more difficult to understand why in ix. 4 the golden *θυμιατήριον*, that is, the censer or incense-altar,—for the usage of the word does not determine which is meant,—is assigned to the Holy of Holies. But a passage from the almost contemporary *Apocalypse of Baruch*, to which Harnack has directed attention (*Stud. u. Krit.*, 1876, p. 572 *seq.*), similarly connects the censer with the Holy of Holies, and seems to show that our author here proceeds on a current opinion and has not simply made a slip.[2] Apart from Wieseler's arguments, there is still something to be said for Alexandria. The use in ch. xi. of 2 Maccabees, an Egyptian Apocryphon,[3] the general sympathy of the argument with Alexandrian thought, the apparent analogy between our Hebrews and the free-thinking Jews of whom Philo speaks, are all in favor of this address, though we do not know enough about the early history of the Egyptian Church to speak with positiveness either for or against this view of the epistle. Among Continental scholars the disposition at present is to favor the Roman address; upon which view, since that church was a mixed one, we must suppose that the letter was originally directed to a Jewish section of the Roman Christians. This is not quite plausible, especially since we find in the epistle no trace of the division of parties alluded to by Paul in his epistle from Rome to the Philippians. It is argued, however, that there is an analogy between the way of thinking of our Hebrews and the disposition of the majority of the Roman Church as it appears in Rom. ix. *seq.* The persecution x. 32 is supposed to be that of Nero, in which case *θεατριζόμενοι* may literally mean "exposed as a public spectacle;" and xiii. 7 is taken as an allusion to the martyrdom of Peter and Paul. In working out this view there is great divergence of opinion; thus Renan will have it that the epistle was written from Ephesus in the year 65, while Harnack (*Patr. Ap.*, I. p. lxxxii.) thinks he finds traces of two distinct persecutions (?), and dates the book from the time of Domitian. The early currency of the epistle at Rome is urged in favor of the Roman address, but the ignorance of the Roman Church as to the author's name seems to go rather in the opposite direction. Ch. xiii. 24 gives us no help, for they of Italy (*οἱ ἀπὸ τῆς Ἰταλίας*) may in the epistolary style be Italians either at home or abroad. It is most natural to infer from x. 32 *seq.*, compared with xii. 4, that the church spoken of had not yet produced martyrs, but had suffered only by bonds and the loss of goods. This would exclude Rome, but perhaps the inference is not quite stringent.

Returning from this survey we bring little with us that can throw light on the authorship of the epistle. We can only say that the writer was a man of the first intellectual mark and of Alexandrian culture, whose home and work lay mainly among Jewish Christians, but who was at the same time associated with the Pauline circle. Of the names offered to us in other New Testament writings, Barnabas and Apollos seem the most likely, and Barnabas will claim the preference if we are entitled to give any weight to tradition. Either name would go well with the Alexandrian address. Apollos was an Alexandrian Jew. Barnabas was of Cyprus, always closely connected with Egypt; and the tradition which connects his relative and associate Mark with the church of Alexandria is as old as the 2d century.

Literature.—A full account of the older literature will be found in Delitzsch's *Commentary;* and in the great work of Bleek (*Der Brief an die Hebräer erläutert durch Einleitung, Uebersetzung, und fortlaufenden Commentar:* Abth. I., *Versuch einer vollstämdigen Einleitung*, Berlin, 1828; Abth. II., *Uebersetzung und Commentar*, 1836, 1840), which has formed the basis for all subsequent work on the epistle, and is an indispensable storehouse of material for the student. Bleek's ultimate views on the exposition of the book may be gathered from the briefer posthumous work edited by Windrath (Elberfeld, 1868). To the recent commentaries cited in the course of the article may be added those of Ebrard (1850; Eng. Trans., Edinburgh, 1853), Tholuck (3d ed. 1850; Eng. Trans., Edinburgh, 1842), Lünemann (3d ed., Göttingen, 1867). For the doctrine of the epistle the most elaborate work is Riehm's very useful *Lehrbegriff*

[1] *Das Sendschreiben an die Hebräer und Jakobos' Rundschreiben, übersetzt und erklärt von H. Ewald*, Gött., 1870.

[2] The Syriac word in Baruch is Pirmâ. To the passages cited by Harnack to establish for this word the sense of censer, not incense altar, may be added Bar Ali ed. Hoffmann, No. 2578; Barhebr., *Chron. Eccl.*, p. 507; Ezek. viii. 11 (Pesh. and Syr. Hex.).

[3] Professor Plumptre, in the *Expositor*, vol. i., has also traced analogies with the book of Wisdom.

des Hebräerbriefs, Ludwigsburg, 1858–59; with which, in addition to the general works on New Testament theology by Weiss, Reuss, and others, the reader may compare Ritschl's *Entstehung der Altkatholischen Kirche*, 2d ed., p. 159 *seq.* (Bonn, 1857), and Pfleiderer's *Paulinismus*, chap. ix. (Leipsic, 1873). An excellent summary of the present state of the critical questions bearing on the epistle is given by Zahn in the article "Hebräerbrief" in the new edition of Herzog's *Encyklopädie*. (W. R. S.)

HEBRIDES, The, or Western Isles of Scotland, is a name sometimes applied collectively to all the islands on the west coast of Scotland, but seldom including Bute, Arran, and the other islands situated in the Firth of Clyde. The group is usually divided into the Outer Hebrides, or Long Island, and the Inner Hebrides. The former division embraces the Lewis, Harris, North and South Uist, Benbecula, Barra, and a number of small islands, the whole length of this group from Barra-Head to the Butt of Lewis being about 130 miles. The Inner Hebrides include Islay, Skye, Mull, Jura, Coll, Colonsay, Rum, Eigg, Tiree, Lismore, and Ulva. The number of inhabited islands is over 100, and the population is nearly 100,000. The principal islands are noticed under separate headings. The outer range consists almost exclusively of gneiss rocks, with poor soil and large proportions of peat and moor. The inner range is composed chiefly of trap and slate. The scenery of the islands may be generally described as partaking of the wild and sublime. Large masses of mountains of all forms tower up in the interior; and the coasts, indented by arms of the sea, are rugged and varied in outline. Spots of great beauty—green pastoral glens, sheltered bays and lakes—are interspersed with the wildest scenes. The climate, though mild, is humid and unsuitable for corn crops. Only a very small portion of the surface is arable, the greater part being mountains, and the valleys intersecting them narrow and frequently covered with peat moss. Much of the land has, however, been converted into sheep walks, and the moors and desolate tracts are often let at high rents to sportsmen. The development of the prosperity of the islands has been greatly aided by the construction of excellent roads, and by the establishment of various lines of steamers in connection with Glasgow, thus rendering the fine and in some respects unique scenery fully and easily accessible to tourists. One of the principal sources of wealth is that of the fisheries, Stornoway in the island of Lewis being the headquarters of that industry on the western coast.

The Hebrides are mentioned by Ptolemy under the name of Ἐβουδα, and by Pliny under that of *Hebudes*, the modern spelling having, it is said, originated in an accidental misprint. By the Norwegians they were called *Sudreyjar* or Southern Islands. The Latinized form was Sodorenses, preserved to modern times in the title of the bishop of Sodor and Man. The original inhabitants of the Hebrides seem to have been of the same Celtic race as those settled on the mainland—the Scoto-Irish whom Columba about the middle of the 6th century converted to Christianity. Scandinavian hordes then poured in with their northern idolatry and lust of plunder, but in time they adopted the language and faith of the islanders. Mention is made of incursions of the vikings on their shores as early as 793, but the principal emigration took place towards the end of the 9th century in the early part of the reign of Harold Haarfager, and consisted of persons driven thither, as well as to Orkney and Shetland, to escape from his tyrannous rule. Soon afterwards they began to make incursions against their mother-country, and on this account King Harold fitted out an expedition against them, and placed Orkney, Shetland, the Hebrides, and the Isle of Man under Norwegian government. The chief seat of the Norwegian sovereignty was Colonsay. About the year 1095 Godred Crovan, king of Dublin, of Man, and of the Hebrides, died in Islay. His third son, Olaus or Olave, succeeded to the government about 1103, and the daughter of Olaus was married to Somerled or Sorlet of Argyle, who became the founder of the dynasty known as Lords of the Isles. Many efforts were made by the Scottish monarchs to displace the Norwegians. Alexander II. led a fleet and army to the shores of Argyllshire in 1249, but he died in the island of Kerrera. On the other hand King Haco, at once to restrain the independence of his jarls and to keep in check the ambition of the Scottish kings, set sail in 1263 on a great expedition, which, however, ended disastrously. Magnus, son of Haco, concluded in 1266 a peace with the Scots, renouncing all claim to the Hebrides and other islands except Orkney and Shetland, and King Alexander agreed to give him a sum of 4000 merks in four yearly payments. It was also stipulated that Margaret, daughter of Alexander, should be betrothed to Eric, the son of Magnus, a connection long remembered and lamented in Scottish song and story.

The race of Somerled continued to rule the islands, and from a younger son of the same potentate sprang the lords of Lorn, who took the patronymic of Macdougall. John Macdonald of Isle of Islay, who died about 1386, was the first to adopt the title of "Lord of the Isles." He was one of the most potent of the island princes, and was married to a daughter of the Earl of Strathern, steward of Scotland. His son, Donald of the Isles, was memorable for his rebellion in support of his claim to the earldom of Ross, in which, however, he was unsuccessful. Alexander, son of Donald, resumed the hereditary warfare against the Scottish crown; and in 1462 a treaty was concluded between Alexander's son and successor John and King Edward IV. of England, by which John, his son Donald Balloch, and his grandson John, became bound to assist King Edward and James, earl of Douglas, in subduing the kingdom of Scotland. The alliance seems to have led to no active operations, and the island king was adjudged to be a traitor to his liege sovereign of Scotland. In the reign of James V. another John of Islay resumed the title of "Lord of the Isles," but was compelled to surrender the dignity. The glory of the lordship of the isles—the insular sovereignty—had departed. From the time of Bruce the Campbells had been gaining the ascendency in Argyll. The Macleans, Macnaughtons, Maclachlans, Lamonts, and other ancient races had sunk before this favorite family. The lordship of Lorn was wrested from the Macdougalls by Bruce, and their extensive possessions, with Dunstaffnage Castle, bestowed on the king's relative, Stewart, and his descendants, afterwards lords of Lorn. The Macdonalds of Sleat, the direct representatives of Somerled, though driven from Islay and deprived of supreme power by James V., still kept a sort of insular state in Skye. There were also the Macdonalds of Clanranald and Glengarry (descendants of Somerled), with the powerful houses of Macleod of Dunvegan and Macleod of Harris, M'Neill of Barra and Maclean of Mull. Fierce sanguinary feuds continued throughout the 16th and 17th centuries among these rival clans and their dependent tribes, and the turbulent spirit was not subdued till a comparatively recent period. James VI. made an abortive endeavor to colonize Lewis. William III. and Queen Anne attempted to subsidize the chiefs in order to preserve tranquillity, but the wars of Montrose and Dundee, and the Jacobite insurrections of 1715 and 1745, showed how futile were all such efforts. It was not till 1748, when a decisive blow was struck at the power of the chiefs by the abolition of heritable jurisdictions, and the appointment of sheriffs in the different districts, that the arts of peace and social improvement made way in these remote regions.

The change was great, and at first not unmixed with evil. A new system of management and high rents were imposed, in consequence of which numbers of the tacksmen, or large tenants, emigrated to America. The exodus continued for many years. Sheep-farming on a large scale was next introduced, and the crofters were thrust into villages or barren corners of the land. The consequence was that, despite the numbers who entered the army or emigrated to Canada, the standard of civilization sank lower, and the population multiplied in the islands. The people came to subsist almost entirely on potatoes and herrings; and in 1846, when the potato blight commenced its ravages, a scene of nearly universal destitution ensued—embracing, over the islands generally, 70 per cent. of the population. Temporary relief was administered in the shape of employment on roads and other works; and an emigration fund being raised, from 4000 to 5000 of the people in the most crowded districts were removed to Australia.

The principal books on the Hebrides are Martin's *Description of the Western Islands of Scotland*, 1703; Pennant's *Tour in Scotland and Voyage to the Hebrides*, 1774; Sir Joseph Banks's *Contributions to Pennant's Tour*; Boswell's *Tour to the Hebrides with Samuel Johnson, LL.D.*; Macculloch's *Geological Account of the Hebrides*, 1819; Hugh Miller's *Cruise of the Betsy*; W. A. Smith's *Lewisiana, or Life in the Outer Hebrides*, 1874. Their history under Norwegian rule is given in the *Chronica Regum Manniæ et Insularum*, edited, with learned notes, from the MS. in the British Museum by Professor P. A. Münch of Christiania, 1860.

HEBRON, the most southern of the three cities of refuge west of Jordan (Josh. xx. 7), built "seven years before Zoan (Tanis) in Egypt" (Num. xiii. 22). Tanis, according to Brugsch, was standing at least 2400 years B. C. Hebron was originally called Mamre and Kirjath Arba, after Arba, one of the Anakim (Josh. xiv. 15). It is frequently mentioned in the Old Testament (Gen. xiii. 18 and xxiii. 19; 2 Sam. iii. 20 and v. 5). The present town encloses the *Haram* or sanctuary built over the supposed site of Machpelah; but if this site be (as seems probable) genuine, the ancient Hebron must have faced the cave, as is remarked by many ancient writers (Gen. xxiii. 17). The name Machpelah signifies "place of division," and the cave was therefore called as

early as the 6th century *Spelunca Duplex*. In the 12th century an iron door (still visible) is mentioned as leading from the Haram wall to the cavern. In 1167 A. D. Hebron became the see of a Latin bishop, and it was taken in 1187 by Saladin. In 1834 it joined the rebellion against Ibrahim Pasha, who took the town and pillaged it. Modern Hebron rises on the east slope of a shallow valley—a long narrow town of stone houses, the flat roofs having small stone domes. The main quarter is about 700 yards long, and two smaller groups of houses exist north and south of this. The hill behind is terraced and luxuriant vineyards surround the place, which is well watered on the north by three principal springs, including the Well Sirah, now *'Ain Sârah* (2 Sam. iii. 26). Three conspicuous minarets rise, two from the Haram, the other in the north quarter. The population includes 17,000 Moslems and 600 Jews. The Bedawin bring wool and camel's hair to the market; and glass bracelets, lamps, and leather water-skins are manufactured in the town. The modern name of Hebron is *El Khalîl*, "the friend," in allusion to Abraham the friend of God. The most conspicuous building is the *Haram*, an enclosure measuring 112 feet east and west by 198 north and south, surrounded with high rampart walls of masonry similar in size and dressing to that of the Jerusalem Haram walls. These ramparts are ascribed by architectural authorities to the Herodian period. The interior area is partly occupied by a 12th century Gothic church, and contains six modern cenotaphs of Abraham, Isaac, Jacob, Sarah, Rebecca, and Leah. The cave beneath the platform has probably not been entered for at least 600 years. The numerous traditional sites now shown round Hebron are traceable generally to mediæval legendary topography, including the tombs of Adam, Esau, Judah, Abner, and Jesse, the Field of Damascus, the Vale of Tears, and the Oak of Mamre ("plain" in A. V., Gen. xiii. 18), which has at various times been shown in different positions from ¾ mile to 2 miles from the town.

HECATÆUS, son of Hegesander, was sprung from an ancient and noble family of Miletus. His life seems to fall between the years 550 and 475 B. C. His earlier years were spent in travelling. He lived some time in Egypt (Herod., ii. 143); he was well acquainted with the resources and power of the Persian empire (Herod., v. 34); and the extant fragments of his writings seem to imply personal acquaintance with Libya, Spain, and Italy, as well as with the countries bordering on the Ægean and Euxine seas. After middle life he seems to have settled in Miletus, where he occupied a position of great honor, and to have devoted his time to the composition of geographical and historical works. When Aristagoras held a council of the leading Ionians at Miletus, to organize a revolt against the Persian rule, Hecatæus tried to dissuade his countrymen from the undertaking. Being overruled, he then advised them to equip a strong fleet, using for the emergency the treasures of the temple at Branchidæ, which might be repaid after the war. But both then and at a later period of the war (Herod., v. 124) his skilful and prudent advice was given in vain. When the remainder of the revolted Ionians sued for terms, he was one of the ambassadors sent to the Persian satrap Artaphernes. He wrote a work on geography entitled Περίπλους or Περιήγησις τῆς Γῆς, in which he went over the countries of the known world, told their inhabitants, enumerated the towns, and described their situation and history. He improved the map of the world which Anaximander had made. He also wrote a work called Γενεαλογίαι or Ἱστορίαι, describing systematically the traditions and mythology of the Greeks. According to Arrian, he was the first to employ critical method to distinguish myth from historical fact; though he accepts Homer and the other poets as trustworthy authority. Herodotus, though obviously regarding him with respect, often controverts his statements.

HECATÆUS, of Abdera, sometimes confounded with Hecatæus of Miletus, was a Greek historian and philosopher of the 4th century B. C. He was a disciple of Pyrrho and a contemporary of Alexander the Great and Ptolemy Sotor. He accompanied the latter in an expedition to Syria, and during the reign of the same prince sailed up the Nile as far as Thebes. Some fragments of works by him on Egypt and on the Hyperboreans still exist. According to Suidas, he also wrote a treatise on the poetry of Hesiod and Homer. Regarding his authorship of a work on the Jews, of which some fragments remain, there is some disagreement among critics, but in all probability he is not the author of it.

The *Hecatæi Abderitæ Fragmenta* were collected by P. Zorn, and published at Altona in 1730. See C. Müller, *Histor. Græcor. frag.*, and Vossius, *De Historicis Græcis*.

HECATE, a Greek goddess who is never mentioned in Homer, but is of great importance in other parts of the literature as well as in religious observance. The name Hecatos, the masculine corresponding form, is a frequent epithet of Apollo; and though the word ἑκάτη is never used exactly as an epithet of Artemis, yet this suggests a close relationship between the two goddesses, which an examination of their functions fully confirms. Their character and attributes stamp both as moon-goddesses. In fact, though often distinguished from Artemis, yet at other times Hecate is identified with her. The worship of Hecate seems to have flourished especially among the wilder tribes of Greek nationality, in Samothrace, Thessaly, and elsewhere; she has, however, been received into the Pantheon of the more civilized Greek races, probably on account of her close resemblance to Artemis; and this is doubtless the meaning of Hesiod's statement (*Theog.*, 423) that she alone of all the Titanic powers was left undisturbed in her honors by Zeus. The parentage of Hecate is variously given. Hesiod names her father Perses (a word connected with Perseus, Persephone, etc., all of which denote powers of light) and her mother Asteria, the starry sky of night. Zeus and Demeter, Zeus and Hera, etc., are also named as her parents. Her chief prerogatives or functions are the following.

(1) She is the chief goddess who presides over magic arts and spells, for all incantations naturally were performed by the light of the moon. Medea is in this respect closely associated with her worship. See her prayer in Sophocles, *Rhizot. fr.* In Theocr., *Id.* ii., where a woman's incantation to bring back her faithless lover is given, Hecate is constantly invoked. (2) She is a Chthonian power, and is worshipped at the Samothracian mysteries. She is then closely connected with Demeter. Alone of the gods besides Helios, she witnessed the abduction of Persephone, and, torch in hand (a natural symbol for the moon's light), she assisted Demeter in the search for her daughter (*Hym. Dem.*, 45 *ff.*). She is obviously a by-form of Persephone, who as queen of the lower world is also the moon, the bride of the sun, when at setting he has gone to the lower world. She rules as a terrible power, Krataïs, among the shades (*Orph.*, 48, etc.). (3) As δᾳδοῦχος, φωσφόρος, ὑπολάμπτειρα, she lights wanderers on their way by night, and is therefore, along with Hermes, worshipped as patron of roads under the name ἐνοδία. At cross-roads she was the director, hence her name τριοδῖτις, and probably also τρίμορφος, τριπρόσωπος, etc. Pillars called Hecatæa, like the Hermæ, stood, especially in Athens, at cross-roads and door-ways. (4) She is the goddess of fertility, and, like Artemis, presides especially over the birth and the youth of wild animals. As the moon measures the months, the moon-goddess in all forms, as Artemis, Helena, etc., presides over birth. (5) It follows easily from the last that she should be the goddess who gives wealth and power. Thus she is celebrated by Hesiod (*l.c.*). On the Acropolis at Athens Hecate Epipyrgidia, as protectress of the citadel, had a shrine beside the temple of Victory. To Hecate dogs were offered, also honey and black she-lambs, as black victims were offered to other Chthonian deities. She was represented generally as a triple form, holding in the six hands torches, with sometimes a snake, a key, a whip, or a dagger, often with dogs standing beside her. The three heads support a basket, "kalathos," such as often adorns the statues of Artemis and Hera. The Hecatæa also generally represent her with three heads; occasionally, however, a single-formed Hecate is found, still with torch or key in hand, and sometimes with crescent moon on head.

HECKMONDWYKE, a town of England, in the West Riding of Yorkshire, on the Huddersfield and Bradford Railway, 2 miles N. W. of Dewsbury and 10 miles S. W. of Leeds. It occupies a gradually sloping site, and is somewhat irregularly built, although latterly it has assumed a more town-like appearance. It possesses a church dedicated to St. James erected in 1831, a market-house erected in 1868, a working men's club established in 1868, a mechanics' institute founded in 1873, a chamber of commerce dating from the same year, and a literary institute established in 1878. There are three board schools, a national school, and a Roman Catholic school, the whole affording accommodation for 1600 scholars. Much has been done for the improvement of the town by draining, and under the provisions of the Dewsbury and Heckmondwicke Waterworks Act of 1876

an ample supply of water has been obtained for domestic and manufacturing purposes. A cemetery with chapels for churchmen and dissenters was formed in 1860. The chief manufacture is blankets, and there are also carpet factories, machine shops, dye works, and iron foundries. Coal is extensively wrought in the vicinity. The town is under the government of a local board of health established in 1853. The area of the township is about 700 acres. The population of the town, which in 1801 was only 1742, had in 1871 reached 8300, and in 1901, 9,459.

HECLA. See ICELAND.

HECTOR, son of Priam and Hecuba, the champion of the Trojans and the mainstay of their city. Like Paris and other Trojans, he had an Oriental name, Darius, as well as a Greek one, an interesting fact on which many fanciful theories have been founded. He was married to Andromache, daughter of Eetion, king in the Cilician Thebe. By Homer his character is drawn in most favorable colors as a good son, a loving husband and father, and a trusty friend,—religious without superstition, tenderhearted yet courageous. The one blemish apparent in some parts of the *Iliad* (see Geddes's *Homeric Problem*) is a tendency to presumptuous and boastful confidence. He is an especial favorite of Apollo; and later poets even describe him as a son of that god. When Achilles, enraged with Agamemnon, deserted the Greeks, Hector drove them back to their ships, which he almost succeeded in burning. Patroclus, the friend of Achilles, who came to the help of the Greeks, was slain by Hector with the help of Apollo. Then Achilles, to revenge his friend's death, returned to the war, slew Hector, dragged his body behind his chariot to the camp, and afterwards dragged it round the tomb of Patroclus. Priam, guarded by Hermes, went to Achilles and prevailed on him to give back the dead body, which was buried with great honor (*Il.*, xxiv.). Hector was worshipped in the Troad by the Bœotian tribe Gephyræi; and he is, like other heroes, probably an ancient god. It would require an inquiry into the whole Trojan legend to determine the conception involved: it is impossible to do more in this place than refer to Ruckert's essay in this direction.

Scenes from the life of Hector are favorite subjects in vase paintings. A very ancient pinax from Camirus represents his fight with Menelaus over the dead Euphorbus; and on an amphora, also from Camirus, of not later date than 450 B.C., he is represented starting for battle, standing beside the quadriga into which his charioteer Cebriones has already mounted. Both vases are now in the British Museum. Though many of the subjects in which he was supposed to appear have now been assigned to other heroes,—for example, the frequently occurring Parting of Hector and Andromache is by a more searching criticism generally transformed into a scene from the life of Amphiaraus,—yet many undoubted examples remain. We find such scenes as the parting cup given by Hecuba to her son as he departs to the battle, his battle with Achilles in presence of Apollo and Athene, or the dragging of his corpse round the tomb of Patroclus.

HECUBA (the Latin form of the Greek *Hekabe*), wife of Priam, is in Homer daughter of the Phrygian king Dymas, who dwelt on the bank of the Sangarius; but according to Euripides, Virgil, etc., her father was named Cisseus. According to Homer she was mother of nineteen of Priam's fifty sons. When Troy was captured and Priam slain, she was made prisoner by the Greeks. Her fate is told in various ways, most of which connect her with the promontory Cynossema, on the Thracian shore of the Hellespont. According to Euripides (*Hekabe*), her youngest son Polydorus was placed during the siege under the care of Polymestor, king of Thrace. When the Greeks came to the Thracian Chersonese on their way home Hecuba discovered that her son Polydorus had been murdered, and in revenge she contrived to put out the eyes of Polymestor and murder his two sons. She was acquitted by Agamemnon; but, as Polymestor foretold, she was turned into a dog, and her grave became a mark for ships. Other tales about her may be found in Ovid (*Met.*, xiii. 423 *ff.*) and Dictys. It is obvious from the tales of Hecuba's transformation and death that she is a form of some goddess to whom dogs were sacred; and the analogy with Scylla is striking.

HEDA, WILLEM CLAASZ, Dutch painter, born at Haarlem it is said in 1594, and still living there in 1668, was one of the earliest Dutchmen who devoted himself exclusively to the painting of still life. He was the contemporary and comrade of Dirk Hals, with whom he had in common pictorial touch and technical execution. But Heda was more careful and finished than Hals, and showed considerable skill and not a little taste in arranging and coloring chased cups and beakers and tankards of precious and inferior metals. Nothing is so appetizing as his "luncheon," with rare comestibles set out upon rich plate, oysters,—seldom without the cut lemon,—bread, champagne, olives, and pastry. Even the commoner "refection" is also not without charm, as it comprises a cut ham, bread, walnuts, and beer. One of Heda's early masterpieces, dated 1623, in the Munich Pinakothek is as homely as a later one of 1651 in the Lichtenstein Gallery at Vienna. A more luxurious repast is a Luncheon in the Augsburg Gallery, dated 1644. Most of Heda's pictures are on the Continent, notably in the galleries of Paris, Parma, Ghent, Darmstadt, Gotha, Munich, and Vienna. He was a man of repute in his native city, and filled all the offices of dignity and trust in the guild of Haarlem. He seems to have had considerable influence in forming the younger Frans Hals.

HEDGEHOG (*Erinaceus europæus*, Linn.), the Common Urchin of Pennant, *Hérisson* of the French, *Riccio* of the Italians, *Igel* of the Germans, is the best known, and from an anatomical point of view perhaps the most characteristic, of the *Insectivora*. The genus is remarkable for its dentition, its armature of spines, and its short tail, while the ordinary species is characterized by not having the spines longer than the head or the ears more than half that length. The upper jaw is longer than the lower one, and the whole snout, which is long and flexible, has somewhat the appearance of that of the hog; the nostrils are narrow; and the claws are long but weak. The animal is about 10 inches long, its eyes are small, and the integument of the ventral surface is covered with hairs of the ordinary character. The brain is remarkable for its low degree of development, the cerebral hemispheres being excessively small, and marked with but one groove, and that a shallow one, on each side, while the more special characters of this region call to mind the organization of the same parts in the very lowest of mammals.

The most remarkable point in its external appearance is the possession of spines, and the power possessed by it of rolling itself up into a ball, from which these spines stand out in every direction. The spines, which are modified hairs, are sharp, hard, and elastic, and form so efficient a defence that there are but few animals that are able, and even they rarely, to effect a successful attack on this curious creature. The moment it is touched, or even hears the sound of so slight a menace as the report of a gun, it rolls itself up by the action of the powerful muscles which lie just beneath the skin, while this same contraction effects the erection of the spines. The most important muscle is the *orbicularis panniculi*, which extends over the anterior region of the skull, as far down the body as the ventral or purely hairy region, and on to the tail; three other muscles are connected with this, and aid in the contraction of the integument, passing as they do from the breast-bone to the face and lower jaw, from the fore-arm to the sides of the ventral region, and from the fore-arm to the dorsal surface.

Hedgehog.

Though insectivorous, the hedgehog is reported to have a great liking for mice, while frogs and toads, as well as

plants and fruits, all seem to be acceptable; its ingestion of snakes has been detailed by Buckland and Broderip, and its fondness for eggs has caused it to meet with the enmity of game-preservers. Pennant reports that "it lies under the undeserved reproach of sucking cattle, and hurting their udders, but the smallness of its mouth renders that impossible," nor does it seem that any well-authenticated report of such an occurrence has ever been made. It makes a not rare domestic pet. In a state of nature it does not emerge from its retreat during full daylight, unless urged out by hunger or by the necessities of its young. During the cold of winter it passes into a state of complete hibernation, and its temperature falls very considerably; having provided itself with a nest of dry leaves, it is well protected from the influences of the rain, and rolling itself up it remains undisturbed till distinctly warmer weather returns. In July or August the female brings forth four to eight young, or, according to others (Bell), two to four at a somewhat earlier period; at birth the spines, which in the adult are black in the middle, are white and soft, but soon harden, though they do not attain their full size until the succeeding spring. It is commonly found in woods and gardens, and extends over nearly the whole of Europe; it has been found at 6000 to 8000 feet above the level of the sea. The witch in *Macbeth* who heard the "hedge-pig" *whine* thrice and once gave not an incorrect account of the character of its voice, rarely as this is heard. The adult is provided with thirty-six, and the young with twenty-four teeth; in both cases canines appear to be absent; the median incisors are very long, and project; there are two more false grinders in the upper than in the lower jaw, while the true molars of the upper jaw are remarkable for the presence of four cusps, of which the anterior inner and the posterior outer are connected by an obliquely-set ridge. This is the same arrangement as is seen in man. In the lower jaw the corresponding teeth are, as in the lemurs (or half-apes), provided with two transverse ridges.

Sixteen species of the genus have been recognized by some zoologists. The tenrec (*Centetes*) of Madagascar has very many points in common with it.

HEDGE-SPARROW. See SPARROW.

HEEM, JAN DAVIDSZ VAN (or JOHANNES DE), was born according to Houbraken and Sandrart in 1604, according to Descamps in 1600, at Utrecht, and died at Antwerp in 1683 or 1684. Thoré has said of Heda, but it is only true of De Heem, that "he glorified insects, butterflies, and all the minute beings that swarm in vegetation, and made the moth drink in cups of chased gold." He was, if not the first, certainly the greatest painter of still life in Holland; no artist of his class combined more successfully perfect reality of form and color with brilliancy and harmony of tints. No object of stone or silver, no flower humble or gorgeous, no fruit of Europe or the tropics, no twig or leaf, with which he was not familiar. Sometimes he merely represented a festoon or a nosegay. More frequently he worked with a purpose to point a moral or illustrate a motto. Here the snake lies coiled under the grass, there a skull rests on blooming plants. Gold and silver tankards or cups suggest the vanity of earthly possessions; salvation is allegorized in a chalice amidst blossoms, death as a crucifix inside a wreath. Sometimes De Heem painted alone, sometimes in company with men of his school, Madonnas or portraits surrounded by festoons of fruit or flowers. At one time he signed his initials, at others with Johannes, at others again with the name of his father joined to his own. At rare intervals he condescended to a date, and when he did the work was certainly of the best. De Heem entered the guild of Antwerp in 1635–6, and became a burgher of that city in 1637. He steadily maintained his residence till 1667, when he moved to Utrecht, where traces of his presence are preserved in records of 1668, 1669, and 1670. It is not known when he finally returned to Antwerp, but his death is recorded in the guild books of that place. A very early picture, dated 1628, in the gallery of Gotha, bearing the signature of Johannes in full, shows that De Heem at that time was familiar with the technical habits of execution peculiar to the youth of Albert Cuyp. In later years he completely shook off dependence, and appears in all the vigor of his own originality.

Out of 100 pictures or more to be met with in European galleries scarcely eighteen are dated. The earliest after that of Gotha is a chased tankard, with a bottle, a silver cup, and a lemon on a marble table, dated 1640, in the museum of Amsterdam. A similar work of 1645, with the addition of fruit and flowers and a distant landscape, is in Lord Radnor's collection at Longford. A chalice in a wreath, with the radiant host amidst wheatsheaves, grapes, and flowers, is a masterpiece of 1648 in the Belvedere of Vienna. A wreath round a Madonna of life size, dated 1650, in the museum of Berlin, shows that De Heem could paint brightly and harmoniously on a large scale. In the Pinakothek at Munich is the celebrated composition of 1653, in which creepers, beautifully commingled with gourds and blackberries, twigs of orange, myrtle, and peach, are enlivened by butterflies, moths, and beetles. A landscape with a blooming rose tree, a jug of strawberries, a selection of fruit, and a marble bust of Pan, dated 1655, is in the Hermitage at St. Petersburg; an allegory of abundance in a medallion wreathed with fruits and flowers, in the gallery of Brussels, is inscribed with De Heem's monogram, the date of 1668, and the name of an obscure artist called Lambrechts. All these pieces exhibit the master in full possession of his artistic faculties.

CORNELIUS DE HEEM, the son of Johannes, was in practice as a flower painter at Utrecht in 1658, and was still active in his profession in 1671 at the Hague. His pictures are not equal to those of his sire, but they are all well authenticated, and most of them in the galleries of the Hague, Dresden, Cassel, Vienna, and Berlin. In the Staodel at Frankfort is a fruit piece, with pot-herbs and a porcelain jug, dated 1658; another, dated 1671, is in the museum of Brussels. DAVID DE HEEM, another member of the family, entered the guild of Utrecht in 1668 and that of Antwerp in 1693. The best piece assigned to him is a table with a lobster, fruit, and glasses, in the gallery of Amsterdam; others bear his signature in the museums of Florence, St. Petersburg, and Brunswick. It is well to guard against the fallacy that David de Heem above mentioned is the father of Jan de Heem. We should also be careful not to make two persons of the artist who sometimes signs Johannes, sometimes Jan Davidsz or J. D. Heem.

HEEMSKERK, JOHAN VAN (1597–1656), Dutch poet, was born at Amsterdam in 1597. He was educated as a child at Bayonne, and entered the university of Leyden in 1617. In 1621 he went abroad on the grand tour, leaving behind him his first volume of poems, *Minnekunst* (The Art of Love), which appeared in 1622. He was absent from Holland four years. He was made master of arts at Bourges in 1623, and in 1624 visited Hugo Grotius in Paris. On his return in 1625 he published *Minnepligt* (The Duty of Love), and began to practise as an advocate in the Hague. In 1628 he was sent to England in his legal capacity by the Dutch East India Company, to settle the dispute respecting Amboyna. In the same year he published the poem entitled *Minnekunde*, or the Science of Love. He proceeded to Amsterdam in 1640, where he married Alida, sister of the eminent statesman Van Beuningen. In 1642 he published *The Cid*, a tragi-comedy, and in 1647 his most famous work, the pastoral romance of *Batavische Arcadia*, which he had written ten years before. During the last twelve years of his life Heemskerk sat in the upper chamber of the states-general. His last poetical work was *The Inconstant Hylas*. He died at Amsterdam on the 27th of February, 1656.

The poetry of Heemskerk, which fell into oblivion during the 18th century, is now once more read and valued. He takes a prominent place among writers of the second rank in the great age of Dutch literature. But his famous pastoral, the *Batavian Arcadia*, which was founded on the *Astrée* of Honoré d'Urfé, enjoyed a great popularity for more than a century, and passed through twelve editions. It provoked a host of more or less able imitations, of which the most distinguished were the *Doortsche Arcadia* (1662) of Lambertus Bos, the *Zaanlandsche Arcadia* (1658) of Hendrik Zooteboom, and the *Rotterdamsche Arcadia* (1703) of Willem den Elger. But the original work of Heemskerk, in which a party of nymphs and shepherds go out from the Hague to Katwijk, and there indulge in polite and pastoral discourse, surpasses all these in brightness and vorsatility.

HEEMSKERK, MARTIN JACOBSZ (1498–1574), sometimes called Van Veen, was born at Heemskerk in Holland in 1498, and apprenticed by his father, a small farmer, to Cornelisz Willemsz, a painter at Haarlem. Recalled after a time to the paternal homestead and put to the plough or the milking of cows, young Heemskerk took the first opportunity that offered to run away, and demonstrated his wish to leave home for ever by walking in a single day the 50 miles which separate his native hamlet from the town of Delft. There he studied under a local master whom he soon deserted for John Schoreel of Haarlem. At Haarlem he formed what is known as his first manner, which is but a quaint and *gauche* imitation of the florid

style brought from Italy by Mabuse and others. He then started on a wandering tour, during which he visited the whole of northern and central Italy, stopping at Rome, where he had letters for a cardinal. It is evidence of the facility with which he acquired the rapid execution of a scene-painter that he was selected to co-operate with Antonio da San Gallo, Battista Franco, and Francesco Salviati to decorate the triumphal arches erected at Rome in April, 1536, in honor of Charles V. Vasari, who saw the battle-pieces which Heemskerk then produced, says they were well composed and boldly executed. On his return to the Netherlands he settled at Haarlem, where he soon (1540) became president of his guild, married twice, and secured a large and lucrative practice. In 1572 he left Haarlem for Amsterdam, to avoid the siege which the Spaniards laid to the place, and there he made a will which has been preserved, and shows that he had lived long enough and prosperously enough to make a fortune. At his death, which took place on the 1st of October, 1574, he left money and land in trust to the orphanage of Haarlem, with interest to be paid yearly to any couple which should be willing to perform the marriage ceremony on the slab of his tomb in the cathedral of Haarlem. It was a superstition which still exists in Catholic Holland that a marriage so celebrated would secure the peace of the dead within the tomb.

The works of Heemskerk are still very numerous, but by no means in the same demand as they were in the master's own time. Adam and Eve, and St. Luke painting the Likeness of the Virgin and Child, in presence of a poet crowned with ivy leaves, and a parrot in a cage—an altar-piece in the gallery of Haarlem, and the Ecce Homo in the museum of Ghent, are characteristic works of the period preceding Heemskerk's visit to Italy. An altar-piece executed for St. Laurence of Alkmaar in 1538–41, and composed of at least a dozen large panels, would, if preserved, have given us a clue to his style after his return from the south. In its absence we have a Crucifixion executed for the Riches Claires at Ghent (now in the Ghent Museum) in 1543, and the altar-piece of the Drapers' Company at Haarlem, now in the gallery of the Hague, and finished in 1546. In these we observe that Heemskerk studied and repeated the forms which he had seen at Rome in the works of Michelangelo and Raphael, and in Lombardy in the frescos of Mantegna and Giulio Romano. But he never forgot the while his Dutch origin or the models first presented to him by Schorecl and Mabuse. As late as 1551 his memory still served him to produce a copy from Raphael's Madonna di Loretto (gallery of Haarlem). A Judgment of Momus, dated 1561, in the Berlin Museum, proves him to have been well acquainted with anatomy, but incapable of selection and insensible of grace, bold of hand and prone to daring though tawdry contrasts of color, and fond of florid architecture. Two altar-pieces which he finished for churches at Delft in 1551 and 1559, one complete, the other a fragment, in the museum of Haarlem, a third of 1551 in the Brussels Museum, representing Golgotha, the Crucifixion, the Flight into Egypt, Christ on the Mount, and scenes from the lives of St. Bernard and St. Benedict, are all fairly representative of his style. Besides these we have the Crucifixion in the Hermitage of St. Petersburg, and two Triumphs of Silenus in the gallery of Vienna, in which the same relation to Giulio Romano may be noted as we mark in the canvases of Rinaldo of Mantua. Other pieces of varying importance are in the galleries of Rotterdam, Munich, Cassel, Brunswick, Carlsruhe, Mainz, and Copenhagen. In England the master is best known by his drawings. A comparatively feeble picture by him is the Last Judgment in the palace of Hampton Court.

HEEREN, Arnold Hermann Ludwig (1760–1842), an eminent German historian, was born 25th October, 1760, at Arbergen near Bremen. He studied philosophy, theology, and history at Göttingen, and thereafter travelled in Italy, France, and the Netherlands. In 1787 he was appointed one of the professors of philosophy at Göttingen, and he afterwards was chosen aulic councillor, privy councillor, etc., received in short those rewards which are the lot of successful German scholars. He died 7th March, 1842. Heeren's great merit as an historian was that he regarded the states of antiquity from an altogether fresh point of view. He examined their economic relations, their constitutions, their financial systems, and thus was enabled to throw quite a new light on the development of the old world. He possessed vast and varied learning, perfect calmness and impartiality, and great power of historical insight. A French critic has thus briefly summed up his merits—"He had all the qualities of the historians of his nation without their defects, and there is not a French historian superior to him in clearness of thought and method of composition."

Heeren's chief works were—*Ideen über Politik, den Verkehr, und den Handel der vornehmsten Völker der alten Welt* (2 vols., Gött., 1793–1796; 4th ed., 5 vols., 1824–26; English trans., Oxford, 1833); *Geschichte des Studiums der classischen Literatur seit dem Wiederaufleben der Wissenschaften* (2 vols., Gött., 1797–1802; new ed., 1822); *Die Geschichte der staaten des Alterthums* (Gött., 5th ed., 1826; English trans., Oxford, 1840); *Geschichte des europäischen Staatensystems* (Gött., 1800; 5th ed., 1830; English trans., 1834); *Versuch einer Entwickelung der Folgen der Kreuzzüge* Gött., 1808, and, in French, Paris, 1808, a prize essay of the Institute of France. Besides these Heeren wrote brief biographical sketches of Joh. von Müller (Leipsic, 1810), Spittler (1812), and C. G. Heyne (Gött., 1813), founded with Ukert the famous historical collection *Geschichte der europ. Staaten* (Gotha, 1819, and following years), and contributed many papers to learned periodicals. A collection of Heeren's *Historische Werke* was published in 15 vols., 1821–26.

HEGEL, Georg Wilhelm Friedrich (1770–1831), was born at Stuttgart on the 27th August, 1770. His father, an official in the fiscal service of Würtemberg, is not otherwise known to fame; and of his mother, who died when her eldest son, the future philosopher, was in his fourteenth year, we only hear that she had scholarship enough to teach him the elements of Latin. He had one sister, Christiana, who died unmarried, and a brother Ludwig, who served in the campaigns of Napoleon.

At the gymnasium or grammar school of Stuttgart, where Hegel was educated between the ages of seven and eighteen, he was not remarkable. His main feat was a diary kept in German and to a less extent in Latin, at intervals during eighteen months (1785–7), to record and comment on incidents of the class-room, the street, and the parlor. His private industry was shown by written translations of the *Antigone*, the *Manual* of Epictetus, etc. But the characteristic feature of his studies was the copious extracts which from this time onward he unremittingly made and preserved. Alphabetically arranged under suitable heads, this strange congeries, forming his intimate library, comprised annotations on classical authors, passages from newspapers, whole treatises on morals and mathematics from the standard works of the period. It is the palpable exhibition of the marvellous receptivity by which he saturated himself with the thoughts of others, and absorbed in their integrity the raw materials for elaboration. Yet as evidence that he was not merely receptive we have essays already breathing that admiration of the classical world which he never lost. Even then too his chief amusement was cards, and even then he began the habit of taking snuff.

In the autumn of 1788 he entered at Tübingen as a student of theology; but though an exhibitioner and on the foundation, if we may so call the "Stift," he showed no interest in the theology or philosophy of the place· his sermons were a failure; and, instead of seeking after academical distinction he found more congenial reading in the classics, on the advantages of studying which his first essay was written. After two years he took the customary degree of Ph.D., and in the autumn of 1793 received his theological certificate, stating him to be of good abilities, but of middling industry and knowledge, and especially deficient in philosophy.

His university career, unlike that of Schelling, who, five years younger, came to Tübingen in 1790, was not brilliant. Hegel was quietly making himself at home in the Greek and Roman world, and gathering stores of miscellaneous information. Amongst his comrades he went by the title of "old man," such, it is said, being his withered aspect. He took part, however, in the usual walks and beer-drinking, and even it seems love-making, of the student. But he gained most from intellectual intercourse with his contemporaries. Several of these are mentioned, but the two best known to fame were Hölderlin and Schelling. The former, who was of the same age as Hegel, left for Jena about the time that Schelling arrived. With him Hegel learned to feel for the old Greeks a love which grew stronger as the semi-Kantianized theology of his teachers more and more failed to interest him. With Schelling like sympathies bound him. They both protested against the political and ecclesiastical inertia of their native state, and adopted with fervor the revolutionary doctrines of freedom and reason. The myth which tells how the two went out one morning to dance round a tree of liberty in a meadow is antedated, as the incident happened after they had left:

still it is in keeping with their opinions, if unsuited to their character.

Like many a German student, Hegel was glad of a tutorship, in 1793, when his university course ended. For three years he taught the children of a M. Steiger of Tschugg. Tschugg was the summer residence of the family, near Erlach on the lake of Biel; in winter they lived in Bern. Little happened in these years. Hegel had a few acquaintances in Bern; but, on the whole, intellectually he lived in isolation. He was, however, far from inactive. Local influences may explain a systematic account of the fiscal system of the canton Bern which he made for himself. But the main factor in Hegel's mental growth came from his study of Christianity. Under the impulse given by Lessing and Kant he turned to the original records of Christianity, and attempted to construe for himself the real significance of Christ. He wrote a life of Jesus, in which Jesus was simply the son of Joseph and Mary. He did not stop to criticise as a philologist, and simply ignored the miraculous. He asked for the secret contained in the conduct and sayings of this man which made him the hope of the human race. To Hegel Jesus appeared as revealing the unity with God in which the Greeks in their best days unwittingly rejoiced, and as lifting the eyes of the Jews from a lawgiver who metes out punishment on the transgressor, to the destiny which in the Greek conception falls on the just no less than on the unjust.

The interest of these lucubrations is in general twofold. In Jesus Hegel finds the expression for something higher than mere morality: he finds a noble spirit which rises above the contrasts of virtue and vice into the concrete life, seeing the infinite always embracing our finitude, and proclaiming the divine which is in man and cannot be overcome by error and evil, unless the man close his eyes and ears to the godlike presence within him. In religious life, in short, he finds the principle which reconciles the oppositions of the temporal and ordinary mind. But, secondly, the general source of the doctrine that life is higher than all its incidents and codes is of interest. He does not free himself from the current theology either by rational moralizing like Kant, or by bold speculative synthesis like Fichte and Schelling. He finds his panacea in the concrete life of humanity: he turns to history, and not to abstract speculation. But although he goes to the Scriptures, and tastes the mystical spirit of the mediæval saints, the Christ of his conception has traits that seem borrowed from Socrates and from the heroes of Attic tragedy, who suffer much and yet smile gently on a destiny to which they were reconciled. Instead of the Hebraic doctrine of a Jesus punished for our sins, we have the Hellenic idea of a man who is calmly tranquil in the consciousness of his unity with God.

During these years of arduous wrestling with the problems of religion, Hegel kept up a slack correspondence with Schelling and Hölderlin. Schelling was already on the way to fame. He was trying (to quote his own words) to find the premises to the results of Kant. Meanwhile he kept Hegel abreast with German speculation. Both of them were intent on forcing the theologians from their holes into the daylight, and grudged them any aid they might expect from Kant's postulation of God and immortality to crown the edifice of ethics. After lamenting his want of books, Hegel concludes a letter of 1795 with the words, "Let reason and freedom remain our watchword, and our point of union the church invisible." Great is their animus against the pietistic hypocrisy of Würtemberg. Meanwhile Hölderlin in Jena had been following Fichte's career with an enthusiasm with which he infected Hegel.

After these vehement struggles of thought, it is pleasing to turn to a short tour which Hegel in company with three other tutors made through the Bernese Oberland in July and August, 1796. Of this tour he has left a minute diary. It embraced Lauterbrunnen, Grindelwald, the Grimsel, and the valley of the Reuss to the lake of Lucerne. The popular passion for natural scenery had scarcely begun, and the days of hotels and tourists were distant. Our four tutors carried little luggage, save a pack of cards to while away the hours of rest. Hegel was particularly delighted with the varied play of the waterfalls. Still no glamour blinds him to the squalor of Swiss peasant life. The glaciers and the rocks call forth no raptures. "The spectacle of these eternally dead masses gave me nothing but the monotonous and at last tedious idea, 'Es ist so.'" Again, speaking of the upper parts of the Hasli-thal: "I doubt if the most orthodox theologian would be bold enough in these regions to credit nature with the purpose of being useful to man, who with difficulty must wrest from her the scanty pittance of which he can make use,—who is uncertain whether rocks or avalanches may not crush him to pieces even as he steals a poor handful of grass, and destroy his miserable hut and cow-stall, the wretched work of his hands."

Towards the close of his engagement at Bern, Hegel had received hopes from Schelling of a post at Jena. Tired of isolation, he was anxious to get away from Bern. Fortunately his friend Hölderlin, who was now tutor in Frankfort, secured a similar situation there for Hegel in the family of a Herr Gogol, a merchant. Hegel entered upon his new post in January, 1797. It was apparently more agreeable, and left more time for study. At the same time he was nearer the centre of public interest. But above all it renewed the much-missed intellectual society. Hölderlin was still, as formerly, enamored of the ideal of ancient Greece. And another friend called Sinclair, a Fichtean, the author of several forgotten philosophical works, helped to animate Hegel's interest in philosophy.

It may have been the political position of Frankfort that made Hegel about this time turn to questions of economics and government. He had studied Gibbon, Hume, and Montesquieu in Switzerland. We now find him making copious extracts from the English newspapers on the Poor-Law Bill of 1796; criticising the Prussian land laws, promulgated about the same time; and writing a commentary on Sir James Steuart's *Inquiry into the Principles of Political Economy*, as a means of defining his own views on economics. Here, as in contemporaneous criticisms of Kant's ethical writings, Hegel aims at correcting the abstract discussion of a topic by treating it in its systematic interconnections. Church and state, law and morality, commerce and art, are reduced to factors in the totality of human life, from which the specialists had isolated them.

But the best evidence of Hegel's attention to contemporary politics is two unpublished essays—one of them written in 1798, "On the Internal Condition of Würtemberg in Recent Times, particularly on the Defects in the Magistracy," the other a criticism on the constitution of Germany, written, it is probable, not long after the peace of Lunéville (1801). Both essays show more vigor in pointing out the inadequacies of the present than in suggesting a remedy. Criticism, not construction, is their forte. In the first Hegel showed how the supineness of the committee of estates in Würtemberg had favored the usurpations of the superior officials in whom the court had found compliant servants. And though he perceived the advantages of change in the constitution of the estates, he still doubted if an improved system could work in the actual conditions of his native province. The main feature in the pamphlet is the recognition that a spirit of reform is abroad. If Würtemberg suffered from a bureaucracy tempered by despotism, the Fatherland in general suffered no less. "Germany," so begins the second of these unpublished papers, "is no longer a state." Referring the collapse of the empire to the retention of feudal forms and to the action of religious animosities, Hegel looked forward to reorganization by a central power (Austria) wielding the imperial army, and by a representative body elected by the geographical districts of the empire. But such an issue, he saw well, could only be the outcome of violence—of "blood and iron." The philosopher did not pose as a practical statesman. He only described the German empire in its nullity as a conception without existence in fact. In such a state of things it was the business of the philosopher to set forth the outlines of the coming epoch, as they were already moulding themselves into shape, amidst what the ordinary eye saw only as the disintegration of the old forms of social life.

His old interest in the religious question reappears, but in a more philosophical form. Starting with the contrast between a natural and a positive religion, he regards a positive religion as one imposed upon the mind from without, not a natural growth crowning the round of human life. A natural religion, on the other hand, was not, he thought, the one universal religion of every clime and age, but rather the spontaneous development of the national conscience varying in varying circumstances. A people's religion completes and consecrates their whole activity; in it the people rises above its finite life in limited spheres to an infinite life where it feels itself all at one. Even philos-

ophy with Hegel at this epoch was subordinate to religion; for philosophy must never abandon the finite in the search for the infinite. Soon, however, Hegel adopted a view according to which philosophy is a higher mode of apprehending the infinite than even religion.

At Frankfort, meanwhile, the philosophic ideas of Hegel first assumed the proper philosophic form. "In my scientific training," he says (in a letter to Schelling of November 2, 1800), "which started from more subordinate wants of man, I could not but be forced onwards to science, and at the same time the ideal of youth had to transform itself into the reflective form of a system." In a MS. of 102 quarto sheets, of which the three first and the seventh are wanting, there is preserved the original sketch of the Hegelian system, so far at least as the logic and metaphysics and part of the philosophy of nature are concerned. The third part of the system—the ethical theory—seems to have been composed afterwards; it is contained in its first draught in another MS. of thirty sheets. Even these had been preceded by earlier Pythagorean constructions envisaging the divine life in divine triangles.

Circumstances soon put Hegel in the way to complete these outlines. His father died in January, 1799; and the slender sum which Hegel received as his inheritance, 3154 gulden (about £260), enabled him to think once more of a studious life. At the close of 1800 we find him asking Schelling for letters of introduction to Bamberg, where with cheap living and good beer he hoped to prepare himself for the intellectual excitement of Jena. The upshot was that Hegel arrived at Jena in January, 1801. An end had already come to the brilliant epoch at Jena, when the romantic poets, Tieck, Novalis, and the Schlegels made it the headquarters of their fantastic mysticism, and Fichte turned the results of Kant into the banner of revolutionary ideas. Schelling was the main philosophical lion of the time; and in some quarters Hegel was spoken of as a new champion summoned from Swabia by Schelling to help him in his struggle with the more prosaic continuators of Kant. Hegel's first performance seemed to justify the rumor. It was an essay on the difference between the philosophic systems of Fichte and Schelling, tending in the main to support the latter. Still more striking was the agreement shown in the *Critical Journal of Philosophy*, which Schelling and Hegel wrote conjointly during the years 1802–3. So latent was the difference between them at this epoch that it, in one or two cases, is not with certainty possible to determine by whom the essay was written. Even at a later period foreign critics like Cousin saw much that was alike in the two doctrines, and did not hesitate to regard Hegel as a disciple of Schelling. The dissertation by which Hegel qualified for the position of privatdocent—an essay, *De orbitis planetarum*—was probably chosen under the influence of Schelling's philosophy of nature. It was an unfortunate subject. For while Hegel, depending on a numerical proportion suggested by Plato, hinted in a single sentence that it might be a mistake to look for a planet in the interval between Mars and Jupiter, Professor Piazzi had already discovered the first of the asteroids on 1st January, 1801. Apparently in August, when Hegel qualified, the news of the discovery had not yet reached him, but critics have made this luckless suggestion the ground of attack on *a priori* philosophy. The theses attached to this dissertation contained some characteristic paradoxes, *e. g.*, that the syllogism is the principle of idealism, that a square is the law of nature, and a triangle of mind, etc.

Hegel's earliest lectures, in the winter of 1801–2, on logic and metaphysics were attended by about eleven students. At a later period, in 1804, we find him with a class of about thirty, lecturing on his whole system; but his average attendance was rather less. Besides philosophy, he once at least lectured on mathematics. As he taught, he was led to modify his original system, and notice after notice of his lectures promised a text-book of philosophy—which, however, failed to appear. Meanwhile, after the departure of Schelling from Jena in the middle of 1803, Hegel was left to work out his own views. Besides philosophical studies, where he now added Aristotle to Plato, he read Homer and the Greek tragedians, made extracts from books, attended lectures on physiology, and dabbled in other sciences. On his own representation at Weimar, he was in February, 1805, made a professor extraordinarius, and in July, 1806, drew his first and only stipend—100 thalers. At Jena, though some of his hearers became devotedly attached to him, Hegel was not a popular lecturer any more than Krause. The ordinary student found Fries more intelligible.

Of the lectures of that period there still remain considerable notes. The language often had a theological tinge (never entirely absent), as when the "idea" was spoken of or "the night of the divine mystery," or the dialectic of the absolute called the "course of the divine life." Still his view was growing clearer, and his difference from Schelling more palpable. Both Schelling and Hegel stand in a relation to art, but while the æsthetic model of Schelling was found in the contemporary world, where art was a special sphere and the artist a separate profession in no intimate connection with the age and nation, the model of Hegel was found rather in those works of national art in which art is not a part of the common life but an aspect of it, and the artist is not a mere individual but a concentration of the passion and power of beauty in the whole community. "Such art," says Hegel, "is the common good and the work of all. Each generation hands it on beautified to the next; each has done something to give utterance to the universal thought. Those who are said to have genius have acquired some special aptitude by which they render the general shapes of the nation their own work, one in one point, another in another. What they produce is not their invention, but the invention of the whole nation; or rather, what they find is that the whole nation has found its true nature. Each, as it were, piles up his stone. So too does the artist. Somehow he has the good fortune to come last, and when he places his stone the arch stands self-supported." Hegel, as we have already seen, was fully aware of the change that was coming over the world. "A new epoch," he says, "has arisen. It seems as if the world-spirit had now succeeded in freeing itself from all foreign objective existence, and finally apprehending itself as absolute mind." These words come from lectures on the history of philosophy, which laid the foundation for his "Phenomenology of the Mind." The printing of this work (*Phänomenologie des Geistes*) began in 1806 at Bamberg, and the sheets were distributed, as they appeared, to a class where he treated the phenomenology as an introduction to logic. That course he closed on the 18th September, 1806, as follows:—"This, gentlemen, is speculative philosophy, so far as I have worked it out. We stand in a momentous time,—a seething mass, in which the mind has made a sudden bound, left its old shape behind, and is gaining a new. The whole bulk of our old ideas, the very bands of the world, are rent asunder, and collapse like a dream. Mind is preparing a new start. Philosophy, above all things, has to own and welcome such a start. While some in powerless resistance cling to the past, and the majority help, but unconsciously, to swell the numbers of its cortege, philosophy, recognizing it as the eternal, has to show it due honor."

Less than a month after, on the 14th October, 1806, Napoleon was at Jena. But Hegel, like Goethe, felt no patriotic shudder at the victory, and in Prussia he saw only a corrupt and conceited bureaucracy. Writing to his friend Niethammer on the day before the battle, he speaks only with admiration of the "world-soul," the emperor, and only with satisfaction of the probable overthrow of the badly-generalled and inefficient Prussians. The scholar's wish was to see the clouds of war pass away, and leave thinkers to their peaceful work. His manuscripts were his main care; and doubtful of the safety of his last despatch to Bamberg, and disturbed by the French soldiers in his lodgings, he hurried off, with the last pages of the *Phenomenology* in his pocket, to take refuge in the pro-rector's house. Hegel's fortunes were now at the lowest ebb. Without means, and obliged to borrow from his friend Niethammer, he had no further hopes from the impoverished university. He had already tried to get away from Jena. In 1805, when several lecturers left in consequence of diminished classes, he had written to Voss suggesting that his philosophy might find more congenial soil in Heidelberg; but the application bore no fruit. Now, however, it was necessary to do something. And so, when the proprietor of the *Bamberger Zeitung* was in want of an editor, Hegel, who had been named by Niethammer, at once accepted the offer, which involved a certain partnership in the concern. Early in 1807 he came to Bamberg, and stayed for about eighteen months. Of his editorial work there is little to tell; no leading articles appeared in his columns. Patriotic indignation against Napoleon, or in-

terest in the fortunes of Prussia, were not wanted, and probably would not have been allowed. The editor was only expected to give his constituency news, and he did so with proper neutrality and from the best sources available. It was not a lofty or suitable vocation; and when a nomination to the rectorship of the Aegidien-gymnasium in Nuremberg was procured for Hegel, again by the agency of Niethammer, who was now in the education office at Munich, he was glad to go.

From December, 1808, to August, 1816, Hegel was schoolmaster. Bavaria, at this time under the direction of Montgelas, was modernizing her institutions. The school system was reorganized by new regulations, which, *inter alia*, prescribed a training in philosophy as part of the gymnasial course. To this regulation (with which Hegel, however, was not agreed) we owe a series of lessons in the outlines of philosophy—ethical, logical, and psychological—which Hegel drew up with great care and many revisions. They were published in 1840 by Rosenkranz from Hegel's papers. Deviating somewhat from the official order, he began with the outlines of moral and religious doctrine; he then proceeded to psychology and a combined system of logic and metaphysics, and ended with a general summary of the whole of philosophy.

As a teacher and master Hegel seems to have been fairly successful. He inspired confidence in his pupils, and maintained discipline without pedantic interference in their associations and sports. On the prize-days at the close of the session, his addresses summing up the history of the school year discussed some topic of general interest. Five of these addresses are preserved. The first is an exposition of the advantages of a classical training, when it is not confined to mere points of grammar. "The perfection and grandeur of the master-works of Greek and Roman literature must be the intellectual bath, the secular baptism, which gives the first and unfading tone and tincture of taste and science." The school was mainly classical; yet at least one half of the time was given to arithmetic, history, and geography, mathematics, physics, and preliminary philosophy. In another address, speaking of the introduction of military exercises at school, he says:—"These exercises, while not intended to withdraw the students from their more immediate duty, so far as they have any calling to it, still remind them of the possibility that every one, whatever rank in society he may belong to, may one day have to defend his country and his king, or help to that end. This duty, which is natural to all, was formerly recognized by every citizen, though whole ranks in the state have become strangers to the very idea of it."

On the 16th September, 1811, in the summer vacation, Hegel married Marie von Tucher. The young lady (twenty-two years younger than her bridegroom) belonged to Nuremberg, and seems to have been all that could be wished for in a wife. She brought her husband no fortune, but a cheerful heart. They seem to have had a happy if a frugal home; and a short excursion now and then was their chief dissipation. The husband kept a careful record of income and expenditure. That income at Nuremberg amounted to 1500 gulden (£130) and a house; at Heidelberg, as professor, he received about the same sum; but at Berlin his regular stipend was about 3000 thalers (£300). Two sons were born to them; the eldest, Karl, born 7th June, 1813, has since become eminent as a historian. The younger was named Immanuel, born on the 24th September, 1816. Hegel's letters to his wife, written during his solitary holiday tours to Vienna, the Netherlands, and Paris, breathe of kindly and happy affection. Hegel, the tourist, recalling happy days spent together; confessing that, were it not because of his sense of duty as a traveller, he would rather be at home, dividing his time between his books and his wife; commenting on the shop windows at Vienna; describing the straw hats of the Parisian ladies,—is a contrast to the professor of a profound philosophical system. But it shows that the enthusiasm which in his days of courtship moved him to verse had blossomed into a later age of domestic bliss.

The year after his marriage appeared the first two volumes of his *Wissenschaft der Logik*, and the work was completed by a third in 1816. This work, in which his system was for the first time presented in what, if we except a few minor alterations, was its ultimate shape, found some audience in the world, and from here and there came voices of encouragement. Sinclair, who in 1811 brought out three volumes on *Truth and Certainty*; Windischmann, subsequently professor at Bonn; Thaden, a Danish peasant farmer and votary of free thought; Berger, another Dane and philosopher; Van Ghert, an old pupil, now a Government official at Amsterdam,—these, as well as Knebel and Niethammer, corresponded with him during this period. Towards the close of his eighth session three professorships were almost simultaneously put within his reach,—at Erlangen, Berlin, and Heidelberg. The Prussian offer expressed a doubt that his long absence from university teaching might have made him rusty, so he accepted the post at Heidelberg, whence Fries had just gone to Jena. He came to Heidelberg in October, 1816. Though charmed with the neighborhood, and pleased with the people, he was a little disappointed when only four hearers turned up for one of his courses. Others, however, on the encyclopædia of philosophy and the history of philosophy drew classes of twenty to thirty. While he was there, Cousin first made his acquaintance, but a more intimate relation dates from Berlin. Among his pupils was Hinrichs, who, originally a law student, became a philosophical disciple and wrote several works, to one of which, *Religion in its Inward Relation to Science*, Hegel wrote a rather important preface in 1822. The strangest of his hearers was an Esthonian baron, Boris d'Yrkull, who after serving in the Russian army came to Heidelberg to hear the wisdom of Hegel. But his books and his lectures were alike obscure to the baron, who betook himself by Hegel's advice to some simpler fare, in the shape of rudimentary knowledge, before he returned to the Hegelian system. The logic of his master, with whom he became intimate, was afterwards his constant companion in his travels.

At Heidelberg Hegel was also active in a literary way. In 1817 he brought out the *Encyclopædia of the Philosophical Sciences*, in outline, for use at his lectures. In its first form it was a small treatise of about 300 octavo pages; but in the second of 1827, and the third of 1830, it rapidly grew to twice the original bulk. It is the only exposition of the Hegelian system as a whole which we have direct from Hegel's own hand. Besides this work he wrote two reviews for the Heidelberg *Jahrbücher*—the first on Jacobi, the other a political pamphlet which called forth violent criticism. It was entitled a *Criticism on the Transactions of the Estates of Würtemberg in 1815–16*. On the 15th March, 1815, King Frederick of Würtemberg, at a meeting of the estates of his kingdom, laid before them the draft of a new constitution, in accordance with the resolutions of the congress of Vienna. Though an improvement on the old constitution, it was unacceptable to the estates, jealous of their old privileges and suspicious of the king's intentions. A decided majority demanded the restitution of their old laws, though the kingdom now included a large population to which the old rights were strange. Hegel in his essay, which was republished at Stuttgart, strongly supported the royal proposals, and severely animadverted on the backwardness of the bureaucracy and the landed interests. In the main he was right; but he forgot too much the provocation they had received, the usurpations and selfishness of the governing family, and the unpatriotic character of the king.

After two years at Heidelberg Hegel accepted the renewed offer of the chair of philosophy at Berlin, which had been kept vacant since the death of Fichte. The hopes which this offer raised of a position less precarious than that of a university teacher of philosophy were in one sense disappointed; for more than a professor Hegel never became. But his influence upon his pupils, and his solidarity with the Prussian Government, gave him a position such as few professors have held.

On the 22d October, 1818, Hegel began his lectures at Berlin. "Our business and vocation," he said to his young hearers, "is to cherish the philosophical development of the substantial foundation (*i. e.*, the state) which has renewed its youth and increased its strength." But Prussia had already proved false to the spirit of freedom which had armed the peoples against Napoleon. The enthusiasm which in the hands of Stein, Humboldt, and Scharnhorst had reformed the social, intellectual, and military organization of Prussia still smouldered; but hot-headed youthful politicians made it burst into fitful flames. Sober men were disgusted by the absurdities perpetrated at the Wartburg to celebrate the tricentenary of the Reformation. And though professors like Fries and Oken shared the behavior

of the students in this demonstration, and the assassination of Kotzebue in 1819 found admirers—such as the theological professor De Wette, who spoke of it as a "beautiful sign of the time"—Stein spoke of the two professors as a pair of fools, and Niebuhr grew sad over the extravagances of the younger generation. Secret societies were formed or believed to be forming; and the Governments grew alarmed. In Prussia the reaction triumphed by the withdrawal of Humboldt in the last days of 1819; and the death of Hardenberg in 1822 was followed by a period of bureaucracy and conservatism.

It was in such an atmosphere that Hegel published the "Philosophy of Right" (*Grundlinien der Philosophie des Rechts*) in 1821. It is a combined system of moral and political philosophy, or a sociology dominated by the idea of the state. It turns away contemptuously and fiercely from the sentimental aspirations of reformers possessed by the democratic doctrine of the rights of the omnipotent nation. Fries is stigmatized as one of the "ringleaders of shallowness" who were bent on substituting a fancied tie of enthusiasm and friendship for the established order of the state. The disciplined philosopher, who had devoted himself to the task of comprehending the organism of the state, had no patience with feebler or more mercurial minds who recklessly laid hands on established ordinances, and set them aside where they contravened humanitarian sentiments. With the principle that whatever is real is rational, and whatever is rational is real, Hegel fancied that he had stopped the mouths of political critics and constitution-mongers. His theory was not a mere formulation of the Prussian state. Much that he construed as necessary to a state was wanting in Prussia; and some of the reforms already introduced did not find their place in his system. Yet, on the whole, he had taken his side with the Government. Altenstein even expressed his satisfaction with the book. In his disgust at the crude conceptions of the enthusiasts, who had hoped that the war of liberation might end in a realm of internal liberty, Hegel had forgotten his own youthful vows recorded in verse to Hölderlin, "never, never to live in peace with the ordinance which regulates feeling and opinion." And yet if we look deeper we see that this is no worship of existing powers. It is rather due to an overpowering sense of the value of organization,—a sense that liberty can never be dissevered from order, that a vital interconnection between all the parts of the body politic is the source of all good, so that while he can find nothing but brute weight in an organized public, he can compare the royal person in his ideal form of constitutional monarchy to the dot upon the letter *i*. A keen sense of how much is at stake in any alteration breeds suspicion of every reform.

During his thirteen years at Berlin Hegel's whole soul seems to have been in his lectures. Between 1823 and 1827 his activity reached its maximum. His notes were subjected to perpetual revisions and additions. We can form an idea of them from the shape in which they appear in his published writings. Those on *Æsthetics*, on the *Philosophy of Religion*, on the *Philosophy of History*, and on the *History of Philosophy*, have been published by his editors, mainly from the notes of his students, under their separate heads; while those on logic, psychology, and the philosophy of nature are appended in the form of illustrative and explanatory notes to the sections of his *Encyclopädie*. During these years hundreds of hearers from all parts of Germany, and from beyond the Fatherland, came under his influence. His fame was carried abroad by eager or intelligent disciples. At Berlin Henning served to prepare the intending disciple for fuller initiation by the master himself. Gans and Hotho carried the method into special spheres of inquiry. At Halle Hinrichs maintained the standard of Hegelianism amid the opposition or indifference of his colleagues.

Hegel himself in his class-room was neither imposing nor fascinating. You saw a plain, old-fashioned face, without life or lustre—a figure which had never looked young, and was now bent and prematurely aged; the furrowed face bore witness to concentrated thought. Sitting with his snuff-box before him, and his head bent down, he looked ill at ease, and while still speaking kept turning the folios of his notes. His utterance was interrupted by frequent hemming and coughing; every word and every sentence came out with a struggle; and if, when the right word seemed as if it would never come and no progress appeared to be making, the listener for a moment ceased to listen, he found when attention returned that the lecture had reached a new stage and the connection was lost. And the style of these utterances was no less irregular. Sometimes in the plainest narrative the lecturer would be specially awkward, while in the abtrusest passages he seemed specially at home, rose into a natural eloquence, and carried away the hearer by the grandeur of his diction.

Three courses of lectures are especially the product of his Berlin period: those on æsthetics, the philosophy of religion and the philosophy of history. In the years preceding the revolution of 1830, public interest, excluded from political life, turned to theatres, concert-rooms, and picture galleries. At these Hegel became a frequent and appreciative visitor. He even made extracts from the art-notes in the newspapers. In his holiday excursions, the interest in the fine arts is prominent, and more than once takes him out of his way to see some old painting. His letters to his wife are full of such topics. A visit to Vienna in 1824 presents him spending every moment at the Italian opera, the ballet, and the picture galleries. In Paris, in 1827, curiously enough, he heard Charles Kemble and an English company play Shakespeare. This familiarity with the actual facts of art, though neither very deep nor very historical, gave an unusual freshness to his lectures on æsthetics, which, as put together from the notes of 1820, 1823, 1826, are in many ways the most successful of his efforts.

The lectures on the philosophy of religion are another application of his method to an important sphere of human interest. Shortly before his death he had prepared for the press a course of lectures on the proofs for the existence of God. In his lectures on religion he dealt with Christianity, as in his philosophy of morals he had regarded the state. On one hand he turned his weapons against the ratioualistic school, who reduced religion to the modicum compatible with an ordinary worldly mind. On the other hand he criticised the school of Schleiermacher, who elevated feeling to a place in religion above systematic theology. His middle way attempts to show that the dogmatic creed is the rational development of what was implicit in religious feeling. To do so, of course, philosophy becomes the interpreter and the superior. To the new school of Hengstenberg, which regarded Revelation itself as supreme, such interpretation was an abomination.

A Hegelian school began to gather. The flock included intelligent pupils who applied the method in different provinces of speculation, empty-headed imitators who repeated the catchwords of the new dialectic, and romantic natures who turned philosophy into lyric measures. Opposition and criticism, which were not wanting, only served to define more precisely the adherents of the new doctrine. The master himself grew more and more into a belief in his own doctrine as the one truth for the world. The system had grown gradually with him, and had assimilated intellectual nutriment from every hand so as to make all history and all knowledge bear witness to its truth. He was in harmony with the Government, and his followers were on the winning side. Though he had soon resigned all direct official connection with the schools of Brandenburg, his real influence in Prussia was considerable, and as usual was largely exaggerated in popular estimate. In the narrower circle of his friends his birthdays were the signal for congratulatory verses. In 1826 a formal festival was got up by some of his admirers, one of whom, Herder, spoke of his categories as new gods; and he was presented with much poetry aud a silver mug. In 1830 the students struck a medal in his honor, and in 1831 he was decorated by an order from the king. In 1830 he was rector of the university; and on the tricentenary of the Augsburg Confession in that year, he took the opportunity in his speech on the occasion to charge the Catholic Church with regarding the virtues of the pagan world as brilliant vices, and giving the crown of perfection to poverty, continence, and obedience.

One of the last literary undertakings in which he took part was to give his support to Gans and Varnhagen von Ense in the establishment of the Berlin *Jahrbücher für Wissenschaftliche Kritik*. The aim of this review was to give a critical account, certified by the names of the contributors, of the more important literary and philosophical productions of the time, in relation to the general progress of knowledge. The journal was not solely in the Hegelian interest; and more than once, when Hegel attempted to

domineer over the other editors, he was met by vehement and vigorous opposition. It gave him besides a deal of trouble with sanguine authors, who looked forward to a favorable word from him as a passport to fame.

The revolution of 1830 was a great blow to him as to many other Germans; and the prospect of democratic advances almost made him ill. His last literary work was an essay on the English Reform Bill of 1831, the first part of which appeared in the *Preussische Staats-zeitung*. It contains primarily a careful consideration of the effects likely to come from the alterations in the electoral franchise, in relation, first, to the character of the new members of parliament, and secondly, to the measures which they may introduce. In the latter connection he enlarges on several points where England had done less than many Continental states for the abolition of monopolies and abuses. Surveying with much intelligence of English circumstances the questions connected with landed property, with the game laws, the poor, the Established Church, especially in Ireland, Hegel throws grave doubt on the legislative capacity of the English parliament as compared with the power of renovation and reform manifested in the more advanced states of western Europe. Much of the essay, unfortunately, has not become antiquated as a critique on the social state of Britain.

In 1831 the cholera had first entered Europe. Hegel and his family retired for the summer to a lodging in the suburbs, and there he finished the revision of the first part of his *Science of Logic*. On the commencement of the winter session, however, he returned to his house in the Kupfergraben. On this occasion an unseemly altercation occurred between him and his friend Gans, who in his notice of lectures on jurisprudence had recommended Hegel's *Philosophy of Right*. Hegel, indignant at what he deemed patronage, asked Gans in a rough missive to withdraw the note. On Friday, 11th November, Hegel had lectured as usual. On Sunday he had a violent attack of cholera, and on Monday, the 14th November, 1831, he was dead. He was buried on the spot he had wished for himself, between Fichte and Solger.

Hegel's Philosophy.

Hegelianism is confessedly one of the most difficult of all philosophies. Every one has heard the legend which makes Hegel say, "One man has understood me, and even he has not." He abruptly hurls us into a world where old habits of thought fail us. In three places indeed he has attempted to exhibit the transition to his own system from other levels of thought; but in none with much success. In the introductory lectures on the philosophy of religion he gives a rationale of the difference between the modes of consciousness in religion and philosophy (between *Vorstellung* and *Begriff*). In the beginning of the *Encyclopädie* he discusses the defects of dogmatism, empiricism, the philosophies of Kant and Jacobi. In the first case he treats the formal or psychological aspect of the difference; in the latter he presents his doctrine less in its essential character than in special relations to the prominent systems of his time. The *Phenomenology of Spirit*, regarded as an introduction, suffers from a different fault. It is not an introduction—for the philosophy which it was to introduce was not then fully elaborated. Even to the last Hegel had not so externalized his system as to treat it as something to be led up to by gradual steps. His philosophy was not one aspect of his intellectual life, to be contemplated from others; it was the ripe fruit of concentrated reflection, and had become the one all-embracing form and principle of his thinking. More than most thinkers he had quietly laid himself open to the influences of his time, and the lessons of history.

The *Phenomenology* is the picture of the Hegelian philosophy in the making,—at the stage before the scaffolding has been removed from the building. For this reason the book is at once the most brilliant and the most difficult of Hegel's works, —the most brilliant because it is to some degree an autobiography of Hegel's mind,—not the abstract record of a logical evolution, but the real history of an intellectual growth; the most difficult because, instead of treating the rise of intelligence (from its first appearance in contrast with the real world to its final recognition of its presence in, and rule over, all things) as a purely subjective process, it exhibits this rise as wrought out in historical epochs, national characteristics, forms of culture and faith, and philosophical systems. The theme is identical with the introduction to the *Encyclopädie;* but it is treated in a very different style. From all periods of the world,—from mediæval piety and stoical pride, Kant and Sophocles, science and art, religion and philosophy,—with disdain of mere chronology, Hegel gathers in the vineyards of the human spirit the grapes from which he crushes the wine of thought. The human mind coming through a thousand phases of mistake and disappointment to a sense and realization of its true position in the universe,—such is the drama which is consciously Hegel's own history, but is represented objectively in the field of the world as the process of spiritual history which the philosopher wakes into consciousness and reproduces in himself. The *Phenomenology* stands to the *Encyclopädie* somewhat as the dialogues of Plato stand to the Aristotelian treatises. It contains almost all his philosophy—but irregularly and without due proportion. The personal element gives an undue prominence to recent and contemporary phenomena of the philosophic atmosphere. It is the account given by an inventor of his own discovery, not the explanation of an outsider. It therefore to some extent assumes from the first the position which it proposes ultimately to reach, and gives, not a proof of that position, but an account of the experience (*Erfahrung*) by which consciousness is forced from one position to another till it finds rest in *Absolutes Wissen*.

It is impossible in a mere resumé to do justice to this remarkable work, which is neither a mere psychology, nor logic, nor moral philosophy, nor history, but is all of these at once and a great deal more. What the *Phenomenology* wants is not distillation, but expansion and illustration from contemporary and antecedent thought and literature. It treats of the attitudes of consciousness towards reality under the six heads of consciousness, self-consciousness, reason (*Vernunft*), spirit (*Geist*), religion, and absolute knowledge. The native attitude of consciousness towards existence is reliance on the evidence of the senses; but a little reflection is sufficient to show that the reality attributed to the external world is as much due to intellectual conceptions as to the senses, and that these conceptions slip through our fingers when we try to fix them. If consciousness cannot detect a permanent object outside it, so self-consciousness cannot find a permanent subject in itself. It may, like the Stoic, assert freedom by holding aloof from the entanglements of real life, or like the sceptic regard the world as a delusion, or finally, as the "unhappy consciousness" (*Unglückliches Bewusstsein*), may be a recurrent falling short of a perfection which it has placed above it in the heavens. But in this isolation from the world, self-consciousness has closed its gates against the stream of life. The perception of this is reason. Reason convinced that the world and the soul are alike rational observes the external world, mental phenomena, and specially the nervous organism, as the meeting ground of body and mind. But reason finds much in the world recognizing no kindred with her, and so turning to practical activity seeks in the world the realization of her own aims. Either in a crude way she pursues her own pleasure, and finds that necessity counteracts her cravings; or she endeavors to find the world in harmony with the heart, and yet is unwilling to see fine aspirations crystallized by the act of realizing them. Finally, unable to impose upon the world either selfish or humanitarian ends, she folds her arms in pharisaic virtue, with the hope that some hidden power will give the victory to righteousness. But the world goes on in its life, heedless of the demands of virtue. The principle of nature is to live and let live. Reason abandons her efforts to mould the world, and is content to let the aims of individuals work out their results independently, only stepping in to lay down precepts for the cases where individual actions conflict, and to test these precepts by the rules of formal logic.

So far we have seen consciousness on one hand and the real world on the other. The stage of "Geist" reveals the consciousness no longer as critical and antagonistic but as the indwelling spirit of a community, as no longer isolated from its surroundings but the union of the single and real consciousness with the vital feeling that animates the community. This is the lowest stage of concrete consciousness—life, and not knowledge; the spirit inspires, but does not reflect. It is the age of unconscious morality, when the individual's life is lost in the society of which he is an organic member. But increasing culture presents new ideals, and the mind, absorbing the ethical spirit of its environment, gradually emancipates itself from conventions and superstitions. This "Aufklärung" prepares the way for the rule of conscience, for the moral view of the world as subject of a moral law. From the moral world the next step is religion; the moral law gives place to God; but the idea of Godhead, too, as it first appears is imperfect, and has to pass through the forms of nature-worship and of art, before it reaches a full utterance in Christianity. Religion in this shape is the nearest step to the stage of absolute knowledge; and this absolute knowledge—"the spirit knowing itself as spirit"—is not something which leaves these other forms behind but the full comprehension of them as the organic constituents of its empire; "they are the memory and the sepulchre of its history, and at the same time the actuality, truth, and certainty of its throne." Here, according to Hegel, is the field of philosophy.

The preface to the *Phenomenology* signalled the separation from Schelling—the adieu to romantic. It declared that a genuine philosophy has no kindred with the mere aspirations

of artistic minds, but must earn its bread by the sweat of its brow. It sets its face against the idealism which either thundered against the world for its deficiencies, or sought something finer than reality. Philosophy is to be the science of the actual world—it is the spirit comprehending itself in its own externalizations and manifestations. The philosophy of Hegel is idealism, but it is an idealism in which every idealistic unification has its other face in the multiplicity of existence. It is realism as well as idealism, and in its highest speculations never quits its hold on facts. Compared with Fichte and Schelling, Hegel has a sober, hard, realistic character. At a later date, with the call of Schelling to Berlin in 1841, it became fashionable to speak of Hegelianism as a negative philosophy requiring to be complemented by a "positive" philosophy which would give reality and not mere ideas. The cry was the same as that of Krug (more than once alluded to by Hegel) asking the philosophers who expounded the absolute to construe his pen. It was the cry of the Evangelical school for a personal Christ and not a dialectical Logos. Philosophy, as Schelling says, was asked to supply the real God and not the mere conception of Him. Experimental science complained that the real world of matter and force had been supplanted by a fantastic tissue of logical forms and ethereal processes. The claims of the individual, the real, material, and historical fact had been sacrificed, it was said, by Hegel, to the universal, the ideal, the spiritual, and the logical.

There was a truth in these criticisms. It was the very aim of Hegelianism to render fluid the fixed phases of reality,—to show existence not to be an immovable rock limiting the efforts of thought, but to have thought implicit in it, waiting for release from its petrifaction. Nature was no longer, as with Fichte, to be a mere spring-board to evoke the latent powers of the spirit. Nor was it, as in Schelling's earlier system, to be a collateral progeny with mind from the same womb of indifference and identity. Nature and mind in the Hegelian system—the external and the spiritual world—have the same origin, but are not co-equal branches. The natural world proceeds from the "idea," the spiritual from the idea and nature. It is impossible, beginning with the natural world, to explain the mind by any process of distillation or development, unless consciousness or its potentiality has been there from the first. Reality, independent of the individual consciousness, there must be; reality, independent of all mind, is an impossibility. At the basis of all reality, whether material or mental, there is thought. But the thought thus regarded as the basis of all existence is not consciousness with its distinction of ego and non-ego. It is rather the stuff of which both mind and nature are made, neither extended as in the natural world, nor self-centred as in mind. Thought in its primary form is, as it were, thoroughly transparent and absolutely fluid, free, and mutually interpenetrable in every part,—the spirit in its seraphic scientific life, before creation had produced a natural world, and thought had risen to independent existence in the social organism. Thought in this primary form, when in all its parts completed, is what Hegel calls the "idea." But the idea, though fundamental, is in another sense final, in the process of the world. It only appears in consciousness as the crowning development of the mind. Only with philosophy does thought become fully conscious of itself in its origin and development. Accordingly the history of philosophy is the presupposition of logic, or the three branches of philosophy form a circle.

The exposition or constitution of the "idea" is the work of the Logic. As the total system falls into three parts, so every part of the system follows the triadic law. Every truth, every reality, has three aspects or stages; it is the unification of two contradictory elements, of two partial aspects of truth which are not merely contrary, like black and white, but contradictory, like same and different. The first step is a preliminary affirmation and unification, the second a negation and differentiation, the third a final synthesis. For example, the seed of the plant is an initial unity of life, which when placed in its proper soil suffers disintegration into its constituents, and yet in virtue of its vital unity keeps these divergent elements together, and reappears as the plant with its members in organic union. Or again, the process of scientific induction is a threefold chain; the original hypothesis (the first unification of the fact) seems to melt away when confronted with opposite facts, and yet no scientific progress is possible unless the stimulus of the original unification is strong enough to clasp the discordant facts and establish a reunification. Thesis, antithesis, and synthesis, a Fichtean formula, is generalized by Hegel into the perpetual law of thought.

In what we may call their psychological aspect these three stages are known as the abstract stage, or that of understanding (*Verstand*), the dialectical stage, or that of negative reason, and the speculative stage, or that of positive reason (*Vernunft*). The first of these attitudes taken alone is dogmatism; the second, when similarly isolated, is scepticism; the third, when unexplained by its elements, is mysticism. Thus Hegelianism reduces dogmatism, scepticism, and mysticism to factors in philosophy. The abstract or dogmatic thinker believes his object to be one, simple, and stationary, and intelligible apart from its surrounding. He speaks, *e. g.*, as if species and genera were fixed and unchangeable; and fixing his eye on the ideal forms in their purity and self-sameness, he scorns the phenomenal world, whence this identity and persistence are absent. The dialective of negative reason rudely dispels these theories. Appealing to reality it shows that the identity and permanence of forms are contradicted by history; instead of unity it exhibits multiplicity, instead of identity difference, instead of a whole, only parts. Dialectic is, therefore, a dislocating power; it shakes the solid structures of material thought, and exhibits the instability latent in such conceptions of the world. It is the spirit of progress and change, the enemy of convention and conservatism; it is absolute and universal unrest. In the realm of abstract thought these transitions take place lightly. In the worlds of nature and mind they are more palpable and violent. So far as this Hegel seems on the side of revolution. But reason is not negative or dialectic only; it binds up as well as breaks down, and, while it disintegrates the mass or unconscious unity, builds up a new unity with higher organization. But this third stage is the place of effort, requiring neither the surrender of the original unity nor the ignoring of the diversity afterwards suggested. The stimulus of contradiction is no doubt a strong one; but the easiest way of escaping it is to shut our eyes to one side of the antithesis. What is required, therefore, is to readjust or reconstitute our original thesis in such a way as to include and give expression to both the elements in the process.

The universe, then, is a process or development, to the eye of philosophy. It is the process of the absolute—in religious language, the manifestation of God. In the background of all the absolute is eternally present; the rhythmic movement of thought is the self-unfolding of the absolute. God reveals Himself in the logical idea, in nature, and in mind; but mind is not alike conscious of its absoluteness in every stage of development. Philosophy alone sees God revealing Himself in the ideal organism of thought as it were a possible deity prior to the world and to any relation between God and actuality; in the natural world, as a series of materialized forces and forms of life; and in the spiritual world as the human soul, the legal and moral order of society, and the creations of art, religion, and philosophy.

This introduction of the absolute became a stumbling-block to Feuerbach and other members of the "Left." They rejected as an illegitimate interpolation the eternal subject of development, and, instead of one continuing God as the subject of all the predicates by which in the logic the absolute is defined, assumed only a series of ideas, products of philosophic activity. They denied the theological value of the logical forms—the development of these forms being in their opinion due to the human thinker, not to a self-revealing absolute. Thus they made man the creator of the absolute. But with this modification on the system another necessarily followed; a mere logical series could not create nature. And thus the material universe became the real starting-point. Thought became only the result of organic conditions—subjective and human; and the system of Hegel was no longer an idealization of religion, but a naturalistic theory with a prominent and peculiar logic.

The logic of Hegel is the only rival to the logic of Aristotle. What Aristotle did for the theory of demonstrative reasoning, Hegel attempted to do for the whole of human knowledge. His logic is an enumeration of the forms or categories by which our experience exists. It carried out Kant's doctrine of the categories as *a priori* synthetic principles, but removed the limitation by which Kant denied them any constitutive value except in alliance with experience. According to Hegel the terms in which thought exhibits itself are a system of their own, with laws and relations which reappear in a less obvious shape in the theories of nature and mind. Nor are they restricted to the small number which Kant obtained by manipulating the current subdivision of judgments. But all forms by which thought holds sensations in unity (the formative or synthetic elements of language) had their place assigned in a system where one leads up to and passes over into another.

The fact which ordinary thought ignores, and of which ordinary logic therefore provides no account, is the presence of gradation and continuity in the world. The general terms of language simplify the universe by reducing its variety of individuals to a few forms, none of which exist simply and perfectly. The method of the understanding is to divide and then to give a separate reality to what it has thus distinguished. It is part of Hegel's plan to remedy this one-sided character of thought, by laying bare the gradations of ideas. He lays special stress on the point that abstract ideas when held in their abstraction are almost interchangeable with their opposites—that extremes meet, and that in every true and concrete idea there is a coincidence of opposites.

The beginning of the logic is an illustration of this. The simplest term of thought is being; we cannot think less about anything than when we merely say that it is. Being—the

abstract "is"—is *nothing* definite, and nothing at least *is*. Being and not being are thus declared identical—a proposition which in this unqualified shape was to most people a stumbling-block at the very door of the system. Instead of the mere "is" which is as yet nothing, we should rather say "becomes," and as "becomes" always implies "something" we have determinate being—"a being" which in the next stage of definiteness becomes "one." And in this way we pass on to the quantitative aspects of being.

It is impossible to give a brief account of the long development of thought, especially as the cogency of the demonstration lies in the details. The logical idea is treated under the three heads of being (*Seyn*), essence (*Wesen*), and notion (*Begriff*). The terms treated under the first head, in addition to those already mentioned, are the abstract principles of quantity and number, and their application in measure to determine the limits of being. Under the title of essence are discussed those pairs of correlative terms which are habitually employed in the explanation of the world—such as law and phenomonon, cause and effect, reason and consequence, substance and attribute. Under the head of notion are considered, firstly, the subjective forms of conception, judgment, and syllogism; secondly, their realization in objects as mechanically, chemically, or teleologically constituted; and thirdly, the idea first of life, and next of science, as the completo interpenetration of thought and objectivity. The third part of logic evidently is what contains the topics usually treated in logic-books, though even here the province of logio in the ordinary sense is exceeded. The first two divisions—the "objective logio"—are what is usually called metaphysics.

The characteristic of the system, and one impossible to exhibit in a resumé, is the gradual way in which idea is linked to idea so as to make the division into chapters only an arrangement of convenience. The judgment is completed in the syllogism; the syllogistio form as the perfection of subjective thought passes into objectivity, where it first appears embodied in a mechanical system; and the teleological object, in which the members are as means and end, leads up to the idea of life, where the end is means and means end indissolubly till death. In some cases these transitions may be unsatisfactory and forced; it is apparent that the linear development from "being" to the "idea" is got by transforming into a logical order the sequence that has roughly prevailed in philosophy from the Eleatics; cases might be quoted where the reasoning seems a play upon words; and it may often be doubted whether certain ideas do not involve extra-logical considerations. The order of the categories is in the main outlines fixed; but in the minor details much depends upon the philosopher, who has to fill in the gaps between ideas, with little guidance from the data of experience, and to assign to the stages of development names which occasionally deal hardly with language. The merit of Hegel is to have indicated and to a large extent displayed the filiation and mutual limitation of our forms of thought; to have arranged them in the order of their comparative capacity to give a satisfactory expression to truth in the totality of its relations; and to have broken down the partition which in Kant separated the formal logio from the transcendental analytic, as well as the general disruption between logic and metaphysic. It must at the same time be admitted that much of the work of weaving the terms of thought, the categories, into a system has a hypothetical and tentative character, and that Hegel has rather pointed out the path which logio must follow, viz., a criticism of the terms of scientifio and ordinary thought in their filiation and interdependence, than himself in every case kept to the right way. The day for a fuller investigation of this problem will partly depend upon the progress of the study of language in the direction marked out by W. von Humboldt.

The Philosophy of Nature starts with the result of the logical developmont, with the full scientific "idea." But the relations of pure thought, losing their inwardness, appear as relations of space and time; tho abstract development of thought appears as matter and movement. Instead of thought, we have perception; instead of dialectic, gravitation; instead of causation, sequence in time. The whole falls under the three heads of mechanics, physics, and "organic,"—the content under each varying somewhat in the three editions of the *Encyclopädie*. The first treats of space, time, matter, movement; and in the solar system we have the representation of the idea in its general and abstract material form. Under the head of physics we have the theory of the elements, of sound, heat, and cohesion, and finally of chemical affinity,—presenting the phenomena of material change and interchange in a series of special forces which generate the variety of the life of nature. Lastly, under the head of "organic," come geology, botany, and animal physiology,—presenting the concrete results of these processes in the three kingdoms of nature.

The charges of superficial analogies, so freely urged against the "Natur-philosophie" by critics who forget the impulse it gave to physical research by the identification of forces then believed to be radically distinct, do not particularly affect Hegel. But in general it may be said that he looked down upon the mere natural world. The meanest of the fancies of the mind and the most casual of its whims he regarded as a better warrant for the being of God than any single object of nature. Those who supposed astronomy to inspire religious awe were horrified to hear the stars compared to cruptive spots on the face of the sky. Even in the animal world, the highest stage of nature, he saw a failure to reach an independent and rational system of organization; and its feelings under the continuous violence and menaces of the environment he described as insecure, anxious, and unhappy.

His point of view was essentially opposed to the current views of science. To metamorphosis he only allowed a logioal value, as explaining the natural classification; the only real, existent metamorphosis he saw in the development of the individual from its embryonio stage. Still more distinctly did he contravene the general tendency of scientific explanation. "It is held the triumph of science to recognize in the general process of the earth the same categories as are exhibited in the processes of isolated bodies. This is, however, an application of categories from a field where the conditions are finite to a sphere in whioh the circumstances are infinite." In astronomy he depreciates the merits of Newton and elevates Kepler, accusing Newton particularly, *à propos* of the distinction of centrifugal and centripetal forces, of leading to a confusion between what is mathematically to be distinguished and what is physically separate. The principles which explain the fall of an apple will not do for the planets. As to color, he follows Goethe, and uses strong language against Newton's theory, for the barbarism of the conception that light is a compound, the incorrectness of his observations, etc. In chemistry, again, he objects to the way in which all the chemical elements are treated as on the same level.

The third part of the system is the Philosophy of Mind. Its three divisions aro the "subjective mind" (psychology), the "objective mind" (philosophic jurisprudence, moral and political philosophy), and the "absolute mind" (the philosophy of art, religion, and philosophy). The subjects of the second and third divisions have been treated by Hegel with great detail. The "objective mind" is the topic of the *Rechts-Philosophie*, and of the lectures on the Philosophy of History; while on the "absolute mind" we have the lectures on Æsthetic, on the Philosophy of Religion, and on the History of Philosophy—in short, more than one-third of his works.

The purely psychological branch of the subject takes up half of the space alloted to "Geist" in the *Encyclopädie*. It falls under the three heads of anthropology, phenomenology, and psychology proper. Anthropology treats of the mind in union with the body,—of the natural soul,—and discusses the relations of the soul with the planets, the races of mankind, the differences of age, dreams, animal magnetism, insanity, and phrenology. In this obscure region it is rich in suggestions and rapprochements; but the ingenuity of these speculations attracts curiosity more than it satisfies scientifie inquiry. In the *Phenomenology* consciousness, self-consciousness, and reason are dealt with. The title of the section and the contents recall, though with some important variations, the earlier half of his first work; only that here the historical background on which the stages in the development of the ego were represented has disappeared. Psychology, in the stricter sense, deals with the various forms of theoretical and practical intellect such as attention, memory, desire, and will. In this account of the development of an independent, active, and intelligent being from the stage where man like the Dryad is a portion of the natural life around him, Hegel has combined what may be termed a physiology and pathology of the mind,—a subject far wider than that of ordinary psychologies, and one of vast intrinsio importance. It is, of course, easy to set aside these questions as unanswerable, and to find artificiality in the arrangement. Still it remains a great point to have even attempted some system in the dark anomalies which lie under the normal consciousness, and to have traced the genesis of the intellectual facultics from animal sensitivity.

The theory of the mind as objectified in the institutions of law, the family, and the state is discussed in the "Philosophy of Right." Beginning with the antithesis of a legal system and morality, Hegel, carrying out the work of Kant, presents the synthesis of these elements in the ethical life (*Sittlichkeit*) of the family and the state. Treating the family as an instinctive realization of the moral life, and not as the result of contraot, he shows how by the means of wider associations due to private interests the state issues as the full home of the moral spirit, where intimacy of interdependence is combined with freedom of independent growth. The state is the consummation of man as finite; it is the necessary starting-point whence the spirit rises to an absolute existence in the spheres of art, religion, and philosophy. In the finite world or temporal state, religion, as the finite organization of a church, is, like other societies, subordinate to the state. But on another side, as absolute spirit, religion, like art and philosophy, is not subject to the state, but belongs to a higher region.

The political state is always an individual, and the relations of these states with each other and the "world-spirit" of which they are the manifestations constitute the material of history. The *Lectures on the Philosophy of History*, edited by Gans and subsequently by Karl Hegel, is the most popular of Hegel's works. The history of the world is a scene of judgment where one people and one alone holds for a while the sceptre, as the unconscious instrument of the universal spirit, till another rises in its place, with a fuller measure of liberty—a larger superiority to the bonds of natural and artificial circumstance. Three main periods—the Oriental, the Classical, and the Germanic—in which respectively the single despot, the dominant order, and the man as man possess freedom—constitute the history of the world. Inaccuracy in detail and artifice in the arrangement of isolated peoples are inevitable in such a scheme. A graver mistake, according to some critics, is that Hegel, far from giving a law of progress, seems to suggest that the history of the world is nearing an end, and has merely reduced the past to a logical formula. The answer to this charge is partly that such a law seems unattainable, and partly that the idealistio content of the present which philosophy extracts is always an advance upon actual fact, and so does throw a light into the future. And at any rate the method is greater than Hegel's employment of it.

But as with Aristotle so with Hegel—beyond the ethical and political sphere rises the world of absolute spirit in art, religion, and philosophy. The psychologioal distinction between the three forms is that sensuous perception (*Anschauung*) is the organon of the first, presentative conception (*Vorstellung*) of the second, and free thought of the third. The work of art, the first embodiment of absoluto mind, shows a sensuous conformity between the idea and the reality in which it is expressed. The so-called beauty of nature is for Hegel an adventitious beauty. The beauty of art is a beauty born in the spirit of the artist and born again in the spectator; it is not like the beauty of natural things, an incident of their existence, but is "essentially a question, an address to a responding breast, a call to the heart and spirit." The perfection of art depends on the degree of intimacy in which idea and form appear worked into each other. From the different proportion between the idea and the shape in which it is realized arise three different forms of art. When the idea, itself indefinite, gets no further than a struggle and endeavor for its appropriate expression, we have the symbolic, which is the Oriental, form of art, which seeks to compensate its imperfect expression by colossal and enigmatio structures. In the second or classical form of art the idoa of humanity finds an adequate sensuous representation. But this form disappears with the decease of Greek national life, and on its collapse follows the romantic, the third form of art; where the harmony of form and content again grows defective, because the object of Christian art—the infinite spirit—is a theme too high for art. Corresponding to this division is the classification of the single arts. First comes architecture—in the main, symbolio art; then sculpture, the classical art *par excellence;* they are found, however, in all threo forms. Painting and musio are the specially romantic arts. Lastly, as a union of painting and musio comes poetry, where the sensuous element is more than ever subordinate to tho spirit.

The lectures on the Philosophy of Art stray largely into the next sphere and dwell with zest on the close connection of art and religion; and the discussion of the decadence and rise of religions, of the æsthetic qualities of Christian legend, of the age of chivalry, etc., make the *Æsthetik* a book of varied interest.

The lectures on the Philosophy of Religion, though unequal in their composition and belonging to different dates, serve to exhibit the vital connection of the system with Christianity. Religion, like art, is inferior to philosophy as an exponent of the harmony between man and the absolute. In it the absolute exists as the poetry and music of the heart, in the inwardness of feeling. Hegel after expounding the nature of religion passes on to discuss its historical phases, but in the immature state of religious science falls into several mistakes. At the bottom of the scale of nature-worships he places the religion of sorcery. The gradations which follow are apportioned with some uncertainty amongst the religions of the East. With the Persian religion of light and the Egyptian of enigmas we pass to those faiths where Godhead takes the form of a spiritual individuality, *i. e.*, to the Hebrew religion (of sublimity), the Greek (of beauty), and the Roman (of adaptation). Last oomes absolute religion, in which the mystery of the reconciliation between God and man is an open doctrine. This is Christianity, in which God is a Trinity, because He is a spirit. The revelathe Son of God, in the immediate aspect, is the finite world of tion of this truth is the subject of the Christian Scriptures. For nature and man, which far from being at one with its Father is originally in an attitude of estrangement. The history of Christ is the visible reconciliation between man and the eternal. With the death of Christ this union, ceasing to be a mere fact, becomes a vital idea,—the Spirit of God which dwells in the Christian community.

The lectures on the History of Philosophy deal disproportionately with the various epochs, and in some parts date from the beginning of Hegel's career. In trying to subject history to the order of logio they sometimes misconceive the filiation of ideas. But they created the history of philosophy as a scientific study. They showed that a philosophical theory is not an accident or whim, but an exponent of its age determined by its antecedents and environments, and handing on its results to the future.

For ten years after Hegel's death his system remained the foremost intellectual phenomenon of the time. Besides Gans, Hinrichs, Henning, and Hotho, who have been already alluded to, the most prominent of his immediate disciples were Gabler, whose *Propädeutik* is a good introduction to Hegel; K. L. Michelet, one of the most ardent Hegelians, who is now (1879) on the point of completing a summary of the system; Daub and Marheineke, two theologians; and Göschel, whose *Aphorismen über nicht- Wissen und absolutes Wissen* elicited an appreciative review from Hegel. In æsthetics, where the school won some distinction, are the names of Schasler, Rosonkranz, and Vischer. Karl Rosenkranz, the literary champion of the system, has just ended a life devoted to its exposition; Erdmann still teaches in its spirit at Halle, as does Kuno Fischer at Jena. The last two have specially distinguished themselves by their histories of modern philosophy. With Michelet they form the more orthodox and conservative section of the school. The opposition to its doctrines was concentrated in the *Zeitschrift für Philosophie*, founded in 1837 by the younger Fichte with the help of Weisse; while Beneke and other followers of Herbart vigorously attacked its metaphysics and psychology. But the most notable outgrowth of Hegelianism was the so-called "Left," the critical and heterodox school of Feuerbach, Bruno Bauer, and Ruge. While Hegel had vindicated God as the subject of metaphysics, maintained the consonance of philosophy and theology, and elevated the state to sovereignty in ethics, the Left eliminated God from the system, exposed its alleged pantheistic or atheistic tendencies, and reasserted the supremacy of the individual in morals. To discuss tho evolution of Hegelianism in this direction would almost be to write the history of modern German philosophy up to 1860. Hegelianism has now ceased to exist as an isolated system in Germany, though its spirit and method have leavened the whole mass of philosophic thought. Out of Germany, besides occasional admirers and disciples, it has attracted a considerable amount of general curiosity. In England it has stimulated philosophical thought, and probably suggested the correction of some national limitations; but few if any profess to accept the system in its integrity. Professor Vera of Naples is perhaps its most enthusiastic advocate on the Continent, whilst the *Journal of Speculative Philosophy* upholds its banner in America.

Bibliography.—Shortly after Hegel's death his collected works were published by a number of his friends, who combined for the purpose. They appeared in eighteen volumes in 1832, and a second edition came out about twelve years later. Volumes i.–viii. contain the works published by himself; the remainder is made up of his lectures on the Philosophy of History, Æsthetic, the Philosophy of Roligion, and the History of Philosophy, besides some essays and reviews, with a few of his letters, and the Philosophical Propædeutic.

For his life see Rosenkranz, *Leben Hegels*, Berlin, 1844; Haym, *Hegel und seine Zeit*, Borlin, 1857; Köstlin, *Hegel in philosophischer, politischer, und nationaler Beziehung*, Tübingen, 1870; Rosenkranz, *Hegel als Deutscher National-philosoph*, Berlin, 1870, and his *Neue Studien*, vol. iv., Berlin, 1878.

For the philosophy, see Ruge's *Aus Früherer Zeit*, vol. iv., Borlin, 1867; Haym (as above). Trendelenburg (in *Logische Untersuchungen*), Kym (*Metaphysiche Untersuchungen*), and C. Hermann (*Hegel und die logische Frage*, and other works) are noticeable as modern critics. Vera has translated the *Encyclopädie* into Frenoh, with notes; Bénard, the *Æsthetics*. In English Dr. Stirling's *Secret of Hegel*, 2 vols., London, 1865, oontains a translation of tho beginning of the *Wissenschaft der Logik;* the "Logic" from the *Encyclopädie* has been translated, with prolegomena, by W. Wallace, Oxford, 1874; and large portions have been translated in the *American Journal of Speculative Philosophy*—especially by its energetic editor, W. T. Harris. (W. W.)

HEIBERG, Johan Ludvig (1791–1860), Danish poet and critic, was the son of the political writer Peter Andreas Heiberg, and of the famous novelist, afterwards the Baroness Gyllembourg-Ehrensvärd. He was born at Copenhagen, December 14, 1791. In 1800 his father was exiled, and he was taken by Rahbek and his excellent wife into their house at Bakkehuset. They found him, however, very difficult to manage, and about 1802 sent him back to his own family. His mother's marriage being by a state decree annulled, she married the Swedish baron Gyllembourg-Ehrensvärd, keeping up, however, friendly corre-

spondence with her first husband in Paris. In 1805 she describes, in one of these letters, the brilliant precocity of the young Johan. The latter proceeded to the university of Copenhagen in 1809. It was not needful that he should earn his bread, and accordingly his mother indulged for many years his extraordinary thirst for knowledge. In 1812 he visited Sweden, and made some long stay in Stockholm; he afterwards sent to his mother from Upsala the first important poem which he composed, *Hjemkomsten* (The Return Home), a piece of remarkable strength and brightness. In 1813 his first publication appeared, a romantic drama for children, entitled *The Theatre for Marionettes*. This was followed by *Christmas Jokes and New Year's Tricks* in 1816, *The Initiation of Psyche*, 1817, and *The Prophecy of Tycho Brahe*. These works attracted attention at a time when Baggesen, Oehlenschläger, and Ingemann possessed the popular ear, and were understood at once to be the opening of a great career. In 1817 Heiberg took his degree, and in 1819 went abroad with a grant from Government. He proceeded to Paris, and spent the next three years there, under his father's roof. In 1822 he published his drama of *Nina*, and was made professor of the Danish language at the university of Kiel. At this town he delivered a course of lectures, comparing the Scandinavian mythology as found in the *Edda* with the poems of Oehlenschläger. These lectures were published in German in 1827. In 1825 Heiberg came back to Copenhagen for the purpose of introducing the vaudeville[1] on the Danish stage. Meanwhile he was producing dramatic work of a more serious kind: in 1828 he brought out the national drama of *Elverhöi*, in 1835 the comedy of *The Elves*, and in 1838 *Fata Morgana*. In 1841 Heiberg published a volume of *New Poems*, containing "A Soul after Death," which is perhaps his masterpiece, "The Newly Wedded Pair," and other pieces. All this time he had been busily engaged in editing the famous journal, *The Copenhagen Flying Post*, which he founded in 1827 and continued until 1837. In 1831 he married Johanne Louise Pætges, the greatest actress that Scandinavia has produced. Heiberg's scathing satires at last began to make him very unpopular; and this antagonism reached its height when, in 1845, he published his little malicious drama of *The Nut Crackers*. Notwithstanding this he received in 1847 the responsible post of director of the national theatre, for which indeed he was more eminently fitted than any other living person. He filled it for seven years, working with great zeal and conscientiousness, but was forced by intrigues from without to resign it in 1854. His health was much disturbed by these attacks, and he retired into private life. Heiberg died at Bonderup, near Ringsted, on the 25th of August, 1860.

It has been said that "the average cultivated Dane nowadays is very much what Heiberg has made him." His influence upon taste and critical opinion was greater than that of any writer of his time, and can only be compared with that of Holberg in the 18th century. Most of the poets of the Romantic movement in Denmark were very grave and serious; Heiberg added the element of humor, elegance, and irony to the dignity of Oehlenschläger, the pathos of Ingemann, and the passion of Hertz. His versification was refined and exact, and his very best pieces are those in which he mingles rich lyrical expression with what is satirical or purely ludicrous. The works of Heiberg were collected, in 11 vols., in 1861–62.

HEIDE, a town of Prussia, chief town of the circle of North Ditmarsh, province of Schleswig-Holstein, is situated on a small plateau which stands between the marshes and moors bordering the North Sea, 35 miles N. N. W. of Glückstadt. It is the seat of a provincial office, a court of justice, and a head tax office, and possesses tobacco and cigar manufactories, a tannery, and a rope work. Heide in 1447 became the capital of the Ditmarsh peasant republic, but on the 13th June, 1559, it was the scene of the complete defeat of the peasant forces by the Danes and the duke of Schleswig-Holstein. The population in 1905 was 8,758.

HEIDEGGER, John Henry (1633–1698), theologian, was born at Bärentschweil, in the canton of Zurich, Switzerland, on July 1, 1633. He began his studies in his native country, and completed them at Marburg and Heidelberg. Becoming doctor of philosophy at the latter university, he soon afterwards was appointed professor extraordinarius of Hebrew, and later of philosophy. From Heidelberg he was in 1659 summoned to Steinfurt to fill the chair of theology and ecclesiastical history, and in the same year he became doctor of theology of Heidelberg. In 1660 he revisited Switzerland; and, after marrying, he travelled in the following year over Holland. The war at this time having dispersed the students from Steinfurt, Heidegger returned in 1665 to Zurich, where he was immediately elected professor of moral philosophy. Two years later he succeeded Hottinger in the chair of theology, which he occupied till his death, January 15, 1698. Heidegger was the principal author of the *Formula Consensus Helvetica* in 1675, which was designed to unite the Swiss Reformed churches, but had an opposite effect.

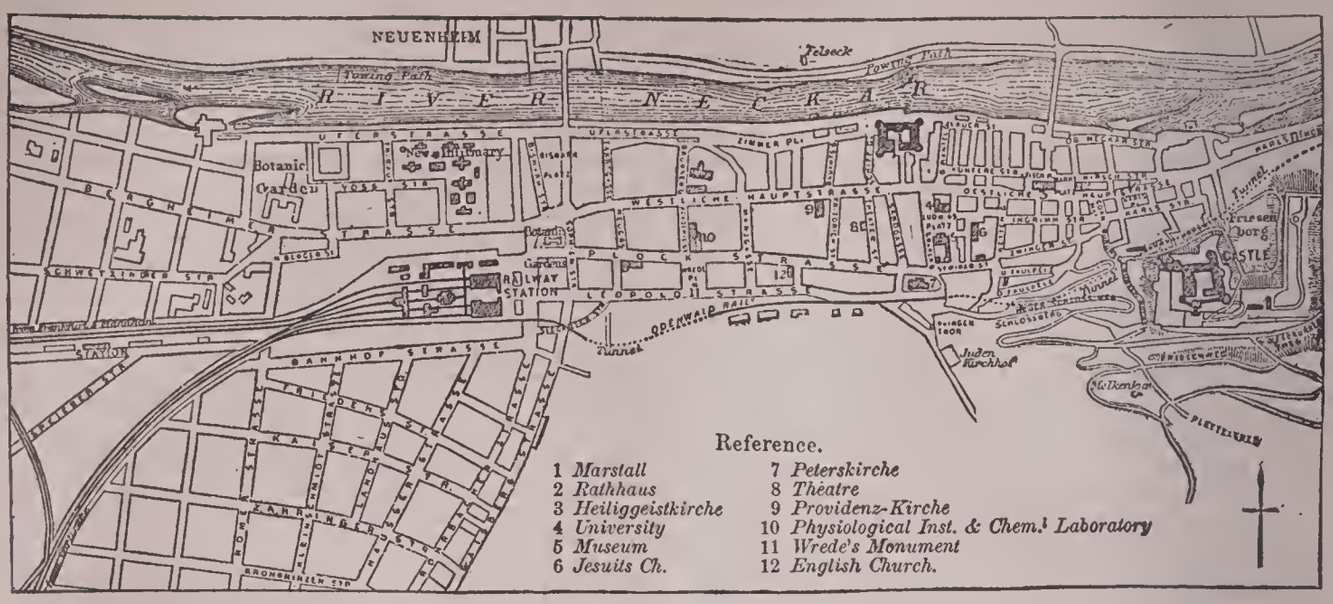
His writings are largely controversial, and are in great part levelled against the Roman Catholic Church. The chief are *De Historia sacra Patriarcharum Exercitationes selectæ*, 1667–1671; *Dissertatio de Peregrinationibus Religiosis*, 1670; *De Ratione Studiorum, opuscula aurea*, etc., 1670; *Historia Papatus*, 1684; *Tumulus Concilii Tridentini*, 1690; *Exercitationes Biblicæ*, 1700; with a life of the author prefixed; *Corpus Theologiæ Christianæ*, 1700; and lives of Hottinger, 1667, and Fabricius, 1698. His autobiography appeared in 1698, under the title *Historia Vitæ J. H. Heideggeri*.

HEIDELBERG, a German university city in the Baden circle and jurisdiction of the same name, lies in 49° 24′ N. lat. and 8° 41′ 32″ E. long., at the foot of the Castlehill, a spur of the Königsstuhl on the south bank of the Neckar, about 12 miles from the junction of that river with the Rhine. The situation of the town is one of romantic beauty. Placed at the opening of the winding Neckar valley, it has behind it and before it lofty hills covered with vineyards and forests. Between these the Neckar rushes swiftly along. To the left the country opens out into the broad Rhine plain, cultivated like a garden, and bounded by distant and hardly perceptible mountains. The town primarily consists of one long narrow street, the Hauptstrasse, which begins near the station of the Main-Neckar railway on the west, and runs parallel to the river with continuations for a distance of about 2 miles to the Karlsthor (where there is a smaller station) on the east. To the south of this the Anlage, a pleasant promenade flanked with fine houses and gardens, leads directly from the chief station to the centre of the town. A number of smaller streets run up from the river, intersecting the Hauptstrasse at right angles. On the other side of the Neckar the Heiligenberg, a vine-clad hill wooded towards the summit, crowned with the ruins of an old chapel, rises abruptly from the river bank. About half-way up the hill the Philosophenweg, a famous road, runs from the Hirschgasse opposite the Karlsthor to the suburb of Neuenheim, opposite the railway station. At this point the Neckar valley ceases, and the river flows slowly onward in the almost level Rhine plain. Of late years the town has grown very much towards the west end on both sides of the river. The additions have been almost entirely of the better class of houses.

Of the churches the chief are the Peterskirche (founded before 1392), where Jerome of Prague in 1460 expounded the Reformed doctrines; the Heiliggeistkirche, erected at the beginning of the 15th century, of which the nave is used for Protestant, the choir for Old Catholic worship; and the Jesuitenkirche, with sumptuously decorated interior. All these are built in the Gothic style. The rathhaus, the museum, and the university (1712) are large but common-place erections. Two handsome bridges cross the Neckar. That to the east, opposite the castle (built 1788), is adorned with a gateway, and with statues of Minerva and the elector Charles Theodore of the palatinate; the other (built 1877) unites Heidelberg and Neuenheim. In the west part of the town there is a bronze statue of Field-Marshal Prince Wrede (1767–1838), erected in 1860 by Louis I., king of Bavaria. The chief building at Heidelberg, and indeed its chief attraction for strangers, is the famous castle which overhangs the west part of the town. It is situated on the Castlehill, more properly called the Jettenbuhel, 330 feet above the Neckar. Though now a ruin, yet its extent, its magnificence, its beautiful situation, its interesting history, render it by far the most noteworthy as it certainly is the grandest and largest, of the old castles of Germany. It was begun about the end of the 13th cen-

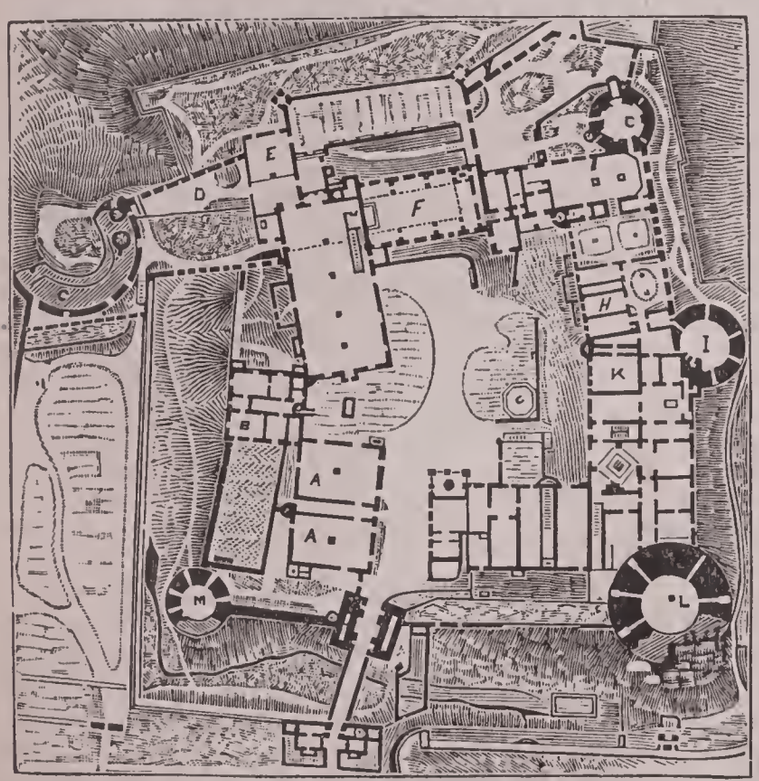
[1] He composed a great number of vaudevilles, of which the best known are *King Solomon and George Hatmaker*, 1825; *April Fools*, 1826; *A Story in Rosenborg Garden*, 1827; *Kjöge Huskors*, 1831; *The Danes in Paris*, 1833; *No*, 1836; *Yes*, 1839; and *Emily's Beating Heart*, 1840.

tury Elector Rupert greatly improved it, and erected the Rupert's building in the early part of the 15th century; succeeding electors of the palatinate did much for it, especially Frederick V., the unfortunate king of Bohemia. It suffered greatly during the Thirty Years' War, but was restored by Charles Louis (1650–1680). It was dismantled



Plan of Heidelberg.

by the French in 1689, and again in 1693. In 1764 it was struck by lightning and its destruction completed. The castle as it at present stands is a square edifice formed of several distinct structures built round a large court-yard; the entrance is on the south side. The court-yard contains a fountain adorned with four granite pillars brought from



Ground-Plan of Heidelberg Castle.

A. Rupert's Building.
B. Old or Rudolph's Building.
C. The Thick Tower.
D. The English or Elizabeth's Building.
E. The Great-Tun Room.
F. Frederick's Building.
G. The Octagonal Tower.
H. Otto Henry's Building.
I. Library Tower.
K. Louis's Tower.
L. The Blown-up Tower.
M. Louis's Tower.

Charlemagne's palace at Ingelheim. The chief parts of the castle are Rupert's building (about 1400) on the left; Otto Henry's building (1556) on the right, "the finest example of Renaissance architecture in Germany," a lofty building of which the front is richly decorated; Frederick's building (1601), the finest part, forming the northern portion of the whole, and adorned with a large number of imposing statues. Within this is the chapel, and behind it the Altan (1610), or castle balcony, which directly overhangs the town and from which the finest of Heidelberg views is obtained. The castle contains an interesting antiquarian museum[1] formed by the Count Graimberg, and the celebrated Great Tun, which was built in 1751, but has been only used on one or two occasions. Its capacity is 49,000 gallons. There is a castle garden, spacious and well laid out.

The university of Heidelberg is the oldest in the German kingdom. It was founded in 1356 by the elector Rupert, but it was not till 1386, when it obtained papal sanction, that its real life begins. It was constructed after the type of Paris, had four faculties, and possessed numerous privileges. Marselius von Inghen was its first rector. Frederick the Victorious, Philip the Upright, and Louis V. respectively cherished it. Otto Henry gave it a new organization, further endowed it, and founded the library. At the Reformation it became a stronghold of Protestant learning. The famous Heidelberg catechism was drawn up by its theologians. Then the tide turned. Damaged by the Thirty Years' War, it led a struggling existence for a century and a half. A large portion of its remaining endowments were cut off by the peace of Lunéville (1801). In 1803 however the elector Charles Frederick raised it anew, and reconstituted it under the name of "Ruperto-Carolina." At present (1907–8) the university of Heidelberg has 176 ordinary and extraordinary professors. The number of the students of 1907–8 was 1,933. A very large proportion are English and Americans. The library was first kept in the choir of the Heiliggeistkirche, and then consisted of 3500 MSS. In 1623 it was sent to Rome by Tilly, and stored as Bibliotheca Palatina in the Vatican. It was afterwards taken to Paris, and in 1815 was restored to Heidelberg. In 1703 the new library was founded; it has now nearly 300,000 volumes, besides many valuable MSS. Among the other university institutions are the academic hospital, the maternity hospital, the physiological institution, the chemical laboratory, and the zoological museum.

The other educational foundations are a gymnasium and a burgher and a real school. There is a small theatre (closed during the summer months) and a Kunstverein. The manufactures of Heidelberg are unimportant. The inhabitants chiefly support themselves by supplying the wants of a large and increasing body of foreign permanent residents, of the considerable body of tourists who during the summer pass through the town, and of the university students. The population of the town and outlying suburbs was 19,988 in 1871, and according to the census of Dec. 31, 1905, was 49,527. About one-third are Catholics. The town is well lighted, and is supplied with excellent water from the Wolfsbrunnen.

[1] This museum was acquired by the town in 1879.

Heidelberg at an early period was a fief of the bishop of Worms, but the rulers of the palatinate came more and more to reside there, till Count Otho of Wittelsbach (1228–1253) made it the capital of the palatinate, and this it continued to be for nearly six centuries. As Heidelberg was one of the great centres of the Reformed faith, it suffered severely in the Thirty Years' War. In 1622 it was sacked by Tilly, and in 1633 was taken by the Swedes. In 1634 it was beleaguered by the Bavarians. In 1635 it was occupied by the imperial forces under Gallas. At the peace of Westphalia (1648) Charles Louis, son of Frederick V., was restored, and he did much to raise the castle, the university, and the town. In 1688, and again in 1693, it was sacked by the French. On the last occasion, so thorough was the work of destruction that only one house—a quaintly decorated erection in the Marktplatz now used as an inn—escaped. In 1720 Charles Philip removed his court to Mannheim, and in 1803 the town became part of the grand duchy of Baden. On 5th March, 1848, was held the famous Heidelberg assembly, at which steps were taken that led to the German revolution of that year.

Of the numerous topographical works on Heidelberg, those of Fickler (1863) and Oncken (2d ed., 1874) may be mentioned. The *Wegweiser durch Heidelberg* (1879) supplies a briefer and more popular account. The university annals are told in Hautz's *Geschichte der Universität Heidelbergs* (2 vols., 1863–64), and the very interesting history of the library in Wilken's *Geschichte der Bildung, Beraubung, und Vernichtung, der alten Heidelberger Büchersammlung* (1817), and in Ruland's *Zur Geschichte der alten nach Rom entführten Bibliothek zu Heidelberg*, Leip., 1856. The *Heidelberger Jahrbücher* (1817–73) contains a mass of interesting and important information as to the history of the town and castle. (F. WA.)

HEIDELOFF, KARL ALEXANDER VON (1788–1865), a German architect, was the son of Victor Peter Heideloff, a painter of some reputation, and was born at Stuttgart 2d February, 1788. He studied at the art academy of his native town, and after following the profession of an architect for some time at Coburg was in 1818 appointed city architect at Nuremberg. In 1822 he became professor at the polytechnic school, and some years later he was chosen conservator of the monuments of art. Heideloff devoted his chief attention to the Gothic style of architecture, and the buildings restored and erected by him at Nuremberg and in its neighborhood attest both his original skill and his purity of taste. He also achieved some success as an historical painter. He died at Hassfurt 28th September, 1865.

Among his writings on architecture are *Die Lehre von den Säulenordnungen*, 1827; *Der Kleine Vignola*, 1832; *Nürnbergs Baudenkmäler der Vorzeit*, 1838–43; and *Die Ornamentik des Mittelalters*, 1838–42.

HEILBRONN, a town of Würtemberg, in the circle of the Neckar, is situated in a pleasant and fruitful valley on the Neckar, and at the junction of several railways, 26 miles N. of Stuttgart. It is the seat of a circle court, a jury court, a superior tribunal, a head tax office, and a chamber of commerce. In the older part of the town the streets are narrow, and it contains a number of high turreted houses with quaintly adorned gables. The old fortifications have now been demolished, and their site is occupied by promenades, outside of which are the more modern parts of the town with wide streets and many handsome buildings. The principal public buildings are the church of St. Kilian, in the Gothic and Renaissance styles, begun in 1019 and completed in 1529, with an elegant tower 210 feet high, a beautiful choir, and a finely carved altar; the town-house, founded in 1540, and possessing a collection of interesting documents; the house of the Teutonic knights, now used as barracks; the Catholic church of St. Joseph; the tower on the Neckar in which Götz von Berlichingen was confined in 1525; the synagogue, the prison, and the hospital. The educational establishments include a gymnasium, a real-school of the second order, an agricultural school, and a female school of industry. The town in a commercial point of view is the most important in Würtemberg, and possesses an immense variety of manufactures, of which the principal are gold, silver, steel, and iron wares, machines, sugar of lead, white lead, vinegar, beer, eau de Cologne, sugar, tobacco, soap, oil, cement, sulphuric acid, tartaric acid, artificial manure, glue, soda, tapestry, thread, and cloth. Grapes, fruit, vegetables, and flowering shrubs are largely grown in the neighborhood, and there are large quarries for sandstone and gypsum. By means of the Neckar a considerable trade is carried on in wood, bark, leather, agricultural produce, fruit, and cattle. The population in 1905 was 40,005.

Heilbronn occupies the site of an old Roman settlement. Its name—originally Heiligbronn or holy spring—was bestowed on it by Charlemagne from a spring of water which until 1857 was to be seen issuing from under the high altar of the church of St. Kilian. In 1225 Heilbronn became a free imperial city. It was frequently besieged during the Middle Ages, and it suffered greatly during the Peasants' War, the Thirty Years' War, and the various wars with France. In 1803 it came into the possession of Würtemberg.

HEILIGENSTADT, a town of Prussian Saxony, government district of Erfurt, is situated on the Leine and on the railway from Halle to Cassel, 32 miles E. N. E. of Cassel. It possesses an old castle, formerly belonging to the electors of Mainz, one Evangelical and two Catholic churches, a Catholic gymnasium, a Catholic normal school, two orphanages, and an infirmary. The principal manufactures are woollen wares, cigars, paper, bone dust, and needles. The population in 1905 was 7,955.

Heiligenstadt is said to have been built by Dagobert, and was formerly the capital of the principality of Eichsfeld. In 1022 it was acquired by the archbishop of Mainz, and in 1103 it came into the possession of Henry the Proud, but when Henry the Lion was placed under the ban of the empire it again came to Mainz. It was destroyed by fire in 1333, and was captured in 1478 by Count Henry the Young of Schwarzburg, and in 1525 by Duke Henry of Brunswick. In 1803 it came into the possession of Prussia.

HEILSBERG, a town of Prussia, capital of a circle in the government district of Königsberg, is situated at the junction of the Simser and Alle, 38 miles S. of Königsberg. It has one Evangelical and two Catholic churches, and an old castle formerly the seat of the prince-bishops of Ermland, but now used as an infirmary. The principal industries are cloth-weaving, yarn and thread spinning, dyeing, and brewing, and there is considerable trade in grain. The population of the town in 1905 was 6,024.

The castle founded at Heilsberg by the German knights in 1240 became afterwards the property of the bishops of Ermland, who in 1306 made it their seat—an honor which it retained for 500 years. On the 10th June, 1807, a battle took place at Heilsberg between the French and the Russians under Benningsen, which, although the French who attacked thought it prudent to withdraw before victory declared for either side, resulted on the following day in the retreat of the Russians.

HEILSBRONN, or KLOSTER-HEILSBRONN, a market-village in the Bavarian government of Middle Franconia, with a station on the railway between Nuremberg and Ansbach. In 1905 it had only 1208 inhabitants, but in the Middle Ages it was the seat of one of the great monasteries of Germany. This foundation, which belonged to the Cistercian order, owed its origin to Bishop Otto of Bamberg in 1132, and continued to exist till 1555. Its sepulchral monuments, many of which are figured by Hocker, *Heilsbronnischer Antiquitätenschatz* (Ansbach, 1731–40), were of exceptionally high artistic interest, ten burgraves of Nuremberg (it was their hereditary burial place), three electoral princes, five margraves of Brandenburg, and many other persons of note having been laid to rest within its walls. The buildings of the monastery have all disappeared, with the exception of the fine church, restored between 1851 and 1866. The "Monk of Heilsbronn" is the ordinary appellation of a didactic poet of the 14th century, whose *Seven Degrees, Daughter of Syon*, and *Life of Saint Alexius* were published by Merzdorf at Berlin in 1870.

See "Notæ Halesbrunnenses" and "Annales Halesbrunnenses," in Pertz, *Mon. Germ. Hist.*, vol. xvi.; Muck, *Beiträge zur Gesch. von Heilsbronn*, Ansb., 1859; Rehm, *Ein Gang durch und um die Münster-Kirche zu Kloster-Heilsbronn*, Ansb., 1875; and Stillfried, *Kloster-Heilbronn, ein Beiträge zu den Hohenzoll. Forschungen*, Berlin, 1877.

HEIM, FRANÇOIS JOSEPH (1787–1865), French painter, belongs to that group of painters in whose works we find the special characteristics of the Restoration. Born at Belfort on 16th December, 1787, he early distinguished himself at the École Centrale of Strasburg, and in 1803 entered the studio of Vincent at Paris. In 1807 he obtained the first prize, and in 1812 his picture of The Return of Jacob (Musée de Bordeaux) won for him a gold medal of the first class, which he again obtained in 1817, when he exhibited, together with other works a St. John

—bought by Vivant Denon. In 1819 the Resurrection of Lazarus (Cathédral Autun), the Martyrdom of St. Cyr (St. Gervais), and two scenes from the life of Vespasian (ordered by the king) attracted attention. In 1823 the Re-erection of the Royal Tombs at St. Denis, the Martyrdom of St. Laurence (Notre Dame), and several full-length portraits increased the painter's popularity; and in 1824, when he exhibited his great canvas, the Massacre of the Jews (Louvre), Heim was rewarded by the legion of honor. In 1827 appeared the King giving away Prizes at the Salon of 1824 (Louvre—engraved by Jazet)—the picture by which Heim is best known—and Saint Hyacinthe. Heim was now commissioned to decorate the Gallery Charles X. (Louvre), work for which he was thought eminently fit. Like many other painters of this period, Heim retained only enough of the high-pitched ideal of David to make an awkward contrast with the lively color and movement by which he tried to give interest to his subjects, and with the emptiness of form and expression which resulted from the hasty execution necessitated by the vast number of his commissions. Ridiculed by the romantists, Heim maintained his position, and replaced Regnault at the Institute in 1834, shortly after which he commenced a series of drawings of the celebrities of his day, which are of much interest. His decorations of the Conference room of the Chamber of Deputies were completed in 1844; and in 1847 his works at the Salon—Champ de Mai and Reading a Play at the Théâtre Français—were the signal for attacks renewed with great violence. Yet something like a turn of opinion in his favor took place at the exhibition of 1851; his powers as a draughtsman and the occasional merits of his composition were recognized, and toleration extended even to his color. Heim was awarded the great gold medal, and in 1855—having sent to the Salon no less than sixteen portraits, amongst which may be cited those of Cuvier, Geoffroy de St. Hilaire, and Madame Hersent—he was made officer of the legion of honor. In 1859 he again exhibited a curious collection of portraits, sixty-four members of the Institute arranged in groups of four; and six years later, on 29th September, 1865, he died, at the age of seventy-eight. Besides the paintings already mentioned, there is to be seen in Notre Dame de Lorette (Paris) a work executed on the spot; and the museum of Strasburg contains an excellent example of his easel pictures, the subject of which is a Shepherd Drinking from a Spring.

HEINE, Heinrich (1799–1856), poet and journalist, was born, according to the most trustworthy accounts, on the 13th December, 1799, at Düsseldorf, of Jewish parents. His father, after various vicissitudes in business, had finally settled in that town, and his mother, who seems to have possessed much energy of character, was the daughter of a physician of the same place. Heine received the rudiments of his education at the gymnasium or *lycée* (as it was called during the foreign occupation) of his native town, and, although not an especially apt or diligent pupil, he acquired while there a good knowledge of French and English,—he tells us that *Gulliver's Travels* in the original was one of the favorite books of his childhood,—as well as some tincture of the classics and Hebrew. But if the influence upon him of his teachers and their teaching was unimportant, not so that of the public events amid which he grew up. His early years coincided with the most brilliant period of Napoleon's career; and the boundless veneration which he is never tired of expressing for the emperor throughout his writings shows that his true schoolmasters were rather the drummers and troopers of a victorious army than the Jesuit fathers of the *lycée;* while, if to the vivid personal impression produced upon him by the pomp and circumstance of the imperial garrison in his birthplace there be added the public, and in a manner national, enthusiasm for Napoleon which he must often have heard vented by his elder co-religionists—who hailed the conqueror as a temporal Messiah—the weighty bearing of his boyhood upon his subsequent fortunes becomes fully apparent. Upon his quitting school, attempts were made to engage him in commerce, but his father and uncle, the latter a wealthy banker of Hamburg, soon perceived that he was bent upon travelling a different path from that which they had followed. It speaks well for both these men that they should have refrained from coercion upon making this discovery; and Solomon Heine, the banker, at once gave his nephew an earnest of the generous treatment the latter was subsequently to experience at his hands, for he came forward with money to enable his young kinsman to go to a university, his sole stipulation being that his protégé should study with the view of entering the legal profession. Heine gladly accepted his uncle's terms, and entered the university of Bonn in the spring of 1819. During his stay there he was an eager student; but the subjects to which he devoted himself had no connection with the profession which had been chosen for him. He seems to have attended no lectures save those on literature and history—notably A. W. von Schlegel's; and he not long afterwards acknowledged his obligations to Schlegel by dedicating a sonnet to him—a tribute which he recalled in later days by a wanton and outrageous attack upon the veteran critic in *Die Romantische Schule.* Why Heine left Bonn does not clearly appear, but it is at Göttingen that we find him in the autumn of 1820. His stay here was even shorter than at Bonn. In February, 1821, the authorities of the "Georgia Augusta" rusticated him for some infraction of the duelling laws. Although from these beginnings Heine's academical career promised to pursue no very even course, he nevertheless determined, after his residence at Göttingen had been cut short, to seek a third university; and it was to Berlin that he now repaired, where Hegel was at the zenith of his renown. Whether or not the lectures of this philosopher benefited him in any way—by giving him, for instance, as some have supposed, a certain dialectical precision of style—he has himself confessed that he seldom understood them; and in after years Hegel's ultra-conservatism and orthodoxy made him the constant butt of his former pupil's ridicule and sarcasm. But the interest of Heine's life in Berlin was social and not academic. He enjoyed the privilege of mixing in the best literary circles of the capital. He was on terms of intimacy with Varnhagen von Ense and his wife, the celebrated Jewess, Rahel, and at their house—the rendezvous of Germany's genius and learning—he frequently met such men as the Humboldts, Hegel himself, and Schleiermacher; while he lived on a still more familiar footing with a number of his own co-religionists, who without having acquired European reputation, were men of varied and approved abilities. In an atmosphere of such geniality as this his gifts were rapidly displayed. He began ere long to contribute poems to the *Berliner Gesellschafter,* many of which were subsequently incorporated in the *Buch der Lieder,* and in 1822 a volume came from the press entitled *Gedichte von Heinrich Heine,* his first avowed act of authorship. He was still further employed at this time as the correspondent of a Rhenish newspaper, as well as in completing his tragedies *Almansor* and *William Ratcliff,* which were published in 1823 with small success. He was now, indeed, fairly embarked upon his literary course. But he was still largely dependent upon his uncle; and in order so far to fulfil his engagements towards his benefactor, he returned to Göttingen in 1825, and shortly afterwards took his degree in law, having previously qualified himself for practice by publicly professing Christianity.

This act of "apostasy," as it has been called, calls for something more than a mere passing reference; for it not only laid Heine open to contumely while alive, but has provoked adverse criticism of special severity since his death. That he was guilty of "apostasy" is no doubt verbally true; but there are two circumstances in this connection which should always be remembered. The one is that Heine was wholly wanting in the religious sense—that he never was a Jew save nominally and by the accident of birth—so that he cannot, with any real propriety, be said to have forsaken the creed of his race; the other, that his family, by encouraging him to adopt a profession which could not be entered except by the gateway of "apostasy," tacitly left him free to take that step. In short, Heine's "apostasy" was a purely secular act; and, although there will doubtless be found many to stigmatize him all the more blackly for this very reason, candor appears rather to require that this change of faith, if such it can be called, should be classed as one of his most venial offences, being the plainly outward act of one who throughout life made himself peculiarly obnoxious to the imputation of malice and bad-heartedness.

Heine seems never to have made any serious attempt to practise law. His life from the year 1826 until his death was devoted entirely to literature, and more especially to journalism, which alone indeed was the main source of his income for many years. At first he lived in Hamburg, and then it was that, besides the *Buch der Lieder,* the earlier portions of the *Reisebilder* appeared, both of which, but

particularly the latter, at once created an immense sensation throughout Germany, not only among the youthful and enthusiastic, who found their own sentiments expressed by the new writer with the happiest audacity, but amongst such dignified and *rangés* personages as Metternich and Gentz. In 1827 Baron Cotta, the Bavarian publisher, offered Heine, who had risen at a bound into celebrity, the joint-editorship of the *Allgemeine Politische Annalen*. The young author accepted the offer, and betook himself to Munich in the winter of that year, after having paid a visit to London, where he found every person and everything detestable save Canning and his policy—and it may be said here in passing that a most violent hatred of England forms a marked feature of all Heine's writings. He remained for a considerable period in the South-German capital, and it was owing, not to any disagreement with his employer, but to the demands of the court of Prussia, which was not long of taking umbrage at his freedom of opinion, that his editorial function ceased so abruptly as it did. What the secret history of the next two or three years of his life was—whether from the very first he really was an object of especial disfavor at Berlin, or whether, as is quite as likely, taking his vanity and love of publicity into account, he exaggerated his powers of offence beyond the endurance of the Government there, and forced it into what seemed a petty persecution—he presently perceived that he must either quit Germany altogether or prepare for a life-time perhaps of fortress-imprisonment. He did not long hesitate between these two alternatives; and on the 1st of May, 1831, Heinrich Heine left his native land for Paris, where he lived for the rest of his life, only once recrossing the Rhine, in 1843.

Just as his adoption of Christianity has led to Heine's being pronounced "apostate," so has his self-expatriation caused German writers to denounce him as "renegade." But the one accusation is as groundless as the other. In the first place Heine was a Jew, in spite of his Christianization, and cannot therefore rightly be called a "renegade" against Germany—least of all when the degraded social and political status of his race in that country at the date of his emigration is recollected. Then again his writings were systematically subjected to the cruelest mutilations, and it is tolerably certain that had he remained in the "Fatherland," he would sooner or later have been deprived of all power of public speech. Was it any wonder, seeing that he had adopted the profession of letters, that he should have turned his back upon such a prospect? He at any rate was the best judge; and it ill becomes Germans to call him "renegade," when, had he continued to tarry among them, their literature would probably have suffered an irreparable loss. At the same time, and for the same reasons, it is equally inept to assert that he was in the essential qualities of his mind a Frenchman who gravitated towards Paris by a sort of intellectual necessity. The necessity (to use that word) was physical. Heine would never have left Germany could he have freely expressed his opinions there.

After settling in his new home, where his life for many years must have been as gay and brilliant as latterly it was sad and sombre, and where he speedily became more or less intimate with such writers as Balzac, Dumas the elder, George Sand, Victor Hugo, and Théophile Gautier, Heine devoted himself more exclusively than ever to journalism; and from 1831 until 1847, he was an active and indefatigable publicist. The two series of papers entitled *Französische Zustände* and *Lutetia* contain a selection from his press-contributions during these years; and even at this date they well repay perusal, not only by the brilliancy of wit and elegance of style which they possess in common with almost all his writings, but also by the remarkable sagacity of their political *aperçus*. Alongside of this main stream of journalism, he also kept up a subsidiary current of literature in its more proper sense—although it may be said that all his writings are of an occasional nature—and to this we owe the *Salon* (1833–39), which comprises among other pieces a series of articles, "Zur Geschichte der Religion und Philosophie in Deutschland," which had originally appeared in the *Revue des Deux Mondes*, and in which Heine came forward as the introducer of German thought to the reading world of Paris. The *Salon* also contains several admirable papers in art-criticism, and a strange, fragmentary medley of sentiment and satire, in its author's most characteristic vein—"Die Florentinische Nächte." To this period, too, belongs *Die Romantische Schule*, to which reference has already been made, and the substance of which is sufficiently indicated by its name. In 1839 *Shakespeare's Mädchen und Frauen* appeared—Heine acting in this slight work as cicerone through a gallery of Shakespeare's heroines. The year 1840 was signalized by the publication of *Heinrich Heine über Ludwig Börne*, a brochure of the wittiest and most trenchant satire, in which the German refugees in Paris—a fraternity whom Heine always anxiously avoided—were far more severely handled than was the defunct agitator whose name it bore, and who, it may be noted, was himself a Jew. In 1844 *Deutschland, ein Wintermärchen*, came forth—the result of the visit to Germany which has been alluded to as the sole journey of the kind which Heine undertook; and this effusion may be ranked, along with a similar performance, *Atta Troll* (1846), as belonging to his most inferior writings. It was in 1848 that Heine, in the very hey-day of his activity, and with gigantic projects seething within him for the foundation of a journal, was suddenly prostrated by the disease which finally carried him off, though not before it had confined him for seven years upon the "mattress-grave" of mournful notoriety. His sufferings throughout that time are reported to have been frequently excruciating, and he at length grew so habituated to the use of opium that the very largest doses failed to afford him relief. But when his malady—a softening of the spinal cord—allowed him a respite, his intellect was as clear and vivacious as ever; and it is to these closing years of his life, harassing as they were, that we are indebted for the finest and most finished of all his poems—for the two collections, that is to say, *Romanzero* (1851) and *Neueste Gedichte* (1853–54), as well as for the various pieces posthumously published in *H. Heine's Letzte Gedichte und Gedanken*. It was from his "mattress-grave" too that the dying man put forth his *Geständnisse* or *Confessions*, the psychological interest of which is very great, whatever their claim to trustworthiness may be. Heine bore the misery of his protracted death-bed with fortitude, nay, with cheerfulness, assiduously attended by his wife Mathilde, and towards the end by that mysterious lady whom he called "Die Mouche," and who was, it now appears, a Madame Krinitz; and there are many anecdotes on record of his bearing in the midst of his trials—and heavier trials seldom fell to the lot of man—which go far to prove that he possessed a healthy *fond gaillard*, for which his writings are scarcely likely to gain him credit. He died on the 17th February, 1856, in Paris, in the Rue d'Amsterdam, and lies buried in the cemetery of Montmartre.

We have called Heine "poet and journalist;" but his reputation has, naturally enough, now come to rest almost exclusively upon his poetry, and above all upon his songs—the *Buch der Lieder* having passed through upwards of twenty-five editions. This great popularity may no doubt (and especially in foreign countries) be attributable, to a certain extent, to the singular good fortune which has wedded to very many of these songs the music of such composers as Schumann and Mendelssohn. But still, when all deductions upon this score are made,—and the true view of the matter probably is that the poet and his composers are mutually obliged,—the fact remains that Heine is one of the great song-writers of the world, not unworthy of a place beside Burns and Béranger, although far less masculine and passionate than the one, and far less jovial and debonair than the other. The intense individualism which prevented him from ever becoming a literary artist in any other department—his dramas and essays in fiction are worthless—stood him in excellent stead in the lyric field,—was a positive and essential strength indeed, for, after all, a song to appeal to men's hearts must be an utterance of personal experience. And this condition is amply fulfilled in the *Buch der Lieder*, the greater portion of which was the direct outcome of a sentiment entertained by the poet for one of his cousins—a sentiment, by the way, which has been alluded to by German writers as a mere *Cousinenschwärmerei*, while others (not Germans) have affirmed that all Heine's bitterness and cynicism in after life arose from its having remained unrequited. On the whole, Heine as a song-writer is a fit descendant of Walther von der Vogelweide and those old *Minnesänger* who of yore assembled in the halls of princes, and recounted their sorrows and their joys—of those nameless bards, too, who sang the *Volkslieder*; and when all his other writings are forgotten, he will be

remembered by such imperishable gems as "Die Rose, die Lilie, die Taube, die Sonne;" "Auf Flügeln des Gesanges;" and "Du bist wie eine Blume." There is much, too, of great beauty in many of his ballads and narrative pieces; witness among others. "Spanische Atriden," "Die Prinzessin Sabbat," "Jehuda-ben-Halevy," "Böses Geträume"—a piece of the most exquisite pathos and simplicity—and "Die Insel Bimini." But too often, no matter how sweet a chord is struck at the beginning, a dissonance creeps in, to end in a crashing discord, and the outraged reader starts like one who should suddenly see Romeo and Juliet fall to grimacing and squeaking like Punch and Judy. Heine's confession that poetry was no more than his "holy plaything" would have been entitled to our unqualified acceptance had he omitted the adjective.

But when we turn to his prose-writings—to his "journalism," that is to say, for, as we have remarked, almost all his prose falls under this category, in its widest acceptation—we see the man Heine indeed, not perhaps, as he was ambitious of being regarded by posterity, in the full panoply of a "soldier of human emancipation," but at any rate as no contemptible assailant of obscurantism and philistinism. Beside such a redoubtable champion of the catholic reason of mankind as Lessing "of the ponderous battle-axe," he looks somewhat small, it is true, and his rapier somewhat gimcrack. But ridicule will often reach whither heavier weapons cannot, and pierce the elephantine hide of pedantry and dulness, after these have been attacked in vain by battering-rams; and Heine was a master of it. The worst is that in unscrupulous hands—and no one was more unscrupulous than he—it may be turned to illegitimate uses, and come to be indulged in finally for its own sake. How easily Heine became the slave of his propensity in this direction may be seen in the two works—which seem his best and most characteristic writings, notwithstanding — *Zur Geschichte der Religion und Philosophie in Deutschland* and *Die Romantische Schule*. Both these abound in the most irreverent passages, especially the former, wherein such philosophers as Kant, Fichte, and Schelling scarcely serve a higher purpose than to be used as pegs whereon the writer may hang his jests. And admirable these are. Nothing can be better, for instance, than his account of how Kant (who is parenthetically described as a man whom nature intended to sell coffee and sugar across a counter) came to postulate a Deity in his practical, after having exploded that idea in his theoretical, system. He did this, says Heine (most adroitly hitting one of the chief *opprobria*, scientifically regarded, of the critical philosophy), for the sake of his old man-servant Lampe, who looked so dismally at the conclusions of the Pure Reason that the philosopher was moved to compassion! The *Romantische Schule*, being concerned for the most part with its author's contemporaries, is far more virulent than the treatise just mentioned, but equally happy; and it aimed a death-blow at a school which rivalled the wildest and most licentious ravings of a Monk Lewis and the most stilted horrors of an Ann Radcliff. And here it may be said, in connection with the attack upon Schlegel occurring in this essay, that Heine's onslaughts were always open and above-board, unmerciful and sometimes grossly brutal as they were. He was a literary swashbuckler, it may be (though that term is singularly inapplicable to one who wrote in such a style), but he was neither a literary assassin nor a literary ghoul. Even his attack upon Börne was really aimed, as we have said, at men who were alive to resent it; and it was resented, though from a strange quarter. Börne's widow's husband challenged Heine, and the latter was slightly wounded in the encounter.

Of the *Reisebilder*, Heine's most voluminous and best-known prose work, and that which originally gave him fame, small space remains to speak. But if we except its first and third books, it has been greatly overrated. It is easy to understand the popularity it acquired upon its first appearance, falling as it did like a breath of genuine life upon a land well-nigh asphyxiated by high art and the "Hübsch-Objectiv"—but nowadays, notwithstanding its undoubted mirth-provoking qualities, it chiefly serves to point out the gulf which was fixed between its author and him who took the *Sentimental Journey*. The most that can be said for it is that Sterne might have written it had he been a German Jew.

The best edition of Heine's works is that published by Hoffmann and Campe, *Heinrich Heine's Sämmtliche Werke*, 20 vols., Hamburg, 1865. Another edition has appeared in America, *Heinrich Heine's Sämmtliche Werke*, in 7 vols. *Heinrich Heine's Leben*, by Adolph Strodtmann, Berlin, 1870, is the only Life of Heine entitled to consideration, although the pleasure of reading it is certainly marred by its length. A biography of the poet has also appeared in England, *Life and Opinions of Heinrich Heine*, by W. Stigand, 1876. Mr. Matthew Arnold has, in his *Essays in Criticism*, handled Heine with his accustomed grace and felicity. Mention may also be made of *Wit, Wisdom, and Pathos of Heinrich Heine*, by J. Snodgrass, London, 1879, a collection of extracts from Heine's works in an English dress. A translation, *Heine's Poems, Complete*, by Edgar A. Bowring, C. B., was issued in Bohn's Standard Library. His prose works have not as yet received adequate renderings, although a version of the *Reisebilder* has been put forth in America. (J. W. F.)

HEINECCIUS, Johann Gottlieb (1681–1741), a celebrated jurist, was born 11th September, 1681, at Eisenberg. He studied theology at Leipsic and law at Halle; and at the latter place he was appointed in 1713 professor of philosophy, in 1718 extraordinary, and in 1720 ordinary professor of jurisprudence. He subsequently filled legal chairs at Franeker in Holland and at Frankfort, but finally returned to Halle in 1733 as professor of philosophy and jurisprudence. He died there, 31st August, 1741.

Heineccius belonged to the school of philosophical jurists. He endeavored to treat law as a rational science, and not merely as an empirical art whose rules had no deeper source than expediency. Thus he continually refers to first principles, and he develops his legal doctrines as a system of philosophy. His chief works were *Antiquitatum Romanarum Jurisprudentiam illustrantium Syntagma* (1718), *Historia Juris Civilis Romani ac Germanici* (1733), *Elementa Juris Germanici* (1735), *Elementa Juris Naturæ et Gentium* (1737, English trans. by Turnbull, London, 2 vols., 1763). Besides these works he wrote on purely philosophical subjects, and edited the works of several of the classical jurists. His *Opera Omnia* (9 vols., Geneva, 1771, etc.) were edited by his son Johann Christian Gottlieb Heineccius.

HEINECKEN, Christian Heinrich (1721–1725), a child remarkable for extraordinary precocity of intellect, was born on February 6, 1721, at Lübeck, where his father was a painter. Able to speak at the age of ten months, by the time he was one year old he knew by heart the principal incidents in the Pentateuch. At two years of age he had mastered all the sacred history; at three he was intimately acquainted with history and geography, ancient and modern, sacred and profane, besides being able to speak French and Latin; and in his fourth year he devoted himself to the study of religion and church history. This wonderful precocity was no mere feat of memory, for the youthful savant could reason on and discuss the knowledge he had acquired. Crowds of people flocked to Lübeck to see the wonderful child; and in 1724 he was taken to Copenhagen at the desire of the king of Denmark. On his return to Lübeck he began to learn writing, but his sickly constitution gave way, and he died, June 22, 1725.

The Life, Deeds, Travels, and Death of the Child of Lübeck were published in the following year by his tutor Schöneich. See also *Teutsche Bibliothek*, vol. xvii., and *Mémoires de Trévoux*, Jan., 1731.

HEINSE, Johann Jacob Wilhelm (c. 1746–1803), German romance writer, was born at Langenwiesen in the Thuringian Forest, February 16, 1746, or, according to some accounts, February 15, 1749. He was educated at the gymnasium of Schleusingen, and afterwards, through many privations, studied law at Jena and Erfurt. At Erfurt he became known to Wieland, and through Wieland's recommendation to the poet Gleim, who, attracted by some of Heinse's early literary attempts, offered him assistance and a home; but at this time he made the acquaintance of an adventurer, Captain von der Goltz, and was induced to accompany him on his travels. Von der Goltz easily succeeded in corrupting the taste and misdirecting the talents of the young author, and the baneful influence of this friendship pervades Heinse's writings. After parting with Von der Goltz Heinse returned for a time to Langenwiesen, and afterwards obtained, with Gleim's assistance, under the feigned name of Rost, a tutorship in the family of Von Massow at Quedlinburg, which, however, he did not keep very long. In 1774 he went to Düsseldorf to assist J. G. Jacobi in the production of the *Iris* journal. In 1780 he obtained from Jacobi leave and the necessary funds to travel in Italy. There he remained three years, living

chiefly at Rome, where he was intimate with the painter Müller. In 1789 he obtained the post of reader to the elector of Mainz, who afterwards made him councillor and librarian. He died at Aschaffenburg, June 22, 1803.

Heinse's works are—*Sinngedichte*, Halberstadt, 1771; *Begebenheiten des Enkolp*, translated from the *Satiricon* of Petronius, 2 vols., Schwabach, 1773; *Die Kirschen*, after Dorat's *Cerises; Laidion, oder die Eleusinischen Geheimnisse*, Lemgo, 1784; prose translations of Tasso's *Jerusalem Delivered*, 4 vols., 1781, and Ariosto's *Orlando*, 4 vols., 1782; *Ardinghello und die glückseligen Inseln*, 2 vols., Lemgo, 1787; *Hildegard von Hohenthal*, 2 vols., Berlin, 1795; *Anastasia und das Schachspiel*, 2 vols., Frankfort, 1803. A collection of his entire works was published at Leipsic in 1838 in 10 vols., and another edition in 1857 in 5 vols.

HEINSIUS, or Heins, Daniel (1580–1655), one of the most famous scholars of the Dutch Renaissance, was born at Ghent, June 9, 1580. The troubles of the Spanish war drove his parents to settle first at Veere in Zealand, then in England, next at Ryswick, and lastly at Flushing. In 1594, being already remarkable for his attainments, he was sent to the university of Franeker to perfect himself in Greek under Henricus Schotanus. He stayed at Franeker half a year, and then settled at Leyden for the remaining sixty years of his life. There he studied under Joseph Scaliger, and there he found Marnix de St. Aldegonde, Janus Douza, Paulus Merula, and others, and was soon taken into the society of these celebrated men as their equal. His proficiency in the classic languages won the praise of all the best scholars of Europe, and offers were made to him, but in vain, to accept honorable positions outside Holland. He soon rose in dignity at the university of Leyden. In 1602 he was made professor of Latin, in 1605 professor of Greek, and at the death of Merula in 1607 he succeeded that illustrious scholar as librarian to the university. The remainder of his life is recorded in a list of his productions. He died at the Hague, February 25, 1655. The Dutch poetry of Heinsius is of the school of Roemer Visscher, but attains no very high excellence. It was, however, greatly admired by Martin Opitz, who was the pupil of Heinsius, and who, in translating the poetry of the latter, introduced the German public to the use of the rhyming alexandrine.

He published his original Latin poems in three volumes—*Iambi* (1602), *Elegiæ* (1603), and *Poemata* (1605); his *Emblemata Amatoria*, poems in Dutch and Latin, were first printed in 1604. In the same year he edited Theocritus, Bion, and Moschus, having edited Hesiod in 1603. In 1609 he printed his Latin *Orations*. In 1610 he edited Horace, and in 1611 Aristotle and Seneca. In 1613 appeared in Dutch his tragedy of *The Massacre of the Innocents;* and in 1614 his treatise *De politica sapientia*. In 1616 he collected his original Dutch poems into a volume. He edited Terence in 1618, Livy in 1620, published his oration *De contemptu mortis* in 1621, and brought out the *Epistles* of Joseph Scaliger in 1627.

HEINSIUS, Nikolaes (1620–1681), Dutch scholar, was the son of Daniel Heinsius, and scarcely less illustrious than his father. While, however, Daniel was the type of the stationary scholar, Nikolaes was by temperament restless and peripatetic. He was born at Leyden, July 20, 1620, and early displayed an extraordinary precocity. His boyish Latin poem of *Breda Expugnata* was printed in 1637, and attracted much attention. In 1642 he began his wanderings with a visit to England in search of MSS. of the classics; it is unhappily recorded that he met with great discourtesy from the English scholars. In 1644 he was sent to Spa to drink the waters; his health restored, he set out once more in search of codices, passing through Louvain, Brussels, Mechlin, Antwerp, and so back to Leyden, everywhere collating MSS. and taking philological and textual notes. Almost immediately he set out again, and arriving in Paris was welcomed with open arms by the French savants. After investigating all the classical texts he could lay hands on, he proceeded southwards, and visited on the same quest Lyons, Marseilles, Pisa, Florence (where he paused to issue a new edition of Ovid), and Rome. Next year, 1647, found him in Naples, from which he fled during the reign of Masaniello; he pursued his labors in Leghorn, Bologna, Venice, and Padua, at which latter city he published in 1648 his volume of original Latin verse entitled *Italica*. He proceeded to Milan, and worked for a considerable time in the Ambrosian library; he was preparing to explore Switzerland in the same patient manner, when the news of his father's illness recalled him hurriedly to Leyden. He was soon called away to Stockholm at the invitation of Queen Christina, at whose court he waged war with Salmasius, who accused him of having supplied Milton with facts from the life of that great but irritable scholar. Heinsius paid a flying visit to Leyden in 1650, but immediately returned to Stockholm. In 1651 he once more visited Italy; the remainder of his life was divided between Upsala and Holland. He collected his Latin poems into a volume in 1653. His latest labors were the editing of Velleius Paterculus in 1678, and of Valerius Flaccus in 1680. He died at the Hague, October 7, 1681. Nikolaes Heinsius was one of the purest and most elegant of modern Latinists, and if his scholarship was not quite so perfect as that of his father, he displayed higher gifts as an original writer.

HEINSIUS, Nikolaes, an illegitimate son of the subject of last article, was born in 1655 at the Hague. At the age of twenty he wrote *The Delightful Adventures and Wonderful Life of Mirander*, a work of extraordinary humor and genius, the sole original romance produced in Holland during the 17th century. Dr. Ten Brink has pointed out that *Mirander* preceded *Gil Blas*, which it curiously resembles, by at least forty years. The author, however, added nothing else to literature. He was disowned by his father, driven from the house, and in 1677 had to flee the country on account of a murder which he committed at night in the streets of the Hague. He lived a precarious life as an outlaw in Paris, Rome, and elsewhere, and died in obscurity.

HEIR. See Inheritance.

HELDER, or The Helder, a township of the Netherlands at the northern extremity of the province of North Holland, directly opposite the island of Texel. Since 1819 it has been the terminus of the North Holland Canal, and it is now connected (since 1865) by railway with Alkmaar and Haarlem. Its fortifications and its dykes are both constructed on an extensive scale, the former comprising four batteries and five forts, and the latter being the most striking on the whole coast. A garrison of 7000 to 9000 men is necessary for the defence of the place, and 30,000 men could be accommodated within the lines. The harbor, called the Nieuwe Diep, is one of the best in Europe. Its area is 6560 feet long by 330 to 490 broad, and it has depth enough for the largest vessels, which are admitted to the North Holland Canal by the Koopvaarders sluice. The Government arsenal comprises an extensive wet dock, a dry dock, and auxiliary establishments. Besides eight churches and a synagogue Helder possesses a palace for the board of marine, a royal institute for the education of naval cadets, a marine hospital, an orphan asylum, a townhouse erected in 1836, and a meteorological observatory. The industries of the place are those usual in a flourishing seaport. Previous to 1819 the population was not much more than 2000, but since then it has rapidly increased. In 1870 the suburbs of Willemsoord, Nieuwe Diep, Nieuwstad, and the Canal Road being included, the total amounted to 16,205. As a commune it numbered 18,366 in 1870 and 25,200 in 1900.

Helder was originally an offshoot of the now decayed town of Huisduinen. The first church was built in 1624, and though the harbor became a favorite resort of the whale fishers, it was not till the construction of the Nieuwe Diep between 1770 and 1780, and its adoption in 1781 as a war harbor, that the prosperity of the place was secured. Under the Batavian republic the fortifications were extended and strengthened, and Napoleon still further improved them. In 1799 the English, under Abercromby, assisted by the Russians, drove out the French and secured the capitulation of the Dutch fleet in the Zuyder Zee.

HELENA, daughter of Zeus and of Leda the wife of Tyndareus king of Sparta, was sister of Castor, Pollux, and Clytemnestra, and was married to Menelaus. According to Homer she was obliged by Aphrodite to flee with Paris to Troy; and after the Trojan War she returned with Menelaus and lived with him as queen in Sparta. She had only one child, a daughter named Hermione, who was married to Neoptolemus. In the Homeric poems her character is drawn with marvellous skill; forced by the gods to do what she regrets, she seems to be separated from the wrong that she does, and remains always an object of interest and respect.[1] Goethe (*Faust*, part ii.) introduces Helena appa-

[1] Most appreciative and sympathetic analyses may be found in Gladstone's *Homeric Studies* and Mure's *History of Greek Literature*.

rently to symbolize the Greek spirit acting on the modern mind. Among later poets the tales of Helen are much more complicated. She was carried off by Theseus to Attica in her childhood, but was recovered by her brothers. Her character often suffers much in the tales followed by lyric and tragic poets. Stesichorus and Euripides (*Helena*), however, relate that Paris on his homeward voyage was driven by stress of wind to Egypt. Proteus, king of Egypt, learning the facts, detained the real Helen in Egypt, while a shadowy Helen was taken to Troy and fought for. Menelaus on his way home from Troy was also driven to Egypt, and there found his true wife. After the death of Paris she is also said to have been married to his brother Deiphobus.

If we turn to the religious ceremonies and the genuine popular tales, we find traces of a more archaic Helen. At Rhamnus in Attica she was connected with the worship of Nemesis, whose daughter she was considered to be. In Argos she was counted mother of Iphigenia, and was said to have founded a temple of Eilcithyia, the goddess of birth. At Sparta she was honored as presiding over the care of children, and festivals were celebrated in her honor by the maidens. A tree appears to have been connected with her worship there (see *Theocr.*, xviii.); and in Rhodes she was worshipped by maidens with the epithet δενδρῖτις, a relic of the very oldest kind of worship, where a sacred tree was worshipped as the embodiment of the god. In most of these cults connection with a moon-goddess, the most important of whose functions was the care over child-birth, is apparent; and we are led to regard ἑλένη as an epithet of the moon, which has gradually been severed from it and raised to an independent existence (*cf.* the account given of Gorgophone under Gorgon). Beauty is a specially common attribute of the moon and of moon-goddesses, such as Hera. This makes it most probable that the word, like σελήνη, is connected with the root *svar*, to shine. The tales connecting Helena with Achilles, who is clearly a sun-god originally, which are known already to the writer of the *Cypria*, are also very instructive. Over the Black Sea coasts Achilles and Helena were worshipped as united in the Elysian fields. With this we must compare the story of Cadmus and Harmonia (see Harmonia), and of Hades and Persephone; and we must remember that these colonies of Miletus were closely connected with Attica. We may then look on it as probable that the rape of Helena by Theseus is merely a device of harmonizing skill to connect the Helena of Spartan religion with the Helena worshipped in Attica. Probably a similar reason has contributed to mould the tale which has formed itself round the undoubtedly historical fact of the destruction of Troy by a Greek tribe or army. The worship of Aphrodite, the goddess whose influence in the story of Paris and Helena is so great, was common to Troy and Cythera. Many facts also point to a close connection between Aphrodite and Helena. The swan from whose egg she is born is the bird of Aphrodite. By the author of the *Cypria* and in Attic tradition Helen is made the daughter of Nemesis; but Nemesis as a goddess of fate is clearly a dawn-goddess (see Kuhn, *Zft.*, iii. 449), and therefore may be identified in origin with Aphrodite. We have here another instance of the intimate relation of the moon and dawn goddesses, and the impossibility of dividing them by any broad line (see Hebe, Hera). It would be at once a most instructive and a most interesting task to trace the steps by which the antique pre-Greek goddess was gradually transformed into the charming heroine round whom the action of the *Iliad* revolves. The data for reconstructing the history of this figure are more than usually full, and are so clear that writers of the most opposite schools (as Welcker, Gerhard, Mannhardt, Maury, Roscher) have recognized in Helena the ancient goddess.

HELENA, Saint, a woman of humble origin, said to have been the daughter of an innkeeper, was the wife of Constantius Chlorus. Of her nationality nothing certain is known. She had one son, Constantine the Great. In 292 A. D. Chlorus was raised to the purple by the emperors Diocletian and Maximian, and forced to divorce Helena to make room for a more noble wife. After her son became emperor she was treated with great respect and styled Augusta, and cities in Bithynia and Lysia were after her named Helenopolis. She became a Christian when her son was converted, and during a pilgrimage to Jerusalem she discovered the holy sepulchre and the true cross. Her zealous patronage of their religion made her a favorite with the Christian writers, and finally procured her the honor of canonization; but pagan historians, such as Zosimus, regard her with dislike, and even question, though without ground, the legality of her marriage. Many coins occur with the name of Helena, but it is difficult or impossible in many cases to determine whether they belong to Saint Helena or to others of the family of Constantine bearing the same name

HELENSBURGH, a town and favorite watering-place of Dumbartonshire, Scotland, is situated at the mouth of the Gareloch, a branch of the Firth of Clyde, opposite Greenock, which is about 4 miles distant. It is 24 miles N. W. of Glasgow by railway. In 1776 the site of the town was advertised for feuing, and in 1802 Helensburgh, named after Lady Helen, wife of Sir James Colquhoun, the superior of the soil, was erected into a burgh of barony, under a provost and council. The boundaries have since been enlarged. The town is pleasantly situated on a gentle slope, the streets mostly intersecting each other at right angles, while many of the houses are surrounded by gardens, —peculiarities that produce an agreeable regularity and openness. A handsome burgh hall was erected in 1879. Near the town is a hospital, and within its boundaries a public park. Convenient as headquarters for visiting the whole district of the Clyde, and connected with Glasgow by both rail and steamer, Helensburgh is much frequented in summer. The population in 1871 was 6231; it is now (1901) estimated at 8,554.

HELIAND (*i. e. Heiland*) is an Old Saxon poem of the 9th century. According to some critics it is a fragment of a larger work which dealt with the entire historical material of the Old and New Testaments. The part which we now possess sets forth the life of Christ as told by the four evangelists, whose various narratives the author seeks to harmonize. The poem is said to have been composed by a Saxon writer at the request of the emperor Louis the Pious; but who the author was, except that he was a Saxon, we have no means of knowing. The general opinion is that he lived in Westphalia, but even this is uncertain. Like all the most ancient remains of Teutonic poetry, *Hêliand* is written in alliterative verse, of which the writer had a perfect mastery. It is almost the only remnant of the Old Saxon dialect, and has therefore a high philological value, but it is still more interesting from a literary point of view. The poet does not merely repeat his authorities; while true to the main facts of the original story, he allows his imagination to play upon them in a free and poetic spirit. He realized with intense force the incidents in the career of the Founder of Christianity, and gives vitality and definiteness to the received conception of His character. The diction is simple and popular, but marked by an elevation of sentiment adapted to the theme and to its epic treatment; and by a happy phrase the author often succeeds in imparting to his style color, variety, and animation. The 9th century is remarkable in the history of Old English and of Old Norse poetry; the *Hêliand* affords proof that the impulse which revealed itself in these two literatures was also experienced to the full by the higher minds of Germany. The historical aspects of this great work are hardly less important than those which claim the attention of the purely literary student. Of all the German tribes the Saxons were the last to submit to the influence of Christianity. They regarded baptism as the symbol of Frankish supremacy, and clung as long as they could to the ancient Teutonic faith. Not until Charlemagne, after more than thirty years of warfare, forced upon them Frankish institutions did they generally accept the new creed, and even then, while they talked of Christ and the saints, they thought of Wodan and Thor, and took delight in the heathen poetry which had been handed down from remote periods. Louis the Pious was of a gentle and conciliatory nature, and by treating the Saxons with kindness obliterated to a large extent the recollection of his father's severity. *Hêliand* was one of the works with which he and the clergy endeavored to replace pagan literature, so that we may regard it as the monument of a struggle between two civilizations. The author is dominated by the ideals and the sympathies of the Catholic Church, but occasional touches remind us of the order of life that was passing away, and these have been found suggestive by writers on German archæology.

Hêliand received its name from A. Schmeller, who edited it (Munich, 1830–40) from the two existing manuscripts, one of which is in the British Museum, the other in Munich (formerly in Bamberg). More recent editions have been issued by Köne (Münster, 1855, accompanied by a modern rendering), Heyne (2d ed. Paderborn, 1873), and Rückert (4th volume of *Deutsche Dichtungen des Mittelalters*, Leipsic, 1876). There are renderings into modern German by Kannegiesser (Berlin, 1847), Grein (Rinteln, 1854; improved edition, Cassel, 1869), Rapp (Stuttgart, 1856), and Simrock (2d ed. Elberfeld, 1866). See also

Vilmar, *Deutsche Alterthümer im Hêliand* (2d ed., Marburg, 1862); Windisch, *Der Hêliand und seine Quellen* (Leipsic, 1868); Grein, *Die Quellen des Hêliands* (Cassel, 1869); and Sievers, *Der Hêliand und die angelsächsische Genesis* (Halle, 1875).

HELICON, a mountain, or more strictly a mountain range, of Bœotia in ancient Greece, celebrated in classical literature as the favorite haunt of the Muses, is situated between Lake Copais and the Gulf of Corinth. On the fertile eastern slopes stood a temple and grove sacred to the Muses, and adorned with beautiful statues, which, taken by Constantine the Great to beautify his new city, were consumed there by a fire in 404 A.D. Hard by sparkled the famous fountains of poetic inspiration, Aganippe and Hippocrene, the latter fabled to have gushed from the earth at the tread of the winged horse Pegasus, whose favorite browsing place was there. At the neighboring Ascra dwelt the ancient Hesiod, a fact which probably enhanced the poetic fame of the region. Pausanias, who describes Helicon in his ninth book, asserts that it was the most fertile mountain in Greece, and that neither poisonous plant nor serpent was to be found on it, while many of its herbs possessed a miraculous healing virtue. The highest summit, the present Paleovuni (old hill), rises to the height of about 5000 feet. Modern travellers, aided by ancient remains and inscriptions, and guided by the local descriptions of Pausanias, have succeeded in identifying many of the ancient classical spots. For details of modern research see Clarke's *Travels in Various Countries* (vol. vii., 1818), Dodwell's *Classical and Topographical Tour through Greece* (1818), and Leake's *Travels in Northern Greece* (vol. ii., 1835).

HELIGOLAND (German, *Helgoland*), *Heiligeland*, or *Hellige Land*, as the natives call it, is one of the Frisian Islands, and an English possession, situated in the North Sea, 54° 11′ 34″ N. lat., 7° 51′ E. long., 36 miles from Cuxhaven at the mouth of the Elbe, and about 100 from Hamburg. Though the red cliffs of the Rock Island are most familiar to the voyager entering the Elbe, there are in reality two islets, the second being the Dune or Sand Island, now lying a quarter of a mile east of the main one, though at one time connected with it by *de waal*, a neck of land which the sea broke through and destroyed in 1720. The Rock Island is nearly triangular in shape, surrounded on every side by steep cliffs, the only beach being the sandy spit where the landing-place is situated, near the south-east point. On this islet there are some 500 houses, divided into a lower town or *Unterland*, on the spit, and an upper town or *Oberland*, situated on the cliff above and connected with the lower town by a wooden stair of 190 steps, the only possible mode of communication between the two sections. The portion of the flat-topped rock not occupied by the houses, the church with graveyard, the Government residences, and place for a battery, comprises a little pasture-land, a few cabbage gardens, potato patches, and a powder magazine at the north end of the rock. About 200 sheep, tethered to particular spots, feed on the scanty herbage, eked out by potato-peelings and halms, cabbage blades, or any other vegetable refuse, which is carried out to them every morning. From one end of the island to the other runs a footpath, called by the Heligolanders the "Landwae" or High Road, but better known to visitors by the name of "Kartoffel-Allee" (Potato Walk). There is also a lighthouse; but, though a few guns are placed behind a rude earthwork, there are no fortifications except the inaccessible cliffs of the island, and no garrison of any kind unless a few coast-guardsmen be considered as such. The greatest length of the island, which slopes somewhat from west to east, is 5880 feet, and the greatest breadth 1845 feet, its circumference 13,500 feet, its average height 198 feet, and the highest point 216 feet. The Dune or Sand Island is little more than a sand-bank covered with scanty herbage, and imperfectly bound together by bent, grass, and carices. It is only about 200 feet above the sea at its highest point, but the drifting sands and the constant inroads of the sea make the height rather variable. The sea-bathing establishment is situated here; but, with the exception of the restaurant keeper and waiters, and the attendants who drag the bathing-coaches into the sea, there are no residents. A shelving beach of white sand presents excellent facilities for bathing; everything is under strict Government surveillance, the boats in which the bathers cross in the morning, the hours of bathing, and the tariff being all regulated by law. Approached from the sea the Rock Island, with its red-tiled houses perched in a little cluster on the red cliff,—"Am Falm," as it is called,—looks very picturesque, and even the narrow brick-paved or sandy lanes of the town are not deficient in a certain degree of quaintness. There are—with the exception of a wheelbarrow and an occasional perambulator—no wheeled carriages in the island, and no horses or other beasts of burden. Even the two cows kept in the Unterland for the use of invalid visitors, and whose milk is sold at the apothecary's shop, are removed at the end of the bathing season to Cuxhaven, the island not supplying food for both man and beast. Mud is unknown on the streets, the rain only serving to wash their sloping surfaces clean as the scoured floor of the housewives' kitchens. Most of the houses are built—the lower half at least—of brick, but some are of wood. There are a theatre, a "conversation house," and a number of hotels and restaurants, though during the season nearly every house is more or less let out to "baadegaster"—visitors for sea-bathing forming the great source of the islanders' prosperity. In both the lower and the upper town there are numbers of shops; but the articles for sale seem to be chiefly intended for the summer "bathing guests," the natives getting most of their supplies from Hamburg or Bremen. The dwellings of the fisher-folk are reasonably clean, and the interiors bear evidence of the seafaring character of the population. Some of the houses have little gardens with flowers, cucumbers, etc., in front of them, and in places protected from the sea breezes there are a few fruit trees. At the foot of "the stair" are one or two lime trees sheltered by the contiguous houses; they are looked upon by the Heligolanders as objects of national pride.

During the summer from 2000 to 3000 people visit the island for sea-bathing. Most of these are from Hamburg, English or other "guests" being rare. There are no English residents, the officials, the governor excepted, being either natives or Germans; and German, when Frisian is not employed, is the official language, though for form's sake on the postage stamps English and German words appear in duplicate. The natives speak a dialect of Frisian, barely intelligible to the other islands of the group. They are perfectly content with the almost perfect autonomy they enjoy under the English Government. There is little emigration, and accordingly the population is slowly increasing. In 1905 the number was a little over 2300. There is regular communication with Bremen and Hamburg in the summer and autumn months, but during the winter the island is often isolated for weeks at a time, owing to tempestuous weather, drift ice, and other causes. It is said that insanity and suicide are in consequence not rare. Epidemic diseases occur, though they do not commonly spread; but scrofula, owing to the poor character of the islanders' food, attacks three-fourths of the population. In ten years there were 309 deaths—about 15 to the 1000; while during the same period—from 1863 to 1872—inclusive—there were no less than 17 suicides. At one time the population did not exceed 300, and it was only when it increased to over 1000 that the inhabitants had to dispense with the few horses they kept to till their patches of land. This is now done with the spade, and loads are conveyed either in wheelbarrows or in shallow willow baskets.

The temperature of the Oberland is, owing to its exposure, about 1·5° lower than that of the Unterland. The following are the means of the months, from a series of observations taken for seven consecutive years at the lighthouse built on the highest point of the island:—January, 31·9° Fahr.; February, 33·9°; March, 35·2°; April, 43·1°; May, 48·9°; June, 57·5°; July, 62·2°; August, 61·0°; September, 58·4°; October, 48·2°; November, 40·0°; December, 34·3°—the mean temperature of the whole year being 47·2° Fahr.[1] The winters are however very stormy, and the air is so laden with salt spray that the rain leaves a delicate deposit of salt after it has evaporated. May and the early part of June are very wet and foggy, so that the first visitors do not arrive until the middle of the latter month.

The rocks composing the island are of Triassic age, bunter-sandstone, keuper, lias, oolite, muschelkalk, and chalk (now denuded), topped by Pliocene—"the brown tock," in which are found the scales and teeth mostly of freshwater fishes, freshwater *Mollusca*, and fruit and leaves of a *Carpinus*, a *Quercus*, an *Alnus*, a maple, a plant allied to a hoya (*Stomato-*

[1] Zimmermann, *Die sanitären Zustände Helgolands, mit specieller Berücksichtigung des Ozongehaltes der Luft*, 1873, pp. 12, 13.

phyllum helgolandicum), etc. The cliffs are worn into caves, and around the Rock Island are many fantastic arches and columns of rock. There is no just ground, however, for believing that the Rock Island was ever much bigger than it is,—the tales of the great size of Heligoland—its numerous churches and villages in early times—being doubtless exaggerated by tradition, while the maps affecting to show its former extension doubtless relate to the Sand Island, which was incontestably much larger in very recent periods, and is now yearly becoming smaller. The natural history presents nothing remarkable. There are no wild animals on it, and the numerous birds which breed in its cliffs, or light on it during their migrations, all belong to the mainland or to the North Sea.[1] Hallier has enumerated 220 flowering plants as growing on the island, but none of them are peculiar to it, though there are one or two local varieties. The sandy-bottomed shallow sea supplies abundance of flat fish, and in the deeper water crabs, lobsters, haddock, etc., abound. There are, however, not many fishing-boats, and these of small size. Most of the men act as pilots.

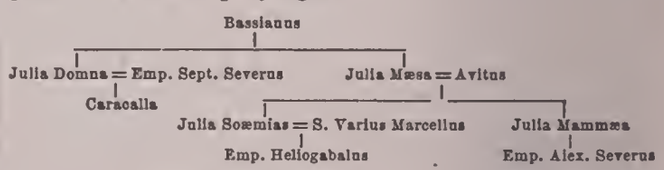
The trade of the island is insignificant. The only time when it enjoyed any commercial prosperity was during the Napoleonic wars, when, by the "Continental system," the European ports were supposed to be shut to England. During that period smuggling prospered, and the island was crowded with soldiers and adventurers. In 1878 the revenue was £7236, the expenditure £7548, and the public debt £2115. The imports are mostly from Bremen and Hamburg, those from Britain being valued at only £72; the exports, consisting chiefly of goods bought by visitors, are ladies' feathers, hats, muffs, fish, etc. The government is vested in a governor appointed by the English crown, aided by a council,—the former mode of government having been more democratic, but less conducive to the islanders' peace than the present. The taxes are few, and consist chiefly of a duty on wine, beer, and spirits, a small house tax, and the "kur-tax," levied on all visitors who reside beyond three days.[2]

History.—The history of Heligoland, "the holy island," is interesting. "Sunt et aliæ insulæ contra Friesiam et Daniam, sed nulla earum tam memorabilis," writes Adam of Bremen. "Multa regna, multas regiones et insulas perlustravi, nec unquam similem huic sacræ vidi," are the words of Pontanus. Here Hertha[3] had her great temple, and hither came from the mainland the Angles to worship at her shrine. Here lived King Radbod, a pagan, and on this isle St. Willebrod, 1200 years ago, first preached Christianity; and for its ownership, before and after that date, many sea-rovers have fought. Finally it settled down to be a fief of the dukes of Schleswig or Holstein, though often in pawn for loans advanced to these impecunious princes by the free city of Hamburg. The island thus happened in 1807 to be a Danish possession, when the English seized and held it until it was formally ceded to them in 1814. In these days of swift steamers the value of Heligoland as a military position commanding the Elbe mouth has been doubted. There is not, with the exception of wells, the rain collecting in the "Sapskulen" or hollows, and that caught in casks, any water on the island, while the shelter afforded by the north and south harbors formed by the sand point on which the Unterland is built is but indifferent. It is only vessels of small size that can approach the shore, and passengers by the steamers have to land in open boats at the end of a long jetty (the Läster-Allee, or "Misery Walk"). Under British rule the islanders enjoy the utmost freedom, and in return for this privilege are subjected to a trifling taxation for local purposes, and escape the compulsory military service to which they would be liable were they to become German or Danish subjects.[4]

Bibliography.—Von der Decken, *Philosophisch-historisch-geographische Untersuchungen über die Insel Helgoland oder Heiligeland und ihre Bewohner* (Hanover, 1826); Wiebel, *Die Insel Helgoland, Untersuchungen über deren Grösse in Vorzeit und Gegenwart vom Standpunkte der Geschichte und Geologie* (Hamburg, 1848; from *Gebiete der Naturwissenchaften herausgegeben von dem naturwissenschaftlichen Verein in Hamburg*, vol. ii.; it contains a good bibliography up to date); Oetker, *Helgoland. Schilderungen und Erörterungen* (Berlin, 1855); Hallier, *Helgoland, Nordseestudien* (Hamburg, 1869; the botanical part is also printed separately, *Die Vegetation auf Helgoland*). See also Hansen, *Chronik der friesischen Uthlande* (Gaarding, 1877); Wiegelt, *Die nordfriesischen Inseln* (Hamburg, 1873); Berenberg, *Die Nordsee-Inseln an der deutschen Küste* (Norden and Norderney, 1875); Hansen, *Die Friesen* (Gaarding, 1876); and the local guide books. (R. B.)

HELIODORUS, son of Theodosius, was born at Emesa in Syria, in the second half of the 4th century. He belonged to a family of priests of the Syrian sun-god Elagabalus, but he was himself a Christian, and became bishop of Tricca in Thessaly. He is famous as the author of the best of the Greek love-romances. It is called *Æthiopica*, as it relates the history of Chariclea, daughter of Hydaspes, king of Æthiopia, her love for Theagenes, a Thessalian of high rank, and the happy issue after a series of exciting adventures and hairbreadth escapes. The Alexandrian pastoral poets often introduced brief love episodes to give animation to their scenes of pastoral life. When rhetorical prose became the fashionable style of composition, the mere episode was expanded into a complete history of the lovers from their birth to their happy union. Antonius Diogenes, according to Photius, was the first to write a book of the kind; and Jamblichus, about 100 A. D., also wrote a love romance. But the *Æthiopica* is the oldest work of the kind that has come down to us. It is full of the most improbable scenes and incidents; the hero is a weak and dull character, but the heroine is well drawn and full of interest. The description of customs and manners, especially of religious ceremonies, is minute, and often most interesting in an antiquarian point of view. The work not only became a model for the later Greek romance writers, but has been much imitated by the French and Italian writers of romance. Tasso praises the artful development of the plot; and the early life of Clorinda (*Jerusalem Delivered*, c. xii.) is almost identical with that of Chariclea. Racine meditated a drama on the subject of the romance, and Raphael has made scenes from it the subject of two of his pictures. The best edition is that of Coräes (Paris, 1804). The book has been translated frequently, and into almost all modern European languages.

HELIOGABALUS, a Græcized form of Elagabalus, the name of a Syrian deity, was the name adopted by Varius Avitus Bassianus, the Roman emperor. His pedigree is given in the accompanying table:—



On the murder of Caracalla (217 A. D.), Julia Mæsa was forbidden the court by the new emperor Macrinus. She retired to her ancestral city Emesa with her daughters and grandsons. Varius Avitus, though still only a boy, was appointed high priest of the Syrian sun-god Elagabalus, one of the chief seats of whose worship was Emesa. His beauty, and the splendid ceremonials at which he presided, made him a great favorite with the troops stationed in that part of Syria, and Mæsa increased his popularity by spreading reports that he was in reality the illegitimate son of Caracalla. Macrinus was very unpopular with the army; an insurrection was easily raised, and Varius under his adopted name Heliogabalus was proclaimed emperor. The troops sent to quell the revolt joined the new emperor, and Macrinus, advancing in person against him, was defeated and soon afterwards slain (218). Heliogabalus was at once recognized by the senate as emperor. After spending the winter in Nicomedia, he proceeded in 219 to Rome. He made it his business to exalt the honor of the deity whose priest he was. The Syrian god was proclaimed the chief deity in Rome, and all other gods his servants; splendid ceremonies in his honor were celebrated, at which Heliogabalus danced in public; and it was believed that secret rites accompanied by human sacrifice were performed in his honor. The shameless profligacy of the emperor's life was such as to shock even a Roman public. His popularity with the army declined, and Mæsa, perceiving that the liking of the soldiers inclined to Alexander Severus, persuaded him to raise his cousin to the dignity of Cæsar (221). Heliogabalus soon repented of this step. An attempt to murder Alexander was frustrated by the watchful Mæsa. Another such attempt in 222 produced a mutiny among the soldiers, in which Heliogabalus and his mother Soæmias were slain.

HELIOGRAPHY is the name applied to the method of communicating between distant points in which visual signals are obtained by reflecting the rays of the sun from a mirror or combination of mirrors in the required direction. This method can of course be only employed to advantage in places where the sky is free from clouds and the atmosphere clear for considerable periods of time, and the fact that an atmospheric change may indefinitely delay the transmission

[1] Gätke, *Edinburgh New Philosophical Journal*, n. s., ix., p. 333; Blasius, "Naumannia," 1858, p. 303 (*Ibis*, 1862, p. 58); Cordeaux, *Ibis*, 1875, p. 1872.—Mr. Gätke, the island secretary, is preparing a special work on Heligoland ornithology.

[2] The tax is at present—for one person three marks (Hamburg), for a family of two to three persons four marks, and for larger families six marks; after a stay of four weeks the visitors are free of "kur-tax."

[3] Fossite, after whom in pre-Christian days the rock was called Fossite-land, was not, as is often asserted, the goddess herself, but only the priestess of Hertha.

[4] [Both islands were ceded to Prussia, July 1, 1890, in exchange for African territorial claims (400,000 sq. m.) in the lake region.—Am. Ed.]

of a message is an insuperable objection to the establishment of permanent heliographic stations in most climates. In favorable localities, however, heliography possesses important advantages for military signalling over other methods, the principal being the portability of the apparatus, the great distance to which messages can be sent without retransmission, and the fact that the signals are visible to those only who are on the direct line of signalling.

The signals are produced by causing the reflected beam to appear and disappear or be obscured alternately at the distant point, the intervals of appearance and obscuration being usually varied in length, so as to produce the combinations of long and short signals known as the Morse alphabet. This is done in two distinct ways. In the first of these, known as signalling by "appearance," the reflected beam or "flash" is obscured from the receiving station except when a message is being transmitted, the flashes then giving the signals or "dots" and "dashes;" while in the second method, or signalling by "obscuration," the flash is kept continually on the receiving station, and only obscured for intervals forming signals. The first method is more easily read by learners; the second is less fatiguing to the eye, and possesses the advantage of enabling the signaller to correct the adjustment of his instrument at any time.

Glass mirrors with a plane surface are employed, hence the angle of divergence of the extreme rays in the reflected beam is the same as that subtended by the sun's diameter at the point, or about 32 minutes of arc; this small divergence rendering the flash visible to great distances.

The distance through which signalling by this method can be carried on depends on the size of the mirror employed and the angle of reflection of the rays, a large mirror giving a more intense "flash" than a small one, since it reflects more rays, and being therefore visible to a greater distance; also when the angle of reflection is nearly a right angle the flash will be more intense than when the rays are only diverted through a small angle from the greater extent of surface exposed to the sun's rays. The range, however, depends to so great a degree on the state of the atmosphere that it is impossible to assign any limits to the distance that the flash might be seen through in exceptionally clear weather. From the Himalayas a 5-inch mirror has been found to give very distinct signals over a distance of 60 miles; but when the air was at all misty a very much larger mirror had to be employed.

The more perfect reflection when the angle between the direct and reflected rays is large is not sufficient to compensate for the loss of intensity caused by the small number of reflected rays. Hence when this angle is greater than a right angle two mirrors are used, the sun's rays being reflected from one back to the other and thence to the distant point. This is called the duplex method of working.

Two forms of instrument are at present used in the British army. In the one known as Begbie's field heliostat the mirrors are square, the sun mirror having a side of 5 inches, and the signalling mirror 4 inches. The object of this difference is to ensure the latter receiving the flash over its whole extent of surface. The mirrors are screwed on to tripod stands, the stand for the signalling mirror having a sighting bar with a frame of cross wires at the end, by means of which the alignment can be accurately taken by looking through a hole in the centre of the mirror. When this has been found a small white disc is put into a hole in the centre of the cross wire frame, and a black disc in the central hole in the signalling mirror, or, if two mirrors are used, the white disc in the signalling and the black disc in the sun mirror. The flash is then brought on the true line by making the shadow corresponding to the black disc fall on the white one; this is accurately obtained by means of slow-motion screws in a vertical and horizontal direction, by which means also the sun's apparent motion is continually corrected. The obscuration is effected by a screen placed on a tripod in the alignment of the flash, pivoted horizontally, and worked by a handle. In the heliograph patented by Mr. Mance the mirrors are circular, the obscuration being effected by giving a small angular motion to one of the mirrors, causing the reflected beam to travel through twice the angle and completely disappear from the distant point. This is more easily manipulated than obscuration by a screen. Its working is made very similar to that of an ordinary Morse key. The sun's motion is corrected by slow-motion screws, and the arrangements for directing the flash are very similar to those in the heliostat. Two tripod stands are employed: one is for the signalling mirror; the other in single working carries a jointed arm, fitted with a small white metal tablet having a black spot on which is thrown the shadow from an unsilvered hole in the centre of the signalling mirror, while in duplex working a piece of paper in the centre of the second mirror answers the same purpose.

In addition to its usefulness as a signalling instrument, the heliograph has been found of great service in defining exactly distant points for large surveys, such as the triangulation of India. For this purpose it was constantly employed by the late astronomer-royal at the Cape, Sir T. Maclear, in his verification of the arc of the meridian. (P. C.)

HELIOPOLIS. See BAALBEC and EGYPT, vol. vii. p. 667.

HELIOTROPE, or TURNSOLE, *Heliotropium*, L. (Greek, *ἡλιοτρόπιον*, *i. e.*, a plant which follows the sun with its flowers and leaves, or, according to Theophrastus, *Hist. Plant.*, vii. 15, which flowers at the summer solstice), a genus of usually more or less hairy herbs or undershrubs of the tribe *Heliotropieæ* of the natural order *Borragineæ*, having alternate, rarely sub-opposite leaves; small white, lilac, or blue flowers, in terminal or lateral one-sided simple or once or twice forked spikes, with a calyx of five deeply-divided segments, a salver-shaped, hypogynous, 5-lobed corolla, and entire 4-celled ovary; fruit 2- to 4-sulcate or lobed, at length separable into four 1-seeded nuts, or into two hard 2-celled carpels; and seeds generally with a scanty albumen. In some species the cone surmounting the stigma is bearded. The heliotropes are indigenous mostly to tropical and subtropical regions, but a few species are natives of Europe, as *H. europæum*, L., which is also a naturalized species in the southern parts of North America. *H. indicum*, L. (of the section *Heliophythum*, D.C.), is to be met with in equinoctial Africa, America, and Asia, but apparently not in Australia. Of 23 Australian species of *Heliotropium* that have been described, 16 are endemic. The common heliotrope of English hothouses, *H. peruvianum*, L., popularly known as "cherry-pie," is on account of the delicious odor of its flowers a great favorite with florists. It was introduced into Europe by the younger Jussieu, who sent seed of it from Peru to the royal garden at Paris. About the year 1757 it was grown in England by Mr. P. Miller from seed obtained from St. Germains. The plant has been known to occur with double flowers (Masters, *Veg. Terat.*, p. 510, Ray Soc., 1869). *H. corymbosum*, Ruiz et Pav., which was grown in Hammersmith nurseries as early as 1812, has larger but less fragrant flowers than *H. peruvianum*. The species commonly grown in Russian gardens is *H. suaveolens*, which has white, highly-fragrant flowers. Heliotropes may be propagated either from seed, or, as commonly, by means of cuttings of young growths taken an inch or two in length. The plants require in hot weather a plentiful supply of water, and in winter careful protection from frost, which soon kills them. If favored with a light rich soil and a warm conservatory, in which they may be grown in a border, or against a pillar, wall, or, trellis, they bloom all the year round. The formation of flowers is promoted by a sunny situation. Many florists' varieties of heliotrope are now under cultivation.

Heliotropium suaveolens.

Pliny (*Nat. Hist.*, xxii. 29) distinguishes two kinds of "helio tropium," the *tricoccum*, and a somewhat taller plant, the *helioscopium;* the former, it has been supposed, is *Croton tinctorium*, L., and the latter the *ἡλιοτρόπιον μικρόν* of Dioscorides, or *Heliotropium europæum*. The helioscopium, according to Pliny, was

variously employed in medicine; thus the juice of the leaves with salt served for the removal of warts, whence the term *herba verrucaria* applied to the plant. What, from the perfume of its flowers, is sometimes called winter heliotrope, is the fragrant butterbur, or sweet-scented coltsfoot, *Petasites* (*Tussilago*) *fragrans*, Presl., a perennial Composite plant. (For fig. see Maund, *The Botanic Garden*, i., pl. iv., fig. 4; 1878; and *Gardener's Chron.*, Feb. 2, 1878, p. 147.)

See Ruiz and Pavon, *Fl. Peruv.*, ii. 2–4, pl. cvii.-cxi., 1799; P. Miller, *Dict.*, ed. T. Martyn, i. pt. ii., 1807; *Hist. Nat. de Plinie*, ed. A. de Grandsagne, xiv. 158 *seq.*, 1832; De Candolle, *Prodr.*, x. 532, 1845; Bentham, *Fl. Austral.*, iv. 392, 1869; Bentham and Hooker, *Gen. Plant.*, ii. 843, 1873–76; Hemsley, *Handb. of Hardy Trees and Shrubs*, etc., p. 325, 1873; *Proc. Americ. Acad. Arts and Sci.*, x. 49, Bost., 1875; *Gardener's Chron.*, 1878, i. 21; and, for fig. of *H. peruvianum* and *H. corymbosum*, *Curtis's Bot. Mag.*, No. 141, 1791, and No. 1609, 1814.

HELIOTROPE, or BLOODSTONE, a cryptocrystalline variety of quartz, dark green in color, with small spots of red jasper, resembling drops of blood. The name, from the Greek ἥλιος, sun, and τρέπω, to turn, is stated by Pliny (*Nat. Hist.*, xxxvii. 60) to be due to its giving, when thrown into water, a red reflection of the light of the sun. The modern heliotrope, however, is Pliny's *prasius* (*op. cit.*, xxxvi. 34); and what he terms heliotrope was apparently a leek-green prase or plasma, abundantly veined with blood-red jasper. Heliotrope is found in the Isle of Rum, and in Mull of Cantyre, Argyllshire, and in several foreign localities. It is of common occurrence in the trap-rocks of the Deccan. Medicinal and other virtues were formerly ascribed to the stone. It is used for signet rings and a variety of ornamental articles.

HELL. See ESCHATOLOGY, vol. viii. p. 474.

HELLANICUS, the most important of the Greek logographers, was a native of Mytilene. His father was named Andromenes or Aristomenes. His life, which, as Lucian tells, lasted eighty-five years, extends over the 5th century B. C. but the date of his birth is uncertain, and the circumstances of his career are unknown. If the quotation in the scholiast on Aristoph., *Ran.*, 706, can be trusted (fr. 80), Hellanicus in one of his works referred to the battle of Arginusæ (406 B. C.). In that case (482–397 B. C.) the dates assigned by Müller (*Fragm. Hist. Gr.*, i. p. xxxiv.), following the author of the *Vita Euripidis*, must be approximately correct. On the other hand Thucydides (i. 93), who died in 403 B. C., criticises the work in which this statement might be expected to occur, which leaves a very narrow interval for the work to appear and acquire reputation enough to be taken notice of by Thucydides; while the style of the reference certainly suggests at first sight that Hellanicus was dead when Thucydides was writing. If on these grounds we disregard the scholiast, we may on the authority of Pamphila assign 496–411 as the limits of his life. Suidas says that he died at Perperene, a town on the Gulf of Adramyttium, and that he lived for some time at the Macedonian court along with Herodotus. If the latter fact be true, the time to which Suidas assigns it, viz., during the reign of Amyntas (553–504), is impossible.

The following list of his works gives the results of Müller's careful discussion of the extant fragments:—

(1.) *Persica*, probably in two books. This work, which was written before those on Greek history, gave (probably in bk. i.) an account of the Assyrians and the Medes, and (in bk. ii.) a history of the Persian empire. (2.) *Phoronis*, Argolic traditions from Phoroneus, "father of mortal men," the contemporary of Ogyges, down probably to the return of the Heraclidæ. It consisted chiefly of genealogies, with short notices of events interspersed. It was probably in two books; and the works quoted as *Bœotica* and *Argolica* are probably only portions of it. (3.) *Deucalionia*, tracing Thessalian traditions in a similar manner from Deucalion, who corresponds to Phoroneus as the first man. It was in two books; and the *Thessalica* is probably only another name for it or the title of a part of it. *Asopis* was apparently an appendix giving the genealogy of the Æcid race from Zeus and Ægina, daughter of Asopus, down to Miltiades. (4.) *Atlantis*, in two books, briefly enumerating the descendants of Atlas in general, but dwelling at much greater length on the offspring of Electra, and introducing in this part an account of Trojan history. Hence the work is often cited under the name of *Troica*. The works quoted as περὶ Ἀρκαδίας and περὶ Λυδίας are probably merely parts. (5.) *Atthis*, called by Thucydides (i. 97) ἡ Ἀττικὴ συγγραφή, giving in four books the history of the country from Ogyges or Cecrops down at least to the beginning of the Peloponnesian War. Thucydides says that he enumerated the events between 480 and 431 B. C. very briefly, and with little regard to chronological sequence. These four works on Greek history (2–5) were probably published in one single work, and were divided by later grammarians into separate sections and books. (6.) *Lesbiaca* or *Æolica*, a σύνταγμα ἐπιχώριον in two books at least. (7.) Ἱέρειαι τῆς Ἥρας, a list of the priestesses of the Argive Hera, incorporating a synopsis both of what had been scattered through his other works and of history that had not come within the scope of these works. We may presume that a list of priestesses was preserved in the temple with a slight account of contemporary events, particularly those relating to festivals and religious matters, and that Hellanicus made this the basis of his work. Reference to this line of priestesses was one of the commonest methods of dating, and is used by Thucydides in important cases (ii. 2; iv. 133). This is probably the same work that is often referred to under the name of *Histories*. It was in three books; the first came down to the apotheosis of Heracles and the voyage of Theseus to Crete, and the second probably to the Persian Wars. (8.) *Carneonicæ*, a list of the victors in the Carnean games of Apollo from their foundation, Ol. 26; along with the conquerors in the poetical and musical contests, it probably contained notices of literary events. (9.) Βαρβαρικὰ νόμιμα, quoted also with the titles περὶ ἐθνῶν, etc. As the history of the barbarian races was too little known to be arranged as Hellanicus had arranged the Greek history, the plan in this work was to enumerate the towns, and to describe the country, manners of the people, etc., like a geographer. The *Ægyptiaca* and the *Iter ad Templum Ammonis*, which were parts of this work, are counted by Müller spurious insertions on Orphic theology by an Egyptian writer; while Διὸς πολυτυχία is merely a part of this spurious insertion. Preller (*De Hellan. Lesb. Histor.*) considers this whole work to be spurious.

As an historian Hellanicus is greatly in advance of preceding logographers. He was not content to repeat the traditions that had gained general acceptation through the poets, but he tried to give the traditions as they were locally current, and he availed himself of the few national or priestly registers that presented something like contemporary registration. Thus, in the first place, he gave in many points accounts quite different from the usual beliefs: *e. g.*, he recorded the local belief in the Troad that Troy had not been totally destroyed by the Greeks but had continued to exist to his own time; and in the *Atthis*, touching on Spartan affairs, he made no reference to Lycurgus, but attributed the Spartan constitution to Eurysthenes and Procles. Now it is certain that the Spartan state registers could not have made any mention of Lycurgus on account of the plan on which they were framed (Müllor, *Hist. Dor.*, i. p. 132). Secondly, Hellanicus laid the foundations of a scientific chronology, though his materials were insufficient and he often had recourse to the usual rough reckoning by generations. On account of his deviations from common tradition, Hellanicus is often called an untrustworthy writer by the ancients themselves; but probably few authors would have been more useful to a scientific student if his works had been preserved. Dionysius (*Judic. de Thucyd.*) censures him for arranging his history, not according to the natural connection of events, but according to the locality or the nation he was describing; and undoubtedly he never, like his contemporary Herodotus, rose to the conception of a single current of events wider than the local distinction of race. His style, like that of the older logographers, was dry and bald; and there seems little foundation for the statement of Suidas that he wrote poetry, though perhaps some parts of the *Æolica* were in verse.

HELLEBORE (Greek ἑλλέβορος; Modern Greek also σκάρφη; German, *Nieswurz*, *Christwurz*; French, *elébore*, and, in the district of Avranche, *herbe enragée*), *Helleborus*, L., a genus of plants of the natural order *Ranunculaceæ*,[1] natives of Europe, Western Asia, and North America. The leaves[2] are palmate or pedate (BOTANY, vol. iv. p. 99, fig. 108), are usually solitary, and have five persistent petaloid sepals, within the circle of which are placed the minute gland-like tubular petals, the nectaries of Linnæus, of the form of a horn with an irregular opening, and representing according to Baillon (*Nat. Hist. of Plants*, i. 13, 1871), "the lower or outermost stamens transformed into staminodes."[3] The stamens are very numerous, and are spirally arranged; and the carpels are variable in number, sessile or stipitate, and slightly united at the base, and dehisce by ventral suture (vol. iv. 128, 135).

Helleborus niger, L., Black Hellebore, or, as from blooming in mid-winter it is termed, the Christmas Rose (Ger., *Schwarze*

[1] On the plants known as White Hellebore (*Veratrum album*) and American White Hellebore, commonly called "Green Hellebore" (*V. viride*), which are members of the natural order *Melanthaceæ*, see VERATRUM.

[2] On the development and structural relations of the leaves, see A. Trécul, *Ann. Sci. Nat.*, Bot., ser. iii., tom. xx. 260, 268, pl. 23, figs. 101–3, 1853; and Clos, *Bull. Soc. Bot. de France*, iii. 682, 1856.

[3] On the petals of the hellebores, see J. B. Payer, *Traité d'Organogénie comparée de la Fleur*, pp. 256–260, 1857. In the opinion of Baillon (*op. cit.*, pp. 15–21), the groups *Eranthis* and *Coptis*, from the structure of their flowers, as also strictly *Isopyrum* and *Trollius*, should not be generically separated from *Helleborus*.

Nieswurz; Fr., *Rose de Noël*), is found in southern and central Europe, and with other species was cultivated in the time of Gerard (see *Herball*, p. 977, ed. Johnson, 1733) in English gardens. Its knotty bracteated rhizome is blackish-brown externally, and, as with other species, gives origin to numerous straight roots. The leaves are radical, coriaceous, smooth, distinctly pedate, dark green above, and lighter below, with 7 to 9 segments, and long petioles. The scapes, which end the branches of the rhizome, have a loose entire bract at the base, and terminate in a single flower, with two bracts, from the axis of one of which a second flower may be developed. The flowers have 5 white or pale-rose, eventually greenish sepals, 15 to 18 lines in breadth; 8 to 13 tubular green petals containing a sweet liquid secretion; and 5 to 10 free carpels.

Varieties of Black Hellebore are *H. niger minor*, or *H. angustifolius*, and Giant Hellebore, distinguished as *H. niger major*, *maximus*, *giganteus*, and *grandiflorus*, or as a distinct species, *H. altifolius*. *H. fœtidus*, L., Stinking Hellebore, in Westmoreland Felon-grass, known also, from the shape of its leaves, as Bear's-foot (Fr., *Pied de Griffon*), is a native of England, where, like *H. viridis*, it is confined chiefly to limestone districts; it is common in France and the south of Europe. Its leaves have

Helleborus niger. 1, Vertical section of flowers: 2, nectary, side and front view (nat. size).

7- to 11-toothed divisions, and the flowers are in panicles, numerous, cup-shaped, and drooping, with many bracts, and green sepals tinged with purple, alternating with the five petals.

H. viridis, L., or Green Hellebore proper, ranges from England, where it is probably indigenous in some of the southern and eastern counties, to Spain and Italy, and even it is said to Turkey. It has bright yellowish-green flowers, 2 to 4 on a stem, with large leaf-like bracts. Brunfels and Bock (16th century) regarded the plant as the Black Hellebore of the Greeks.

The radical leaves of *H. viridis* and its varieties, as also of *H. multifidus*, Visian, *H. purpurascens*, W. & K., *H. cyclophyllus*, Boiss., and several allied forms, wither in winter. In *H. vesicarius*, Auch. (Boissier, *Fl. Orient.*, i. 60), a native of Syria, the flower-stem bears 4 to 5 flowers, and the carpels are much compressed laterally, and, when ripe, united half way up, as in certain *Nigellæ*. *H. lividus*, Soland (*H. argutifolius*, Viv., *trifolius*, Mill., and *ilicifolius* and *triphyllus*), Holly-leaved Hellebore, found in the Balearic Islands, and in Corsica and Sardinia, is remarkable for the handsomeness of its foliage. *H. antiquorum*, Braun, which has purplish-white flowers, occurs in Bithynian Olympus. *H. olympicus*, Lindl., is perhaps a variety of it. *H. cyclophyllus* (Boiss., *Fl. Orient.*, i. 61), a Grecian species, has ovate-orbicular green sepals. *H. orientalis*, Lam., *Ency.*, iii. 92 (*H. ponticus*, Braun, see Boiss., *op. cit.*), indigenous to Macedonia, Thrace, the vicinity of Constantinople, and northern Asia Minor as far east as Trebizond, has leaves pubescent below, and of 7 to 9 segments, and scapes bearing 3 to 5 flowers, with white or rosy sepals. Allied to it are *H. odorus*, W. & K., of which Koch regards *H. atrorubens* as a variety, and *H. caucasicus*, Koch,[1] having green and purplish-green sepals respectively.

[1] According to Regel, *H. orientalis*, *caucasicus*, *colchicus*, *antiquorum*, *olympicus*, *guttatus*, and *abchasicus* should all be reduced to one species. Koch (*Gard. Chron.*, 1874, i. 118) regards the Hungarian *H. purpurascens*, W. & K., and the Caucasian *H. colchicus*, Reg. (= *H. porphyromelas*, Braun), as varieties of the last-named. The "*H. abschasicus*" of Belgian florists is stated by M. J. L. Le Bêle ("Monog. des Helléb.," *La Belgique Horticole*, vii. 331) to be merely a variety of *H. intermedius*, Guss.

Hellebores may be grown in any ordinary light garden mould, but thrive best in a soil of about equal parts of turfy loam and well-rotted manure, with half a part each of fibrous peat and coarse sand, and in moist but thoroughly-drained situations, more especially where, as at the margins of shrubberies, the plants can receive partial shade in summer. For propagation, cuttings of the rhizome may be taken in August, and placed in pans of light soil, with a bottom heat of 60° to 70° Fahr.; hellebores can also be grown from seed, which must be sown as soon as ripe, since it quickly loses its vitality. The seedlings usually blossom in their third year. The exclusion of frost favors the production of flowers; but the plants, if forced, must be gradually inured to a warm atmosphere, and a free supply of air must be afforded, without which they are apt to become much affected by greenfly. The flowers on one plant of *H. niger major* in Mr. B. Hooke's garden at Bradfield, Berks, about the end of January, 1878, numbered nearly 500 (*Gard. Chron.*, 1878, i. 145). For potting, *H. niger* and its varieties, and *H. orientalis*, *atrorubens*, and *olympicus* have been found well suited. After lifting, preferably in September, the plants should receive plenty of light, with abundance of water, and once a week liquid manure, not over-strong. The flowers are improved in delicacy of hue, and are brought well up among the leaves, by preventing access of light except to the upper part of the plants. Of the numerous species of hellebore now grown, the deep-purple-flowered *H. colchicus* is one of the handsomest. *H. atropurpureus*, introduced in 1844, blooms in March or at the end of February, and may be effectively used in flower borders to succeed hepaticas, scillas, and crocuses (Maund, *Bot. Gard.*, vi., pl. ccxviii., fig. 2). Hellebores having variously colored spreading or bell-shaped flowers, spotted with crimson, red, or purple, were grown by Sauer, late superintendent of the Berlin University Garden, about the year 1851, as the result of crossing *H. guttatus*, Braun, and *H. purpurascens*. Other fine varieties have been obtained by Bouché, his successor, from crosses with *H. olympicus*, and by Carl Heinemann from *H. guttatus* and *H. abchasicus*.

The rhizome of *H. niger* occurs in commerce in irregular and nodular pieces, from about 1 to 3 inches in length, white, and of a horny texture within. Cut transversely it presents internally a circle of 8 to 12 cuneiform ligneous bundles, surrounded by a thick bark. It emits a faint odor when cut or broken, and has a bitter and slightly acrid taste. The drug is sometimes adulterated with the rhizome of baneberry, *Actæa spicata*, L., which, however, may be recognized by the distinctly cruciate appearance of the meditullium of the attached roots when cut across, and by its decoction giving the chemical reactions for tannin.[2] The rhizome is darker in color in proportion to its degree of dryness, age, and richness in oil. A specimen dried by Schroff lost in eleven days 65 per cent. of water.

H. niger, *orientalis*, *viridis*, *fœtidus*, and several other species of hellebore contain the glucosides *helleborin*, $C_{36}H_{42}O_6$, and *helleborein*, $C_{26}H_{44}O_{15}$, the former yielding glucose and *helleboresin*, $C_{30}H_{38}O_4$, and the latter glucose and a violet-colored substance *helleboretin*, $C_{14}H_{20}O_3$. Helleborin is most abundant in *H. viridis*. A third and volatile principle is probably present in *H. fœtidus*. Both helleborin and helleborein act poisonously on animals, but their decomposition-products helleboresin and helleboretin seem to be devoid of any injurious qualities. Helleborein produces excitement and restlessness, followed by paralysis of the lower extremities or whole body, quickened respiration, swelling and injection of the mucous membranes, dilatation of the pupil, and, as with helleborein, salivation, vomiting, and diarrhœa. Helleborein exercises on the heart an action similar to that of digitalis, but more powerful, accompanied by at first quickened and then slow and labored respiration; it irritates the conjunctiva, and acts as a sternutatory, but less violently than veratrine.

Of various species of hellebore examined by him, Schroff found *H. orientalis* to possess most medicinal activity; less energetic in succession were *H. viridis*, *fœtidus*, *purpurascens*, *ponticus* (? Braun, *v. sup.*), and *niger*. Pliny states that horses, oxen, and swine are killed by eating "black hellebore;" and Christison (*On Poisons*, p. 876, 11th ed., 1845) writes: "I have known severe griping produced by merely tasting the fresh root in January." Parkinson, who questions the virulence of the drug (*Theat. Botan.*, p. 216, 1640, fol.), possibly observed its effects in the dry condition. According to Bergius (*Mat. Med.*,

[2] For the microscopical characters and for figures of transverse sections of the rhizome, see Lanessan, *Hist. des Drogues*, i. p. 6, 1878.

ii. 496, Stockh., 1778,, the rhizome of *H. niger*, if fresh, is poisonous, rubefacient, and vesicant, when recently dried, emetic, purgative, emmenagogue, insecticidal, and sternutatory: and after long keeping scarcely purgative, but alterative and diuretic. Rayer also has observed that when dried and powdered it is almost devoid of purgative properties. Poisonous doses of helleboro occasion in man singing in the ears, vertigo, stupor, thirst, with a feeling of suffocation, swelling of the tongue and fauces, emesis and catharsis, slowing of the pulse, and finally collapse and death from cardiac paralysis. Inspection after death reveals much inflammation of the stomach and intestines, more especially the rectum. The drug has been observed to exercise a cumulative action. Its extract was an ingredient in Bacher's pills, an empirical remedy once in great repute in France. In British medicine the rhizome was formerly official (see J. B. Nevins, *Transl. New Lond. Pharm.*, p. 666, 2d ed., 1854), and the tincture, powder, or, more rarely, the decoction is still occasionally used. Parkinson (*op. cit*) mentions the employment of the leaves and juice of *H. niger* "to help the Dropsie, Jaundies, and other evil dispositions of the liver and gall;" and Dr. C. D. F. Phillips (*Mat. Med. and Therap.*, p. 27, 1874) has found the tincture of the rhizome of value in dropsical affections, especially in anasarca resulting from scarlet fever. *H. fœtidus* was in past times much extolled as an anthelmintic, and is recommended by Bisset (*Med. Ess.*, pp. 169 and 195, 1766) as the best vermifuge for children, J. Cook, however, remarks of it (*Oxford Mag.*, March, 1769, p. 99): "Where it killed not the patient, it would certainly kill the worms; but the worst of it is, it will sometimes kill both." This plant, of old termed by farriers Ox-heel, Setter-wort, and Setter-grass, as well as *H. viridis* (Fr., *Herbe à séton*), is employed in veterinary surgery, to which also the use of *H. niger* is now chiefly confined in Britain.

In the early days of medicine two kinds of hellebore were recognized, the white, or *Veratrum album* (*vide supra*, note), and the black, including the various species of *Helleborus*. The former, according to Codronchius (*Comm. . . . de Elleb.*, 1610), Castellus (*De Helleb. Epist.*, 1622), and others, is the drug usually signified in the writings of Hippocrates. Among the hellebores indigenous to Greece and Asia Minor, *H. orientalis*, Lam. (*v. supra*), the rhizome of which differs from that of *H. niger* and of *H. viridis* in the bark being readily separable from the woody axis, is the species found by Schroff to answer best to the descriptions given by the ancients of black helleboro, the ἐλλέβορος μέλας of Dioscorides. The rhizome of this plant, if identical, as would appear, with that obtained by Tournefort at Prusa in Asia Minor (*Rel. d'un Voy. du Levant*, ii. 189, 1718), must be a remedy of no small toxic properties. According to an early tradition, black hellebore administered by the soothsayer and physician Melampus (whence its name *Melampodium*), was the means of curing the madness of the daughters of Prœtus, king of Argos. The drug was used by the ancients in paralysis, gout, and other diseases, more particularly in insanity, a fact frequently alluded to by classical writers, *e. g.*, Horace (*Sat.*, ii. 3, 80–83; *Ep. ad Pis.*, 300). Various superstitions were in olden times connected with the cutting of black hellebore. The best is said by Pliny (*Nat. Hist.*, xxv. 21) to grow on Mt. Helicon. Of the three Anticyras (see vol. ii p. 112), that in Phocis was the most famed for its hellebore, which, being there used combined with "sesamoides," was, according to Pliny, taken with more safety than elsewhere.

See Hayne, *Arzney.-Gewächse*, i. pl. 2 and 7–10, 1805; Sibthorp, *Flora Græca*, vi. 19, 1840; Stephenson and Churchill, *Med. Bot.*, i., pl. xi. and xxi., 1831; Woodville, *Med. Bot.*, iii. 473–9, 3d ed., 1832; Spach, *Suites à Buffon, Hist. Nat. des Vég.*, vii. 312–22, 1839; Reichenbach, *Icon. Fl. Germ.*, iv., pl. cliii.–cxii., 1840; W. D. J Koch, *Synop. Fl. Germ. et Helv.*, p. 21, 2d ed., 1843, and *Taschenb. d. Deutsch. u. Schweiz Fl.*, p. 223, 2d ed., 1878; Schroff, *Prager Vierteljahressch. f. d. pract. Heilk.*, lxii. 49–117, and lxiii. 95–134, 1859; Berg and Schmidt, *Off. Gewächse*, iv., pl. xxix. *sq.*, 1863; Syme, *Sowerby's Eng. Bot.*, i. 56–59, pl. xliv., xlv., 1863; Marmé and Husemann, *Zeitsch. d. rat. Medic.*, 3d ser., xxvi. 1–98, 1865, also Drs. A. and T. Husemann, *Die Pflanzenstoffe*, p. 796, 1871; *Gard. Chron.*, 1874, i 480; 1877, i. 432, 464; *The Garden*, vii. 463, and xiv. 178, 451; *The Florist*, 1875, p. 159; Bentley and Trimen, *Med. Pl.*, pt. 5, No. 2, 1876; *Journ. of Hort. and Cott. Gard.*, Nov. 21, 1877, p. 397; Von Boeck, *Ziemssen's Cycl. of the Pract. of Med.*, xvii. 741, 1878; and for bibliography of early treatises on hellebore, J. D. Reuss, *Repert. Comment.*, "Mat. Med.," xi. 143, 1816; and E. J. Waring, *Bibliotheca Therapeutica*, ii. 458, New Cav. Soc., 1879. (F. H. B.)

HELLENISTS (Ἑλληνισταί) was the name usually applied by those who called themselves Greeks (Hellenes) to all Græcizing and more especially to all Greek-speaking foreigners,—a class which, after the conquests of Alexander the Great, formed a large and important element in almost every community throughout the civilized world. More particularly the word is applied in the New Testament (Acts vi. 1, ix. 29, and, according to the *textus receptus*, also xi. 20, where, however, the best MSS. and critical editions read Ἕλληνας) to Greek speaking or "Grecian" Jews, who, besides being very numerous in the various countries of the dispersion, had also many synagogues in Jerusalem, and were remarkable there for their zeal. Indeed their presence in the capital of Judaism at all may safely be taken to have implied on their part a more than ordinary interest in the affairs of the ideal theocratic kingdom; their attitude therefore to Christianity, when that new system first came to be promulgated, could not fail to be very pronounced on the one side or on the other The early records show that the apostles made many converts among the Hellenists of the city; and it is interesting to note that, if the names can be taken as a safe indication, all the seven deacons mentioned in Acts vi. 5 belonged to the "Hellenistic" and not to the "Hebrew" party within the primitive church. Saul of Tarsus also was a Hellenist; but whether he belonged to the synagogue of the "Libertines" or to that of "those of Cilicia" is a question which our data do not enable us to decide. In the Vulgate, which translates Ἑλληνισταί by the word "Græci," the distinction so consistently preserved in our authorized version between 'Grecians" and "Greeks" is made to disappear

HELLESPONT, the modern Dardanelles (vol vi. p. 724) is variously named in classical literature Ἑλλήσποντος, Hellespontus, ὁ Ἑλλης πόντος, Pontus Helles, Hellespontum Pelagus, and Fretum Hellespontiacum. It received its name from Helle, in Greek mythology, daughter of Athamas, king of Orchomenus in Bœotia, and of the goddess Nephele, whom he had married at the command of Hera (Juno). Athamas, however, secretly loved the mortal Ino, and on his marrying her also the dissensions between his wives became so great that he went to consult the Delphic oracle. The priestess there, bribed by Ino, assured him that the sacrifice of Phrixus, the brother of Helle, was necessary to domestic harmony; but Nephele, in order to save her children, despatched them to Colchis in Asia, on the back of the ram with the golden fleece. Helle, however, had the misfortune, when crossing this strait, to slip from her seat, and to be carried away by the current. Hence the name *Hellespontus*, or "Sea of Helle."

HELLIN (*Illunum*), a town in Spain, in the province of Albacete, is situated on the slope of the Sierra de Segura, 35 miles S.S.E. of Albacete. It is a clean and well-built town, and possesses the remains of an old Roman castle and a beautiful parish church, the masonry and marble pavement at the entrance of which are worthy of special notice. The principal manufactures are sulphur obtained from the celebrated mines about 13 miles distant, earthenware, linens, cloth, hats, leather, and oil. Hellin was sacked by the French under Montbrun, and was the point where Joseph and Soult united with Suchet after Marmont's rout at Salamanca. The population is about 14,200.

HELMERS, Jan Frederik (1767–1813), Dutch poet, was born at Amsterdam, March 7, 1767 His early poems *Night* (1788) and *Socrates* (1790) were tame and sentimental, but he woke up after 1805 to the melancholy condition of the Fatherland, and determined, in company with his friend Cornelis Loots, to rouse national feeling by a burst of patriotic poetry His poems, published in 1809 and 1810, but especially his great work *The Dutch Nation* (1812), created great enthusiasm and enjoyed immense success. Helmers died at Amsterdam, February 26, 1813. He was a fiery, somewhat turgid writer, by no means devoid of force, but owing his success mainly to the integrity of his patriotism and the opportune moment at which he sounded his counterblast to the French oppression. His posthumous poems were collected in 1815.

HELMET, or Helm (Anglo-Saxon, *Helm*; Italian, *Elme, Elmetto*; French, *Heaume*, Icelandic, *Hjalmr*), is the term used in a general sense to include the various forms of head defences which were either made in solid metal or of metal plates. The form of helmet used among the Assyrians, as shown by the monumental sculptures, was a close-fitting skull-cap, round or conical, sometimes surmounted by a crest rising from the summit of the cone and curving forwards in a semicircular form. The Greek helmet was also in its simplest form a skull-cap, covering the head in front above the level of the eyes, but reaching down to the nape of the neck from ear to ear. Another form had this lower part prolonged and carried round so as to cover all above the shoulders with the exception of a slit in front, partly protected by a nose-piece. Occasionally hinged cheek-pieces were added to the skull-cap, and the upper part of the casque was sometimes prolonged into a conical shape with a crest curving forwards, or surmounted by a ridged prominence on which was fastened a flowing crest of horsehair. The Greek helmets are often represented as

highly decorated, and many examples of the different forms and their varieties of decoration occur on the painted vases, the gems, and the coinage. The Etruscan helmet differed but slightly from that of the Greeks. It was more conical in form, and often furnished with horns or wings in place of a crest. The Roman helmet was usually a skull-cap, with or without crest, and often plain and undecorated. The Gaulish helmet, of which a beautiful specimen was obtained from an Iron Age burial at Berru in Marne in 1872, was of hammered iron, conical in shape, terminating in an ornamental apex, and having a richly decorated border round the lower part. Conical helmets of an earlier character found at Theil and Auxonne have been assigned to the Age of Bronze. A silver helmet of the Early Iron Age, consisting of a skull-cap with a mask for the face fastened together by a hinge, which was found in the Thorsbjerg Moss in South Jutland, is the only specimen known of the early Teutonic helmet. An Anglo-Saxon helmet of iron, shaped like a skull-cap, and formed of ribs or flat strips of metal, covered with plates of horn, and surmounted with the figure of a boar, was found in a tumulus at Benty Grange in Derbyshire. Such boar-crowned helmets are referred to in the Anglo-Saxon poem of Beowulf. The helmets worn by the Normans and Saxons at the time of the Conquest, as shown in the Bayeux tapestry, were conical in shape with a projecting nasal. The earliest known example of a date subsequent to the Norman Conquest is one which was discovered in the church of Faversham, and is now in the Musée d'Artillerie at Paris. It preserves the conical top of the earlier Norman headpiece, but has a barrel-shaped body, covering all the head and face with the exception of a vertical slit partially protected by a projecting nasal, and having transverse apertures on either side for the eyes. This barrel-shape, with flattened instead of conical top, continued in use during the 12th century in England, although the conical cap with the nasal appears on the great seals of the Scottish kings down to the time of Alexander II. The helm of Edward the Black Prince (died 1370), which still hangs over his tomb in Canterbury Cathedral, has the top shaped like a truncated cone and the lower part more oval than barrel-shaped, the aperture for sight taking the form of a transverse slit between the upper and lower parts of the helm. In the lower portion the perforations for breathing are arranged in the form of a crown on both sides. The helm of Henry V. (died 1422), which hangs with his saddle and shield above his tomb in Westminster Abbey, is lower in the crown, more rounded to the shape of the head, and the *ocularium* or perforation for sight is protected by the projection of the lower part beyond the line of the upper. The helm of King Henry VI., which was suspended over his tomb in St. George's Chapel, Windsor, has the lower part contracted to the form of the neck and rounded to the shape of the shoulders. The *ocularium*, which is wide, is protected by a series of curved bars riveted across it. The helm of Edward IV. (died 1483), which was also suspended in St. George's Chapel, exhibits a still greater shaping to the form of the neck and shoulders; the top is rounder, and has a spike for a crest. In the end of the 15th century the great helm was superseded by the smaller headpiece with movable vizor and beaver or chinpiece and neck guard, which is properly styled a helmet. Other varieties of headpiece were the bascinet, of a plain oval form pointed at the top and somewhat compressed on the sides, having holes at the bottom for the attachment of the camail or gorget of chain-mail. The bascinet was sometimes worn alone and sometimes under the helm. It was succeeded in the 15th century by the salade, a lighter skull-cap with the hinder part projecting, and occasionally a movable vizor. The armet, the burgonet, and the casque are varieties of the lighter form of headpiece, partaking more or less of the skull-cap form, while the morion and the chapelle de fer were distinguished by their flattened brims.

HELMOND, a town of the Netherlands, in the province of North Brabant, to the left of the river Aa, with a station (since 1866) on the state railway between Venloo and Eindhoven. The castle of Helmond remains a beautiful specimen of the architecture of the 15th century, and among the other buildings of note in the town are the spacious church of St. Lambert, the Reformed church, and the town-house. Cotton-weaving on a very extensive scale, dyeing, iron-founding, brewing, soap-boiling, and tobacco dressing are the chief industries of the commune. The population of the town proper in 1870 was only 5280, but the commune, which includes several suburbs, had about 6500.

Helmond is first mentioned as a town in 1354, but it may possibly be identical with a certain Harlemont or Harlomont which appears in the 12th century. In the middle of the 13th century it was the favorite residence of Mary of Brabant, queen of the Romans. Fortified shortly after the attack of the people of Guelderland in 1543, it continued a place of military importance till the peace of Münster. The occupation of the town by the duke of Parma in 1579, its recovery by the states of Holland in 1581, its capture by the count of Hohenlohe in 1588, and the seizure of the castle by Count Frederick of Nassau are the chief events in its military annals. In 1814 the town received the right of parliamentary representation, but it afterwards lost the privilege.

HELMONT, Jean Baptiste van (1577–1644), was born at Brussels in 1577. He was educated at Louvain, and began the study of natural science under the Jesuits in that city. Their hard and dry philosophy, however, had few attractions for a nature so ardent and imaginative as his. Turning for relief to other systems, he found no rest except in the mysticism of A Kempis and Tauler. From them he learned that wisdom is the gift of the Supreme Being, that it must be obtained by prayer, and that we must renounce our own will if we wish to participate in the influence of the divine grace. From this time he began a life of exemplary meekness and humility, made over his property to his sister, and retired from the high society in which he had hitherto walked. He devoted himself to the study of medicine, read carefully all that had been written on the science, and felt dissatisfied with its method and results. He then turned to Paracelsus and the alchemists, and conferred a real boon on humanity by rescuing chemical science from the erratic absurdities of the post-Paracelsian alchemists, and applying to it more philosophical principles. He graduated as M. D. in 1599, and, after travelling through France and Italy, Switzerland and England, married a rich lady of Brabant, by whom he had several children. He died in Holland in 1644, in the sixty-seventh year of his age. Science is under real obligations to Van Helmont, though the greater part of his speculations presents a curious mixture of mystical philosophy and acute chemical research. To him is due the invention, or at least the first application, of the term "gas" in the sense in which it is now used. He also discovered that gas was disengaged in abundance by the application of heat to various bodies, and during the solution of various carbonates and metals in acids.

Van Helmont's works were published at Amsterdam in 1648 by his son Mercurius; a more accurate and complete edition is that of Elzevir, 1652. The fullest account of his speculations is given in Rixner and Sieber, *Beiträge zur Geschichte der Physiologie* (1819–26), Hft. vii. See also Spiess, *Helmont's System der Medicin*, 1840; Rommelaere, *Études sur J. B. v. Helmont*, 1868. Van Helmont's mystical theosophy and alchemy appeared in even greater confusion in the works of his youngest son, Franz Mercurius, who was born in 1618 and died, after a somewhat adventurous and troubled life, at Berlin in 1699. His chief works are *Cabbalah Denudata*, 1677; *Paradoxal Discourses*, 1685; and *Opuscula Philosophica*, 1690.

HELMSTÄDT, or Helmstedt, a town of Germany in the duchy of Brunswick, is situated on the railway from Magdeburg to Brunswick, 23 miles E. of Brunswick. It is the seat of a circle directorate, and of a circle and a district court. The principal buildings are the Julcum in the Byzantine style, founded by Duke Julius of Brunswick in 1575 for the university which was abolished in 1809, and now containing an old library of 40,000 volumes; the church of St. Stephen's, dating from the 12th century; the Lutheran female institution, with a beautiful church in the Roman style; and the Catholic church and ruined monastery of St. Ludger. The educational institutions include a gymnasium, two city schools, an agricultural school, and two female schools of the higher grade. The principal manufactures are yarn, soap, tobacco, sugar, vitriol, earthenware, and tobacco pipes. Not far from the town there is an iron mineral spring especially efficacious in gouty affections. Near it a monument has been erected to those who fell in the Franco-German war of 1870–71; and in the town there is also a monument to those who fell at Waterloo. The population in 1905 was 15,415.

Helmstädt originated in connection with the Ludger monas-

tery, founded by Ludger, the first bishop of Münster, about the end of the 8th century. It obtained town rights in 1099, and although destroyed by the archbishop of Magdeburg in 1199 it was soon rebuilt. In 1457 it joined the Hansa, and in 1490 it came into the possession of Brunswick. See Kunhard, *Beiträge zur Geschichte der Universität Helmstädts*, 1797; Ludewig, *Geschichte und Beschreibung der Stadt Helmstädt*, 1821; *Geschichte der ehemaligen Hochschule Julia Carolina zu Helmstädt*, 1876.

HELOISE. See ABELARD.

HELOTS, in Grecian antiquity, were the serfs or bondsmen of the Spartans. The most probable of the various explanations of their origin seems to be that they were the early aborigines of Laconia, who at the time of the Dorian invasion were reduced to slavery by the conquerors. The name is perhaps best derived from the root ἑλ, found in ἑλεῖν, ἥλων, and other words. The Helots were the lowest class of the inhabitants of Sparta; but those of them who were emancipated formed the class of *Neodamodes*, next in political rights to the Spartan citizens themselves. The *Mothones* or *Mathakes* were domestic slaves who had been brought up along with the young Spartans, and afterwards liberated. The Helots were the property of the state, which alone had the right of emancipating them, although it made over their services to individuals. They were attached to the soil—*adscripti glebæ*—and could not be sold away from it. They tilled the land which was allocated to them in the proportion of one lot to several families; and for each lot they paid to their masters an annual rent of 82 medimni of barley, and a quantity of wine and oil. They were also employed on public works, and performed all domestic service. In time of war the Helots generally served as light-armed troops; but when on special emergencies they fought as *hoplites*, they were usually rewarded with their freedom. The first occurrence of this kind was under Brassidas in 424 B. C. In the fleet the great bulk of the sailors were Helots. Although every care was taken to distinguish the serf from his lord, even in the matter of dress, the accounts of the cruel treatment of the Helots by the Spartans only hold true of the later history of Lacedæmon. The condition of the Helot was better than that of a slave in other Greek states, for, being a serf of the soil, he was not wholly at the mercy of his master, and there was a legal way whereby, after many stages, he could eventually attain freedom and citizenship. After the Messenian war, however, when the multitude of the Helots made them formidable to the diminished numbers of the full citizens, there is no doubt that very cruel measures were adopted against them. The evidence is strong that the *Crypteia*, instituted ostensibly to inure the Spartan youth to hardship, was really intended to reduce the number of the Helots by assassination; and we know from Thucydides (iv. 80) that on one occasion 2000 Helots were treacherously massacred by the Spartan citizens. At the close of the second Messenian war (668 B. C.), the conquered Messenians were classed with and treated as the Helots, till Epaminondas restored them to their native country after the battle of Leuctra (371 B. C.).

For further details see Plutarch's *Life of Lycurgus*, Thirlwall's *History of Greece*, Grote's *History of Greece*, Müller's *History of the Dorians*, and Hermann's *Political Antiquities of Greece*.

HELPS, SIR ARTHUR (1813–1875), fourth and youngest son of Thomas and Ann Frisquett Helps, was born at Balham Hill, in the parish of Streatham and county of Surrey, on the 10th of July, 1813. His father was then and for many years afterwards head of a large mercantile house in the city of London, and for the last thirteen years of his life treasurer of St. Bartholomew's Hospital. His mother was the only surviving child of John, fourth son of the Rev. Charles Plucknett, M. A., of Wincanton. After the usual preliminary training at Eton, young Helps went to Trinity College, Cambridge, passing as B. A. in 1835, when he came out 31st wrangler in the mathematical tripos, and taking his M. A. degree in 1839. Although he took no high honors at the university,—and indeed he had not health sufficiently robust, even if he had possessed the ambition, to achieve them,—he was recognized by the ablest of his contemporaries there as a man of superior gifts, and likely to make his mark in after life. They showed this by electing him as a member of the Conversazione Society, better known as the Apostles, a society which had been established in 1820 for the purposes of discussion on social and literary questions by a few young men attracted to each other by a common taste for literature and speculation. A body which in its early days included the names of Charles Buller, Frederick Maurice, Richard Chenevix Trench, Monckton Milnes, Arthur Hallam, and Alfred Tennyson had in it every element to make its gatherings delightful as well as useful. To be elected into its limited circle was a distinction of which Arthur Helps was proud then and to the close of his life; and, familiar as he was with the best and most intellectual society of his time, the social hours passed year by year with the Cambridge Apostles were always counted by him among his happiest, both in anticipation and in remembrance.

In the discussions of these and later days Helps may have found the suggestions for the dialogues of the *Friends in Council*, in which his genius appears at his best. But his first literary effort, which appeared under the title of *Thoughts in the Cloister and the Crowd* in 1835, the year he took his B. A. degree, assumes a very different but scarcely less ambitious form, that of a series of aphorisms upon life, character, politics, and manners. As a rule, such things are only valuable when they come as the fruits of wide experience and matured thought. Still in this volume are to be found passages which may take their place beside the sayings of Vauvenargues, Chamfort, and other masters of aphorism of the second rank, and are quite equal in quality to the many pithy quotable sayings scattered through Helps's later works.

Soon after leaving the university, where he had established many valuable friendships, Arthur Helps became private secretary to Mr. Spring Rice (afterwards Lord Monteagle), then chancellor of the exchequer in Lord Melbourne's administration. This appointment he filled till 1840, when he went to Ireland as the private secretary of Lord Morpeth (afterwards earl of Carlisle), then the chief secretary of state for Ireland, where he remained until his principal left Ireland in 1841, on the Government passing from Lord Melbourne into the hands of Sir Robert Peel. In the mean while (28th October, 1836) Helps had married Miss Bessy Fuller, a young Irish lady. He was also appointed one of the commissioners for the settlement of certain Danish claims which dated so far back as the siege of Copenhagen; but with the fall of the Melbourne administration his official experience closed for a period of nearly twenty years. The character which he had established for himself by his tact, sagacity, and business habits was not, however, forgotten by his political friends. And combined as these qualities were with an admirable manner which invited confidence while it repelled intrusion, and with a reticence and discretion on which absolute reliance could be placed, his fitness for official life was unmistakable. When, therefore, the clerkship of the Privy Council became vacant in 1860, on the resignation of the Hon. W. L. Bathurst, he was recommended for the appointment by his old friend Lord Granville, who knew that for ability, tact, and discretion it could not be in safer hands.

During his early official career Helps cultivated literature with varying success. His *Essays written in the Intervals of Business*, published in 1841, and his *Claims of Labor, an Essay on the Duties of the Employers to the Employed*, published in 1844, continue to interest, and are likely to keep their place in well-selected libraries. But two plays, *King Henry the Second, an Historical Drama*, and *Catherine Douglas, a Tragedy*, both published in 1843, have no particular merit. Neither in these, nor in his only other dramatic effort, *Oulita the Serf*, published in 1858, a work far superior, however, to his earlier efforts of the same kind, are to be found the sense of dramatic situation and movement, the sharp outlines and contrast of character, or the fitness and concise force of diction which alone justify the selection by an author of the dramatic form as the vehicle for his thoughts. Helps possessed, however, just enough dramatic power to give life and individuality to the dialogues which he introduced with excellent effect to enliven many of his other books. His first effort in this direction was in *Friends in Council, a Series of Readings and Discourse thereon*, published in 1847 and 1851. The plan of this book seems to have been suggested by a passage in Bacon's essay *Of Discourse*, which appears as the motto of it. "It is good in discourse and speech of conversation to vary and intermingle speech of the present occasion with arguments, tales with reasons, asking of questions with telling of opinions, and jest with earnest; for it is a dull thing to tire, and, as we say now, to jade anything too far." The

variety and conflict of opinion, the play of character, the flashes of humor, got by submitting the formal essays on social and moral questions which made the staple of these volumes to be criticised and pulled to pieces by the imaginary personages, who under the names of Milverton, Ellesmere, and Dunsford, grew to be almost as real to Helps's readers as they certainly became to himself, gave a special charm to a book which, by its richness of suggestion, its sweetness of tone, and beauty of style, made for its author a high and enduring reputation. The same expedient was resorted to for the discussion of the ideas of social and philanthropic improvement on which Helps's mind was always at work, in a second series of *Friends in Council*, published in 1859, and again in *Conversations on War and General Culture*, published in 1871. The old familiar speakers, with others added, also appeared in his *Realmah*, and finally in what certainly must always rank as the best of its author's later works, *Talk about Animals and their Masters*, published in 1873.

The subject of slavery was one which had a peculiar fascination for Helps. A long essay is devoted to it in the first series of *Friends in Council*. This was subsequently elaborated into a work in two volumes published in 1848 and 1852, called *The Conquerors of the New World and their Bondsmen*. Helps's interest in the subject led him into further investigations into the history of the conquest of America by the Spaniards, and he went to Spain in 1847 for the special purpose of examining the numerous MSS. bearing upon the subject at Madrid. The fruits of these researches were embodied in an historical work based upon his *Conquerors of the New World*, and called *The Spanish Conquest in America and its Relation to the History of Slavery and the Government of Colonies*. This appeared in four volumes during the years 1855, 1857, and 1861. No pains were spared by its author to secure the most scrupulous accuracy as to the facts with which he dealt. He had found, as most inquirers into the sources of history have found, that this accuracy is rarely to be met with in accepted histories. On this point he was determined that he should not be open to censure; and so anxious was he that fact should not be colored or distorted by imagination that he deliberately resisted the temptation to use the picturesque method of treatment by which other writers on the same subject have secured popularity. The success of this work with the public was injured by other peculiarities. History, like fiction, will not bear to be written with an obtrusively moral purpose, as this book was written. Its merits in a literary point of view were also diminished by the author's tendency to suspend the onward movement of the narrative, whilst he pauses to analyze character, to investigate motives, and to philosophize upon results.

This book, the result of years of research and meditation, was not a success. But the excellence of the studies of the great pioneers of Spanish conquest which it contained was quickly perceived when some years afterwards they were recast and published as separate biographies. Thus *The Life of Las Casas, the Apostle of the Indians*, appeared in 1868, *The Life of Columbus* in 1869, *The Life of Pizarro* in the same year, and *The Life of Hernando Cortes* in 1871. In this form all that is most important as well as attractive in the larger historical work has been placed within the reach of a wide circle of readers, to whom the result of Helps's researches otherwise would have been unknown.

From the time of his appointment as Clerk of the Council in 1860 to his death, Helps continued to add to the already considerable list of books, all dealing in one form or another with questions of social, sanitary, or political reform, which he had most earnestly at heart. No man felt more strongly that, in the words of Lamennais (*Livre du Peuple*, cap. i.), "things in this world are not as they ought to be." No man was more eager to do what he might towards obviating or curing the folly, stupidity, ignorance, lethargy, and selfishness to which so much of the misery, the ill-health, the suffering, and the sin of the world is due. It was a matter of conscience to do what he could towards "the relief of man's estate," by putting again and again before the world the results of his observation and thought upon its defective social and sanitary arrangements, and in this the reason is to be found for nearly all his books. Besides those which have been already mentioned the following may be named to complete the list:—*Organization in Daily Life, an Essay* (1862), *Realmah* (2 vols. 1869), *Casimir Maremma* (1870), *Brevia, Short Essays and Aphorisms* (1871), *Thoughts upon Government* (1872), *Life and Labors of Mr. Thomas Brassey* (1872), *Ivan de Biron* (1874), *Social Pressure* (1875).

His appointment as Clerk of the Council brought him into personal communication with the Queen, and also with the late Prince Consort. They were not slow to find how valuable a servant they had obtained in him. His powers of mind, his gentle, reserved manners, and his tender almost chivalrous devotion to the sovereign, not demonstrated yet subtly making itself felt, produced their natural effect in winning the confidence and respect of these high personages. After the Prince's death, the Queen early turned to Helps to prepare such a sketch of the prince's character as might make her people aware how much they as well as herself had lost by his early death. The task was undertaken by Helps, and performed with all the excellence which might have been anticipated from his sympathy with the great aims and objects of the Prince's life, and his practised skill in the analysis and portrayal of character. His introduction to the collection, published in 1862, of the Prince Consort's speeches and addresses was the first, and will probably always be the standard, attempt to sketch in clear and vivid outlines the varied characteristics of this remarkable man. Helps some years afterwards edited and wrote an introductory preface to the series of extracts from the Queen's diary, which were published in 1868 under the title *Leaves from a Journal of Our Life in the Highlands*. In 1864 he received the honorary degree of D. C. L. from the university of Oxford. He was made a C. B. in 1871, and K. C. B. in the following year.

At no time of his life very strong, an obvious decline of vital strength, accelerated probably by anxiety from embarrassments in which his later years were involved by unfortunate speculations in the purchase of land, was visible to Sir Arthur Helps's friends for some years before his death. This came after only a few days' illness on the 7th of March, 1875.

Sir Arthur Helps was of middle height, slender, dark in complexion, with a high well-defined forehead, deep-set eyes, and a mouth the habitually grave expression of which was tempered by a pleasant smile, when his fancy was touched by the humorous suggestions of his own mind, or the playfulness or wit of others, to which he was peculiarly sensitive. Something of the delicacy of his frame entered into his manner and conversation, which were marked by an avoidance of everything approaching vehemence or even emphasis. He loved good talk, and his low vibrant voice and grave playfulness of mind were very pleasant, when among trusted friends he was tempted into taking an active part in the give and take of easy conversation. But he was in manhood what he was in youth, when we are told by one who knew him well, "he had not the physical force or the animal spirits which predispose novices to oral controversy." As a rule, he was more ready in general society to listen than to talk,—especially when people were present whose character was worth studying, or whose ideas were fresh and based upon experience or comprehensive study. He was always learning, and a new thought or pregnant suggestion dropped by a friend in conversation was often to be found soon afterwards in his writings carefully developed, and illustrated from his own fertile stores of reading and research. As might be expected from his books, there was a sympathetic charm in his familiar intercourse which was peculiarly fascinating. His sensitiveness to pain, especially to moral pain, was extreme, and would have unfitted him for much of the rough work and ways of the world. As an orator, a character for which he had many intellectual qualities, he could scarcely have failed to attain a high rank. He was himself not unconscious of his gifts in this direction; but he was altogether of too fine a fibre for the hard hitting and the fiery struggle of the political arena, in which alone he would have coveted distinction. Wisely, therefore, he made for himself, as was well said by a friend at the time of his death, "work of another sort, applying his gentle ever busy mind to such discussion as purifies the thought, informs the pity, and confirms the forbearance of mankind." To the last his mind retained its vigor as well as its delicacy of perception. Nor would he have regarded it as among the least happy circumstances of his lot on earth that he was taken away before either of these had been touched by the palsy of decay—taken, moreover, swiftly and by no lingering illness to wear out the spirits of himself and those to whom he was dear. (T. MA.)

HELSINGBORG, a town of Sweden, province of Skane and län of Malmö, is beautifully situated at the narrowest part of the Sound—there only 3 miles wide—opposite Elsinore, and 32 miles N.N.W. of Malmö. It is connected with the Swedish railway by a branch line to Hessleholm

and Eslöf, and it has regular communication with Denmark by steamer. The harbor, completed in 1832, is sufficient for vessels of an ordinary size. The inhabitants are chiefly engaged in fishing, commerce, and agriculture. Corn is the principal export. A short distance north-east of the town there is a mineral spring, and about 2 miles south-east are the more famous wells of Ramlösa. The sea-baths to the north of the town are much frequented in summer. At Höganäs, about a mile and a half north, there are extensive coal-mines and also a pottery. The population, which in 1800 was only 1761, in 1860 was 5053, and in 1900 had reached 24,670.

Helsingborg is one of the oldest towns of Sweden. The original site is marked by the tower of Kärnan (*i. e.* the churn), which was probably the strongest in the old fortress first mentioned in the year 1135. In the 14th century it was several times besieged. From 1370 it, along with the other towns of Skane, was joined for fifteen years to the Hanseatic League. The fortress having been laid waste by fire in 1418, King Eric of Pomerania about 1425 built a new fortress near the sea, and caused the town to be transplanted thither, bestowing upon it at the same time important privileges. Until 1658 it belonged to Denmark, and it was again occupied by the Danes in 1676 and 1677. In 1684 its fortifications were dismantled. It was retaken by Frederick IV. of Denmark in November, 1709; but his troops, under General Rantzau, were severely defeated near it by General Stenbock, 10th March, 1710, from which time it has remained in the possession of Sweden. In 1711 it was again bombarded by the Danes.

HELSINGFORS (Finnish, *Helsinki*), chief city of the grand-duchy of Finland and the government of Nyland, in the district Helsinge, on the Gulf of Finland, 274 miles by rail west of St. Petersburg. The latitude of the observatory is 60° 9′ 4″ N., and longitude 24° 57′ 39″ E. from Greenwich. The town is well laid out, with long and wide streets running at right angles. The houses are large and well built, and the principal square contains several fine buildings, as the senate-house, the university, and a magnificent church. Helsingfors has a colossal Lutheran cathedral, assembly-rooms, botanical gardens, an observatory well supplied with both astronomical and magnetic instruments, a beautifully decorated theatre, and other handsome public buildings. The university, removed from Åbo in 1827, has 4 faculties, 53 professors, and about 900 students, and possesses a museum with extensive natural history and mineralogical collections, an ethnological collection, and a chemical laboratory. There are scientific, literary, and other learned societies, a normal lyceum, polytechnic institute, school for the blind, school of navigation, asylum for the insane, hospitals, and other educational and charitable institutions. Helsingfors is the seat of the governor-general of Finland, the imperial senate, and all the central officers of the grand-duchy. In the hall of the senate-house is a splendid throne for the emperor; in the ritter-house the various branches of the assembly meet, and there also are the remains of the library saved from the fire of Åbo, and containing 15,000 volumes. Helsingfors has several machinery manufactories (one with 850 workpeople), and produces at the rate of £100,000 per annum; it has also porcelain, faience, sugar, and tobacco factories. There are two considerable harbors, with a handsome granite quay extending along the front of the town. In 1870 the population was 32,113, in 1900 93,217.

Helsingfors has the largest import trade in Finland, consisting mainly of wool, colonial and manufactured wares, salt, wine, etc., amounting in 1874 to £1,635,744, in 1878 to £3,748,487. The exports consist chiefly of wooden wares, the total amounting to £2,340,327 in 1878. Of the imports £437,100 came from, and of the exports £87,541 went to England. In 1874 880 vessels of 158,717 registered tons entered the port, and in 1878 713 vessels of 73,297 tons; in 1874 980 of 159,549 tons cleared, and in 1878 825 of 132,170 tons. In 1876 the port possessed 43 vessels (18 of them steamers) of 4129 tons.

Helsingfors was founded by Gustavus Vasa in the 16th century, about 4 miles N. E. of the present site, to which it was removed by Queen Christina of Sweden in 1642. In 1742 it was the scene of the capitulation of the Swedes under Löwenhaupt; but in 1749 the fortress of Sveahorg was erected by the Swedish high admiral, Count Ehrenwerd, who at his own request was afterwards buried within its walls. In 1808 Admiral Cronstedt surrendered the place to the Russians under General Suchtalen. A combined squadron of the French and English bombarded Sveaborg in 1808.

See Brummer, *Historiska Uppgifter om Helsingfors*, 1874.

HELST, Bartholomæus van der, was born in Holland at the opening of the 17th century, and died at Amsterdam in 1670. The date and place of his birth are uncertain; and it is equally difficult to confirm or to deny the time-honored statement that he was born in 1613 at Amsterdam. It has been urged indeed by competent authority that Van der Helst was not a native of Amsterdam, because a family of that name lived as early as 1607 at Haarlem, and pictures are shown as works of Van der Helst in the Haarlem Museum which might tend to prove that he was in practice there before he acquired repute at Amsterdam. Unhappily Bartholomew has not been traced amongst the children of Severijn van der Helst, who married at Haarlem in 1607, and there is no proof that the pictures at Haarlem are really his; though if they were so they would show that he learnt his art from Frans Hals and became a skilled master as early as 1631. Scheltema, a very competent judge in matters of Dutch art chronology, supposes that Van der Helst was a resident of Amsterdam in 1636. His first great picture, representing a gathering of civic guards at a brewery, is variously assigned to 1639 and 1643, and still adorns the town-hall of Amsterdam. His noble portraits of the burgomaster Bicker and Andreas Bicker the younger, in the gallery of Amsterdam, of the same date no doubt as Bicker's wife lately in the Ruhl collection at Cologne, were completed in 1642. From that time till his death there is no difficulty in tracing Van der Helst's career at Amsterdam. He acquired and kept the position of a distinguished portrait-painter, producing indeed little or nothing besides portraits at any time, but founding, in conjunction with Nicolaes de Helt Stokade, the painters' guild at Amsterdam in 1654. At some unknown date he married Constance Reynst, of a good patrician family in the Netherlands, bought himself a house in the Doelenstrasse, and ended by earning a competence. His likeness of Paul Potter at the Hague, executed in 1654, and his partnership with Backhuysen, who laid in the backgrounds of some of his pictures in 1668, indicate a constant companionship with the best artists of the time. Waagen has said that his portrait of Admiral Kortenaar, in the gallery of Amsterdam, betrays the teaching of Frans Hals, and the statement need not be gainsaid; yet on the whole Van der Helst's career as a painter was mainly a protest against the systems of Hals and Rembrandt. It is needless to dwell on the pictures which preceded that of 1648, called the Peace of Münster, in the gallery of Amsterdam. The Peace challenges comparison at once with the so-called Night Watch by Rembrandt, and the less important but not less characteristic portraits of Hals and his wife in a neighboring room. Sir Joshua Reynolds was disappointed by Rembrandt, whilst Van der Helst surpassed his expectation. But Bürger asked whether Reynolds had not already been struck with blindness when he ventured on this criticism. The question is still an open one. But certainly Van der Helst attracts by qualities entirely differing from those of Rembrandt and Frans Hals. Nothing can be more striking than the contrast between the strong concentrated light and the deep gloom of Rembrandt and the contempt of chiaroscuro peculiar to his rival, except the contrast between the rapid sketchy touch of Hals and the careful finish and rounding of Van der Helst. The Peace is a meeting of guards to celebrate the signature of the treaty of Münster. The members of the Doele of St. George meet to feast and congratulate each other not at a formal banquet but in a spot laid out for good cheer, where De Wit, the captain of his company, can shake hands with his lieutenant Waveren, yet hold in solemn state the great drinking-horn of St. George. The rest of the company sit, stand, or busy themselves around,—some eating, others drinking, others carving or serving—an animated scene on a long canvas, with figures large as life. Well has Bürger said, the heads are full of life and the hands admirable. The dresses and subordinate parts are finished to a nicety without sacrifice of detail or loss of breadth in touch or impast. But the eye glides from shape to shape, arrested here by expressive features, there by a bright stretch of colors, nowhere at perfect rest because of the lack of a central thought in light and shade, harmonies, or composition. Great as the qualities of Van der Helst undoubtedly are, he remains below the line of demarcation which separates the second from the first-rate masters of art.

His pictures are very numerous, and almost uniformly good; but in his later creations he wants power, and though still amazingly careful he becomes gray and woolly in touch. At Am-

sterdam the four regents in the Werkhuys (1650), four syndics in the gallery (1656), and four syndics in the town-hall (1657) are masterpieces, to which may be added a number of fine single portraits. Rotterdam, notwithstanding the fire of 1864, still boasts of three of Van der Helst's works. The Hague, as we saw, owns but one. St. Petersburg, on the other hand, possesses ten or eleven, of various shades of excellence. The Louvre has three, Munich four. Other pieces are in the galleries of Berlin, Brunswick, Brussels, Carlsruhe, Cassel, Darmstadt, Dresden, Frankfort, Gotha, Stuttgart, and Vienna.

HELSTON, a municipal and parliamentary borough and market-town of England, county of Cornwall, is situated on the declivity of a hill on the river Cober, 9 miles S. W. of Falmouth. It consists of four main streets intersecting each other at right angles; at their junction in the centre stands the market-house. The principal other buildings are the church dedicated to St. Michael and built by the earl of Godolphin in 1763, the town-hall, the old coinage hall, the literary institute, the grammar school, and the union work-house. The prosperity of the town is due to its being the centre of an extensive agricultural and mining district. The principal manufacture is shoes. At Portheven, about 3 miles distant, a considerable export and import trade is carried on. Population of municipal borough (1871), 3797; of parliamentary borough (area 10,992 acres), 8760.

Helston is one of the original coinage towns. It obtained a charter from King John, and the privilege was conferred on it by Edward III. of holding a market and fairs. It was made a corporate town by Elizabeth. Before the Reform Act of 1832 it returned two members to parliament, but it now returns only one.

HELVETII. See SWITZERLAND.

HELVETIUS, CLAUDE ADRIEN (1715–1771), was descended from a family of physicians, the first of whom, John Frederick Schweitzer (Latinized into Helvetius), migrated from Germany to Holland about the year 1649, and became physician to the prince of Orange. His later years were spent in the study of alchemy. His son, John Adrien, also a physician, went to Paris in the hope of establishing a sale for his father's drugs. He failed in this attempt, but was so fortunate as to introduce with the greatest success the use of ipecacuanha, then an unknown drug. The duchess of Chaulnes, whom he had treated successfully, introduced him to Colbert, who recommended the young physician to the dauphin, after which his reputation was firmly established. His son, John Claude Adrien, who embraced the same career with even greater success, was appointed inspector-general of the military hospitals of Flanders and first physician to the Queen Marie Leczinska. He was remarkable for the generosity with which he received and visited poor patients who could pay him nothing. His son, Claude Adrien, the future author of *De l'Esprit*, showed as a boy little aptitude for study, but was fond of desultory reading. His father, who destined him for finance, placed him for a few years with his maternal uncle, M. D'Armancourt, "directeur des fermes" at Caen. There he learned all that was necessary for a profession so simple, and having plenty of spare time amused himself with writing verses and cultivating social graces. He was elected a member of the academy of Caen, and when he was only twenty-three years of age he had the singular good fortune to be appointed, at the Queen's request, to a place as farmer-general; in other words, while still a very young man he was put into a post of great responsibility and dignity which was worth a hundred thousand crowns a year. Thus provided, young Helvetius proceeded to enjoy life to the utmost. He had every advantage except one, that of noble birth; he was the handsomest man of his time; he was possessed of a manner singularly charming; he was able to hold his own among the scholars and philosophers and poets; he was skilled in all those arts cultivated by gentlemen; he was generous like his father, and his great fortune enabled him to gratify his love of giving; he had an inclination to letters, and was a friend of Fontenelle, Voltaire, and Montesquieu, besides being a patron of such writers as Marivaux, Saurin, and Sabatier. Probably there was no young man in Paris in the years 1740 and 1750 who occupied a more enviable position or was more entirely contented with his lot than this spoiled child of fortune, on whose name there rested but one blot, an almost morbid desire to excel. So far indeed did he carry this passion for distinction that he once danced on the stage of the opera under the mask and name of the public favorite Javillier.

As he grew older, his social successes and *bonnes fortunes* naturally ceased; the splendor of his youth had vanished; he began to dream of other and more lasting distinctions. Maupertuis, he observed, had put mathematics in fashion; he himself would be a mathematician. Voltaire was illustrious for poetry; he too would be a poet. Montesquieu had made so brilliant a success with his *Esprit des Lois* that he himself would become a philosopher. The mathematical dream seems to have produced nothing; his poetical ambitions resulted in his poem called *Le Bonheur*, in which he develops the idea that true happiness is only to be found in making the interest of one that of all; his philosophical studies ended in the production of his famous book *De l'Esprit*, the composition of which occupied him for more than seven years. In the year 1751 he married, his wife being a niece of Madame de Graffigny, the author of *Lettres d'une Péruvienne;* and he spent eight months in the year at his newly purchased estate of Voré in Le Perche; the remaining four months were given up to Paris and his duties of *maître d'hôtel* to the queen. It was characteristic of the man that as soon as he thought his fortune sufficient for his wants he gave up his post of farmer-general. The history of his life in the country is full of anecdotes which illustrate his generous and kindly disposition: he relieved the poor, sent physicians to the sick, mediated between those who quarrelled, encouraged agriculture, developed industries, and found happiness in the patriarchal life of a French seigneur, being as great a stickler as any for his seigneurial rights. It was in 1758 that his book *De l'Esprit*, which was to be the rival of *L'Esprit des Lois*, appeared. It was so far successful at the very outset as to attract immediate attention and to arouse the most formidable opposition at the head of which was the dauphin, son of Louis XV. The Sorbonne condemned the book; the priests persuaded the court that it was full of the most dangerous doctrines, and the author, terrified at the storm he had raised, wrote three separate retractations; yet, in spite of his protestations of orthodoxy, he had to give up his office at the court, and the book was publicly burned by the hangman. The virulence of the attacks upon the work, as much as its intrinsic merit, caused the whole world to read it; it was translated into almost all the languages of Europe; it was discussed in every literary circle. Yet the *Esprit des Lois* lives and is still studied with profit, while *De l'Esprit* has long since been forgotten. It is indeed difficult to understand that the work could ever have had any serious influence upon the thought of the time. Voltaire said it was full of commonplaces; Buffon maliciously said that "Helvétius aurait dû faire un livre de moins et un bail de plus dans les fermes du roi;" Rousseau declared that the very benevolence of the author gave the lie to his principles; Grimm thought that all the ideas in the book were borrowed from Diderot; Madame du Deffand said that Helvetius had raised such a storm by simply revealing the "great secret;" Madame de Graffigny averred that all the good things in the book had been picked up in her own salon.

As for the philosophy of the book, it belongs to the selfish school; the four discussions of which it consists have been thus summed up:—(1) all man's faculties may be reduced to physical sensation; memory, comparison, judgment, are only feeling; our only difference from the lower animals lies in our external organization: (2) our interest, founded on the love of pleasure and the fear of pain, is the only spring of our judgments, our actions, our affections; we have no liberty of choice between good and evil; there is no such thing as absolute right—ideas of justice and injustice change according to customs; (3) the inequalities of intellect do not depend on a more or less perfect organization, but have their cause in the unequal desire for instruction, and this desire springs from passions of which all men commonly well organized are susceptible to the same degree; we can therefore all love glory with the same enthusiasm, and we owe all to education; (4) in this discourse the author treats of the ideas which are attached to such words as *genius, imagination, talent, taste, good sense*, etc. It is sufficient to add that, although the book was reprinted after the author's death, it ceased to have any influence even during his own life.

In 1764 Helvetius visited England, and the next year, on the invitation of Frederick, he went to Berlin, where the king paid him marked attention. He then returned to his country estate and passed the remainder of his life in perfect tranquillity. He died in 1771 at the age of fifty-six

leaving behind him a widow, who died in 1800, and two daughters.

A sort of supplement to the *De l'Esprit*, called *De l'Homme, de ses facultés intellectuelles et de son éducation*, was found among his manuscripts after his death, and was published, but created little interest. Editions of the work, however, appeared in 1772, 1773, and 1786. The complete works of Helvetius were published in 1774, 1777, 1781, 1794, 1795, and 1818. The best estimate of his work and place among the philosophers of the 18th century is that by Cousin (*Œuvres*, ii.). (W. BE.)

HELVIDIUS PRISCUS lived in the first century, during the reigns of Nero, Galba, Otho, Vitellius, and Vespasian. In those evil days he won the respect of all good men by his fearless love of freedom. Among the cringing and obsequious senators of Rome he dared to be sincere and outspoken. Tacitus says of him (*Hist.*, iv. 5) that in his early youth he devoted his great abilities to the highest pursuits, and made it his object to enter on public life with a spirit thoroughly fortified against all contingencies. It was natural that such a man should be a warm adherent of the Stoic school of philosophy. His father-in-law, Thrasea Pætus, had been the same; he had been driven to suicide in Nero's reign, and his last words to Helvidius were—"Young man, you have been born into times in which it is well to brace the spirit with examples of courage" (Tacitus, *Annals*, xvi. 35). Although he repeatedly offended the emperor, he held several high offices. During Nero's reign he was quæstor in the province of Achaia; he was also sent into Armenia in command of a legion, and by his good sense and moderation he succeeded in restoring peace and order in that country. By the provincials he was respected and trusted. His well-known sympathies with such men as Brutus and Cassius occasioned his banishment in 66 A. D., and he lived with his wife Fannia in Macedonia until Nero's death. Having been recalled to Rome by Galba in 68 A. D., he at once impeached Eprius Marcellus, one of the most villainous of the informers, and the very man who had been the accuser of Thrasea Pætus. After an angry debate he dropped the charge, as the condemnation of Marcellus would have involved a host of senators in like ruin. As prætor-elect he had once the courage to oppose Vitellius in the senate, and again as prætor in the following year he ventured to argue against the financial policy of Vespasian. Such matters, he maintained, ought to be left to the discretion of the senate. He proposed that the Capitol, which had been destroyed in the Neronian conflagration, should be restored at the public cost. It would seem that he rather perversely went out of his way to insult Vespasian, saluting him by his private name, and not recognizing him as an emperor in the edicts he had to publish as prætor. There was very possibly in all this some of the affectation which often characterized the Stoics. The end of it was that he was banished, his wife Fannia, whose constancy and virtue are highly commended by his friend the younger Pliny, going with him into exile. Shortly afterwards he was executed by Vespasian's order. His life was written at his widow's request by Herennius Senecio; it took the form of a warm panegyric, and proved fatal to its author in the reign of Domitian.

HELVOETSLUYS (in Dutch, *Hellevoetsluis*), a fortified town of the Netherlands, in the province of South Holland, situated in the south of the island of Voorne-and-Putten, on the shore of the Haringvliet. It possesses a good harbor, a dry and a wet dock, extensive wharves, and a naval arsenal, and among its more important public buildings are the communal chambers, the Reformed church dating from 1661–1684, the Roman Catholic church, the synagogue, and the naval college. The population was only 1208 in 1795; by 1840 it had increased to 2523, and by 1900 it was 4,300.

Helvoetsluys was founded in the 17th century. The construction of the dock was decreed by the states of Holland in 1636, and the erection of the fortifications in 1638; but it was not till 1696 that the works were completed. The new harbor soon became an important rendezvous for the Dutch fleet, and in 1688 it was the starting-point of William of Orange's expedition to England.

HELYOT, PIERRE (1660–1716), monastic historian, was born at Paris in January, 1660, of supposed English descent. After spending his youth in study, he entered in his twenty-fourth year the convent of the third order of St. Francis, founded at Picpus, near Paris, by his uncle Jérôme Helyot, canon of St. Sepulchre. There he took the name of Père Hippolyte. Two journeys to Rome on monastic business afforded him the opportunity of travelling over most of Italy; and after his final return he saw much of France, while acting as secretary to various provincials of his order there. Both in Italy and France he was engaged in collecting materials for his great work, which occupied him about twenty-five years, *L'Histoire des Ordres Monastiques, Religieux, et Militaires, et des Congrégations Séculières, de l'un et de l'autre Sexe, qui ont été établies jusqu' à présent*, published in 8 volumes in 1714–21. Helyot died on January 5, 1716, before the fifth volume appeared, but his friend Maximilien Bullot completed the edition. This work, appearing at first anonymously, has been republished several times, and translated into German. Helyot's only other noteworthy work is *Le Chrétien Mourant* (1695).

HEMANS, FELICIA DOROTHEA (1793–1835), was born in Duke Street, Liverpool, September 25, 1793. Her father, George Browne, of Irish extraction, was at the time of her birth a merchant in Liverpool, and her mother, whose maiden name was Wagner, was the daughter of the Austrian and Tuscan consul at Liverpool, and of united German and Italian descent. Felicia, the fifth of seven children, was scarcely seven years old when her father failed in business, and retired with his family to Gwrych, near Abergele; and there the young poetess and her brothers and sisters grew up in the wildest seclusion, in a romantic old house by the sea-shore, and in the very midst of the mountains and myths of Wales, the monotony of her young life being varied only by two visits to London, which she never revisited in after years. The little Felicia was a lovely, precocious child. Her education was desultory; and she may indeed be said to have educated herself, the only subjects in which she ever received regular instruction having been French, English grammar, and the rudiments of Latin. Books of chronicle and romance, and every kind of poetry, she read with avidity; and she studied Italian, Spanish, Portuguese, and German sufficiently to be able to read them with ease and enjoyment. She was also fond of music, and played on the harp and piano, her preference being for simple national and pathetic melodies, especially those of Wales and Spain. In 1808, when she was only fourteen, a quarto volume of her *Juvenile Poems* was published by subscription. Among the earliest of these were "Congratulatory Lines on her Mother's Birthday," "A Prayer," an "Address to the Deity," and some "Lines to Shakespeare,"—stiff, little, childish productions, which show, however, a good ear for rhythm and a considerable imitative faculty. The verses having been rather harshly criticised in the *Monthly Review*, the little poetess was for some days in tears; but the muse was soon reawakened. One of her brothers was fighting in Spain under Sir John Moore: and Felicia, fired with military enthusiasm, wrote *England and Spain, or Valor and Patriotism*, a poem of some length and much elaboration, which was afterwards published and translated into Spanish. Her second volume, entitled *The Domestic Affections and other Poems*, appeared in 1812, on the eve of her marriage to Captain Hemans, which took place in the summer of that year. She lived for some time at Daventry, where her husband was appointed adjutant of the Northamptonshire militia; but about this time her father went on some commercial enterprise to Quebec and died there; and, after the birth of her eldest son, she and her husband took up their abode with her widowed mother at Bronwylfa. Here during the next six years four more children—all boys—were born; but in spite of domestic cares and uncertain health she still read and wrote indefatigably. Her poem entitled *The Restoration of Works of Art to Italy* was published in 1816, her *Modern Greece* in 1817, and in the following year appeared her volume of *Translations from Camoens and other Poets*.

In 1818 Captain Hemans went to Rome, leaving his wife, shortly before the birth of their fifth child, with her mother at Bronwylfa. No further explanation than that it was in the first instance for Captain Hemans's health has ever been offered of this step; there seems to have been then merely a tacit agreement, perhaps on account of their limited means, that they should live for a time apart. Letters were interchanged, and Captain Hemans was often consulted about his children; but the husband and wife remained separate, and indeed never met again. Kind and influential friends—among them the bishop of St. Asaph and Bishop Heber—clustered round the poetess and her children. Her health,

however, began to fail her, and her beauty, which was of a peculiarly delicate type, is said to have faded rapidly, leaving behind it an habitually worn and harassed expression. She became subject, too, to paroxysms of beating of the heart. Yet for the next six years her literary industry never flagged. In 1819 she published *Tales and Historic Scenes in Verse*, and in the same year she gained a prize of £50 offered for the best poem on *The Meeting of Wallace and Bruce on the Banks of the Carron*. The poem was published in *Blackwood's Magazine*. In 1820 appeared *The Sceptic* and *Stanzas to the Memory of the late King*. In June, 1821, she won the prize awarded by the Royal Society of Literature for the best poem on the subject of *Dartmoor*, and during the same year she began her play, *The Vespers of Palermo*. She now applied herself to a course of German reading. Körner was her favorite German poet, and her lines on the grave of Körner were one of the first English tributes to the genius of the young soldier-poet. *The Voice of Spring*, one of her best known lyrics, was written in 1823, the same year in which she began to contribute to the *New Monthly Magazine;* and in the summer of 1823 a volume of her poems was published by Murray, containing "The Siege of Valencia," "The Last Constantine," and "Belshazzar's Feast," which last had appeared previously in a collection edited for a charitable purpose by Joanna Baillie. *The Vespers of Palermo* was acted at Covent Garden, December 12, 1823, and Mrs. Hemans received £200 for the copyright; but, though the leading parts were taken by Young and Charles Kemble, the play was a failure, and was withdrawn after the first performance. It was acted again in Edinburgh in the following April with greater success, when an epilogue, written for it by Sir Walter Scott at Joanna Baillie's request, was spoken by Mrs. Henry Siddons. An interchange of notes on this subject was the beginning of a cordial friendship between Mrs. Hemans and the novelist. In the same year she wrote *De Chatillon, or the Crusaders;* but the manuscript was mysteriously lost, and the poem was not published till two years after her death, and then from a rough copy. In 1824 she began "The Forest Sanctuary," which appeared a year later with the "Lays of Many Lands" and miscellaneous pieces collected from the *New Monthly Magazine* and other periodicals.

In the spring of 1825 Mrs. Hemans, with her mother and children and an unmarried sister, removed from Bronwylfa, which had been purchased by her brother, to Rhyllon, another house belonging to him on an opposite height across the river Clwyd. The contrast between the two houses suggested her *Dramatic Scene between Bronwylfa and Rhyllon*. The house itself was bare and unpicturesque, but the beauty of its surroundings has been celebrated in "The Hour of Romance," "To the River Clwyd in North Wales," "Our Lady's Well," and "To a Distant Scene." This time seems to have been the most tranquil in Mrs. Hemans's life. Her children were growing up about her; her own variable health was at its best; her popularity was spreading, not only in England but in America, where Professor Norton of Harvard university undertook to superintend the publication of a complete edition of her works and to secure to her the profits. But the death of her mother in January, 1827, was a second great breaking-point in her life. Her own health began to alarm her; and though the nature of her illness, which afterwards proved heart complaint, was not at first apparent, she was from this time an acknowledged invalid. In the summer of 1828 the *Records of Woman* was published by Blackwood, and in the same year the home in Wales was finally broken up by the marriage of Mrs. Hemans's sister and the departure of her two elder boys to their father in Rome. Mrs. Hemans therefore left Rhyllon, and took a very small house in the village of Wavertree, near Liverpool, where she hoped to obtain good schooling for her children and society for herself. But, although she had a few intimate friends there, —among them her two subsequent biographers, Henry F. Chorley and Mrs. Lawrence of Wavertree Hall,—she was disappointed in her new home. She thought the people of Liverpool stupid and provincial; and they, on the other hand, found her uncommunicative and eccentric. In the following summer she travelled by sea to Scotland with two of her boys, to visit the Hamiltons of Chiefswood. This visit to Scotland was one of the most daring feats, and perhaps the richest episode, in her uneventful life. She was cordially welcomed in Edinburgh, dined with Jeffrey and other celebrities, visited Henry Mackenzie, heard Alison preach, and stayed with Sir David and Lady Wedderburn, and with Sir Robert Liston at Milburn, where she sat for a bust to Angus Fletcher. Above all, while she was at Chiefswood, she enjoyed "constant, almost daily, intercourse" with Sir Walter Scott, with whom she and her boys afterwards stayed some time at Abbotsford. "There are some whom we meet, and should like ever after to claim as kith and kin; and you are one of those" was Scott's compliment to her at parting. One of the results of her Edinburgh visit was an article full of praise, judiciously tempered with criticism, by Jeffrey himself for the *Edinburgh Review*. The poetess returned to Wavertree to compose her *Songs of the Affections*, which were published early in 1830. In the following June, however, she again left home, this time to visit Wordsworth and the Lake country; and in August she paid a second visit to Scotland. She was resolved to leave Wavertree, and wished to make Edinburgh her home; but the climate was pronounced too rigorous, and, as a brother and his family were already settled in Ireland, it was arranged that she should go to live in Dublin. In her new home kind friends and admirers gathered round the invalid, who now had with her only the youngest of her children. She was obliged to lie constantly, and the exertion of writing began to be painful to her Her poetry of this date is chiefly religious. Early in 1834 her *Hymns for Childhood*, which had appeared some years before in America, were published in Dublin. At the same time appeared her collection of *National Lyrics*, and shortly afterwards *Scenes and Hymns of Life*. She was planning also a series of German studies, to consist of translations from German authors, with introductions and explanatory notes, one of which, on Goethe's *Tasso*, was completed and published in the *New Monthly Magazine* for January, 1834. In intervals of acute suffering she wrote the lyric *Despondency and Aspiration*, and dictated a series of sonnets called *Thoughts during Sickness*, the last of which, "Recovery," was written when she fancied she was getting well. After three months spent at Redesdale, Archbishop Whately's country seat, which had been placed at the disposal of the dying poetess, she was again brought into Dublin, where she lingered till spring. The use of her limbs was entirely gone; but her passion for reading remained to the last, and the table at her bedside was strewn with books, one of which always lay open. Her last poem, the *Sabbath Sonnet*, was dictated to her brother on Sunday, April 26th, and she died on the evening of Saturday, May 16, 1835, at the age of forty-one. She was buried in a vault under St. Anne's church, Dublin. Besides the bust of Mrs. Hemans by Angus Fletcher, there were three portraits taken of her in 1827 by the American painter West, one of which has been engraved; and another portrait, an engraving of which is in Chorley's *Memorials*, was painted in 1831 by a young Irish artist, Edward Robinson.

Mrs. Hemans's poetry is the production of a fine imaginative and enthusiastic temperament, but not of a commanding intellect or very complex or subtle nature. It is the outcome of a beautiful but singularly circumscribed life, a life spent in romantic seclusion, without much worldly experience, and warped and saddened by domestic unhappiness and real physical suffering. Perhaps from these circumstances, aided by a course of self-instruction at best desultory and unguided, the emotional in a sensitive and intensely feminine nature was unduly cultivated; and this undue preponderance of the emotional is a prevailing characteristic in Mrs. Hemans's poetry, and one to which Scott alluded when he complained that it was "too poetical," that it contained "too many flowers" and "too little fruit." Her genius—beautiful and pleasing as it was—was not of a very high order. Like her favorite music, it lay within a small compass, and gave little opportunity for intricate harmonies. Thus her tragedies, and her longer and more complicated poems, such as *The Sceptic* and *Forest Sanctuary*, though by no means devoid of striking passages, are the least notable of her works. It is not, however, as the writer of these more ambitious productions, which in her own time were but doubtful successes and are now rarely read, but as the authoress of many short occasional pieces, and especially as a lyrist, that Felicia Hemans has earned so high a place among our poets. In her lyrics she could concentrate her strength on the perfect expression of simple themes. Her skill in versification, her delicate ear for rhythm, and the few ruling sentiments of her nature here found ample scope. In her lyrics Mrs. Hemans is uniformly graceful,

tender, delicately refined,—sometimes perhaps, even here, too fervent, too emotional,—but always pure and spiritual in tone; and in these too she occasionally displays those rarer qualities which belong only to the finest lyric genius. Many of her poems, such as "The Treasures of the Deep," "The Better Land," "The Homes of England," "Casabianca," "The Palm Tree," "The Graves of a Household," "The Wreck," "The Dying Improvisatore," and "The Lost Pleiad," have become standard English lyrics, and on the strength of these, and others such as these, Felicia Hemans is ranked among our chief British lyrical poets.

An edition of Mrs. Hemans's *Poetical Works* was published, 2 vols., in 1832; *Poetical Remains*, with Memoir by Delta, 1836; *Memorials*, etc., by H. F. Chorley, 1836; *Recollections of Mrs. Hemans*, by Mrs. Lawrence, 1836; *Works of Mrs. Hemans, with a Memoir of her Life*, by her sister (Mrs. Hughes), 7 vols., 1839, and American reprint, 2 vols., 1847; *Early Blessings, a Collection of Poems written between eight and fifteen years of age*, with a Life of the Authoress, 1840; *Poems*, chronologically arranged, Edin., 1849; *Poems*, copyright edition, Edin. and London, 1872; *Poetical Works*, with critical memoir by W. M. Rossetti, London and Edin., 1873. (F. M.)

HEMEL-HEMPSTEAD, a market-town of England, county of Hertford, is pleasantly situated on the declivity of a hill near the river Gade, 23 miles N. W. of London, 1½ miles from the Boxmoor station of the London and North-Western Railway, and on a branch line of the Midland Railway. The town consists almost wholly of one main street about a mile in length. Among the principal buildings are the parish church, cruciform in shape, and partly Norman in style, surmounted by a lofty octagonal spire, and containing an old brass of the time of Edward III.; the town-hall, a long narrow building formerly supported on square wooden pillars, but whose open market-place underneath has now been converted into a corn exchange; the union workhouse, and the West Herts infirmary. The chief industry is straw plaiting, but there are also manufactories of paper, an iron foundry, breweries, and tanneries. The population of the township in 1901 was 11,260, and of the parish 14,500.

From its name, meaning high stead or place, the town is apparently of Saxon origin. In Domesday it is written Henamsteda and Hamelamestede. It received a charter of incorporation from Henry VIII., which was renewed by Cromwell. It still makes annual choice of a bailiff, but he possesses no magisterial authority.

HEMEROBAPTISTS, an ancient Jewish sect, so named from their observing a practice of daily ablution as an essential part of religion. Epiphanius, who mentions their doctrine as the fourth heresy among the Jews, classes the Hemerobaptists doctrinally with the Pharisees, from whom they differed only in, like the Sadducees, denying the resurrection of the dead. The name has been sometimes given to the Mandæans on account of their frequent ablutions; and in the *Clementine Homilies* (ii. 23) St. John the Baptist is spoken of as a Hemerobaptist. Mention of the sect is made by Hegesippus (see Euseb., *Hist. Eccl.*, iv. 22) and by Justin Martyr in the *Dialogue with Tryphon*.

HEMINGFORD, or HEMMINGFORD, WALTER, a Latin chronicler of the 14th century, was a canon regular of the Austin Priory of Gisborough, now Guisborough, in Yorkshire. Leland calls him Hemengoburgus, and in one of the manuscripts of his chronicle his name appears as Hemingburght. In a document of the priory the name is also given as De Hemingburgh; and in Gisborough Chartulary mention is made of a neighboring family of that name. Bale seems to have been the first to give him the name by which he is more commonly known. His chronicle embraces the period of English history from the Conquest (1066) to the nineteenth year of Edward III., with the exception of the latter years of Edward II. It ends with the title of a chapter in which it was proposed to describe the battle of Crécy (1346); but the chronicler seems to have died before the required information reached him. In compiling the first part, Hemingford apparently used the histories of Eadmer, Hoveden, Henry of Huntingdon, and William of Newbury; but the reigns of the three Edwards are original, composed from personal observation and information. There are several manuscripts of the history extant,—the best perhaps being that presented to the College of Arms by the Earl of Arundel. The work is correct and judicious, and written in a pleasing style. One of its special features is the preservation in its pages of copies of the great charters; and Hemingford's versions have more than once supplied deficiencies and cleared up obscurities in copies from other sources.

The first three books were published by Dr. Thomas Gale in 1687, in his *Historiæ Anglicanæ Scriptores Quinque*, and the remainder by Hearne in 1731. The first portion was again published in 1848 by the English Historical Society, under the title *Chronicon de Gestis Regum Angliæ*, edited by H. C. Hamilton.

HEMIPTERA (*ἡμι-*, half, and *πτερόν*, wing), an order of the *Insecta* most commonly known by the name of "bugs," and containing the species so well known to infest houses. In their earlier stages they have what is known amongst naturalists as an incomplete metamorphosis; that is to say, after quitting the egg, and during the two stages of their existence before assuming the perfect form, they move freely about, thus unlike the *Lepidoptera*, etc., whose pupa state or that preceding the perfection of the insect, is quiescent. When the transformations have been completed, the insect generally possesses four wings. The superior pair, or hemielytra as they are called by authors, are attached to the mesothorax, and are composed of two substances,—the basal portion coriaceous, or resembling leather, and the apical one membranaceous, or resembling thin, transparent parchment. The lower pair are attached to the metathorax, and are entirely membranous and generally transparent, and capable of being folded when the insect is in repose. This segment of the sternum likewise bears on each side, anteriorly, a more or less reniform-shaped orifice, within which lies a sac containing the fluid or matter from which so many of the *Heteropterous* portion of the order emit a most disagreeable odor. They also possess in all stages a mouth (rostrum) composed of three or more joints formed for suctorial purposes.

The order is divided into two sub-orders, *Hemiptera-Heteroptera* and *Hemiptera-Homoptera*, and these again are separated into divisions and subdivisions, the latter being distributed into families which contain the various genera and species. In the first sub-order (*Hemiptera-Heteroptera*) there are two divisions, viz., *Gymnocerata* and *Cryptocerata*, and the families comprised under these heads are 69 in number, the following being the generally accepted order in which they are arranged, viz., *Pachycoridæ* (in this family the scutellum is so enlarged as to cover the whole of the upper side of the abdomen, both pairs of wings being concealed beneath it when not in flight; in one genus at least the species might be mistaken for some of the *Buprestidæ* in *Coleoptera*, which they resemble in form and brilliancy of color), *Eurygastridæ*, *Podopidæ*, *Odontoscelidæ*, *Plataspidæ*, *Oxynotidæ*, *Asopidæ*, *Cydnidæ*, *Sciocoridæ*, *Phlæidæ* (this last contains but one genus, the species of which are most peculiar in appearance, as they resemble small, thin pieces of bark joined together), *Halydidæ*, *Pentatomidæ*, *Urostylidæ*, *Edessidæ*, *Phyllocephalidæ*, *Megymenidæ*, *Spartoceridæ*, *Mictidæ*, *Nematopidæ*, *Homœceridæ*, *Syromastidæ*, *Acanthocoridæ*, *Anisoscelidæ*, *Alydidæ*, *Stenocephalidæ*, *Berytidæ*, *Coreidæ*, *Rhopalidæ*, *Lygæidæ*, *Dipsocoridæ*, *Anthocoridæ*, *Microphysidæ*, *Pyrrhocoridæ*, *Largidæ*, *Capsidæ*, *Phymatidæ*, *Macrocephalidæ*, *Hebridæ*, *Zosmenidæ*, *Piesmidæ*, *Tingididæ*, *Brachyrhynchidæ*, *Aradidæ*, *Acanthiidæ*, *Holoptilidæ*, *Lobocephalidæ*, *Sycanidæ*, *Harpactoridæ*, *Saccoderidæ*, *Hæmatoceridæ*, *Tagalidæ*, *Stenopodidæ*, *Reduviidæ*, *Ectrichodidæ*, *Apiomeridæ*, *Piratidæ*, *Nabidæ* (the species comprised in the last 12 families are predaceous in their habits, and the larva of one species, *Reduvius personatus*, is known to prey upon the common house bug, *Acanthia lectularia*; some two or three of the species in South America are also known to live with spiders), *Saldidæ*, *Pelogonidæ*, *Emesidæ*, *Henicocephalidæ*, *Gerridæ*, *Veliidæ*, *Galgulidæ*, *Naucoridæ*, *Belostomidæ*, *Nepidæ*, *Corixidæ*, and *Notonectidæ* (the species pertaining to the last eight families, except the *Galgulidæ*, live either in or on the water, and the genus *Belostoma* contains the largest insect of the order, *Belostoma grandis*, which measures 3½ inches in length by nearly 1½ in breadth). In the second sub-order (*Hemiptera-Homoptera*) there are three grand divisions, viz., *Cicadina*, *Phytophthires*, and *Anoplura*. The first embraces the families *Stridulantidæ*, *Fulgoridæ*, *Tettigometridæ*, *Membracidæ*, and *Cicadidæ*; and in these families are to be found perhaps some of the most curious and wonderful forms of insect life. The well known lantern-fly (*Fulgora laternaria*, L.) belongs here, and the whole of the stridulating or singing group is also included. The *Phytophthires*, or second division, contains three families, viz., *Psyllidæ*, *Aphididæ*, and *Coccidæ*. None of the insects composing this group are of large size, and many of them are only about one line in length. The first family affects trees and plants, in many instances distorting the leaves and buds; one of its species, *Rhinocola speciosa*, has been recorded by Lichtenstein in the annals of the French

Entomological Society for 1872 as puncturing poplar leaves which afterwards attain the size and form of a cucumber. The *Psyllidæ* differ from the second family in having the power to leap, their third pair of legs being formed for this purpose. The *Aphididæ* are perhaps best known by the terms "blight," "green fly," etc. These are to be found almost always in large companies on nearly every kind of tree, plant, and shrub. They are said to produce the honey dew found upon maple and other trees, although this has been disputed by Dr. Hooker in the *Gardener's Chronicle* for July, 1873. They are furnished with two setiform pipes or tubes, varying considerably in length in the different species, placed one on each side of the abdomen on the fourth segment from the apex, from which certainly is emitted a sweet fluid which the ants are well known to follow them for and consume. This family also contains the great vine-pest known by the name of *Phylloxera vastatrix*. The third family, *Coccidæ*, has amongst its members the well-known cochineal insect (*Coccus Cacti*), from the female of which when gathered and killed is obtained the drug or dye used in giving the red colors, scarlet and crimson. It is also used for making carmine. The last division to be dealt with is called the *Anoplura*, and contains the most degraded forms of the whole order, viz., the lice, the fullest information concerning which may be obtained by consulting the works of Nitzch, Burmeister, Leach, and Denny.

Although the *Hemiptera* are of very ancient date, remains of some of the fossil forms having been found in the Primary and other formations, the number of these is but few; they are enumerated in a paper on "Fossil Entomology" by Mr. H. Goss in vol. xv. of the *Entomologist's Monthly Magazine*.

The whole of the group is extremely widely distributed, being found in almost every portion of the globe; and they are very varied both in form and in their modes of life,—man, animals, birds, insects, and plants being subjected to their attacks. On the Continent they have for a long period engaged the attention of naturalists, but in England little was known of the actual number inhabiting these islands until Douglas and Scott in 1865 published their volume of *British Hemiptera-Heteroptera*. In 1859 Dr. A. Dohrn published what may be considered to be the first whole-world catalogue of the order; and, taking it as a basis, for there is no other approximate list, and adding a reasonable amount of new species collected in each year since that time, their number would amount to nearly 10,500 species, 5300 belonging to the heteropterous section and the remainder to the second sub-order. Out of these Europe lays claim to at least 3000, whilst Great Britain is known to possess not fewer than 1000. There is no record of any one of the species being cosmopolitan (except perhaps the house bug, *Acanthia lectularia*), although some of the species inhabiting England are also to be met with in China and Japan.

(J. SC.)

HEMLING. See MEMLING.

HEMLOCK is the *Conium maculatum* of botanists, a biennial umbelliferous plant, found wild in many parts of Great Britain and Ireland, where it occurs in waste places, on hedge-banks, and by the borders of fields, and which is also widely spread over Europe and temperate Asia, and naturalized in the cultivated districts of North and South America. It is an erect branching plant, growing from 3 to 6 feet high, and emitting a disagreeable smell, like that of mice. The stems are hollow, smooth, somewhat glaucous, green, spotted with dull dark purple, as alluded to in the specific name, *maculatum*. The root-leaves have long furrowed footstalks, sheathing the stem at the base, and are large, triangular in outline, and repeatedly divided or compound, the ultimate and very numerous segments being small, ovate, and deeply incised at the edge. These leaves generally perish after the growth of the flowering stem, which takes place in the second year, while the leaves produced on the stem become gradually smaller upwards. The branches are all terminated by compound many-rayed umbels of small white flowers, the general involucres consisting of several, the partial ones of about three short lanceolate bracts, the latter being usually turned towards the outside of the umbel. The flowers are succeeded by broadly ovate fruits, the mericarps (half-fruits) having five ribs which, when mature, are waved or crenated; there are no vittæ or oil-cysts; and when cut across the albumen is seen to be deeply furrowed on the inner face, so as to exhibit in section a reniform outline. The fruits when triturated with a solution of caustic potash evolve a most unpleasant odor.

Hemlock is a virulent poison, but it varies much in potency according to the conditions under which it has grown, and the season or stage of growth at which it is gathered. In the first year the leaves have little power, nor in the second are their properties developed until the flowering period, at which time, or later on when the fruits are fully grown, the plant should be gathered. The wild plant growing in exposed situations is to be preferred to garden-grown samples, and is more potent in dry warm summers than in those which are dull and moist.

The poisonous property of hemlock resides chiefly in the alkaloid *conine* or *conia*, which is found in both the fruits and the leaves, though in exceedingly small proportions in the latter. Conine resembles nicotine in its deleterious action, but is much less powerful. No chemical antidote for it is known. The plant also yields a second less poisonous crystallizable base called *conhydrine*, which may be converted into conine by the abstraction of the elements of water.

When collected for medicinal purposes, for which both leaves and fruits are used, the former should be gathered at the time the plant is in full blossom, while the latter are said to possess the greatest degree of energy just before they ripen. The fruits are the chief source whence conine is prepared. The principal forms in which hemlock is employed are the extract and juice of hemlock, hemlock poultice, and the tincture of hemlock fruits. Large doses produce vertigo, nausea, and paralysis; but in smaller quantities, administered by skilful hands, it has a sedative action on the nerves. It has also some reputation as an alterative and resolvent, and as an anodyne.

The acrid narcotic properties of the plant render it of some importance that one should be able to identify it, the more so as some of the compound-leaved umbellifers, which have a general similarity of appearance to it, form wholesome food for man and animals. Not only is this knowledge desirable to prevent the poisonous plant being detrimentally used in place of the wholesome one; it is equally important in the opposite case, namely, to prevent the inert being substituted for the remedial agent. The plant with which hemlock is most likely to be confounded is the *Anthriscus sylvestris*, or cow-parsley, the leaves of which are freely eaten by cattle and rabbits; this plant, like the hemlock, has spotted stems but they are hairy, not hairless; it has much-divided leaves of the same general form, but they are downy and aromatic, not smooth and nauseous when bruised; the fruit of the *Anthriscus*, besides, is linear-oblong and not ovate.

HEMP, *Cannabis sativa*, an annual herb, having angular rough stems and alternate lobed leaves. The bast fibres of *Cannabis* are the hemp of commerce, but under the name of hemp fibrous products from many different plants are often included. Sunn hemp is the bast fibre of a papilionaceous plant, *Crotolaria juncea*, of India and the Sunda Islands; *Hibiscus cannabinus*, an Indian malvaceous plant, yields brown or Bombay hemp; Jute or Paut hemp is produced by *Corchorus capsularis* and *C. olitorius*, and to some extent by *C. fuscus*, *C. fascicularis*, and *C. decemangulatus*. Manila hemp or feather fibre is derived from the fibro-vascular bundles of certain monocotyledons, namely, several species of *Musa*, chiefly from *M. textilis*, but to some extent from *M. sapientum*, *M. ensete*, *M. mindanensis*, and *M. Cavendishii*, in India, New Guinea, the Philippines, etc. Pita hemp is produced from certain species of *Agave;* the *Agave sisaliana* of Central America yields grass-hemp; and Murva or bowstring-hemp is obtained from an aloe-like plant, *Sanseviera zeylanica*, in Bengal, Ceylon, Java, and southern China.

The hemp plant, like the hop, which is the other member of the same natural order, *Cannabinaceæ*, is dicœcious, that is, the male and female flowers are borne on separate plants. The male plant is smaller than the female, and ripens and dies earlier in the summer. The foliage of the female plant is darker and more luxuriant than that of the male. The leaves of hemp are constituted of 5 to 7 leaflets, the form of which is lanceolate-acuminate, and sharply serrate. The loose panicles of male flowers and the short spikes of female flowers arise from the axils of the upper leaves. The height of the plant varies greatly with season, soil, and manuring; a variety (*C. sativa*, var. *gigantea*) has produced specimens over 17 feet in height, but the average height of the common sort is about 8 to 10 feet. There is but one species of hemp known, *Cannabis sativa*, the *C.*

indica, Lam., and *C. chinensis*, Delile, owing their differences to climate, and losing many of their peculiarities when cultivated in temperate regions. Rumphius (in the 17th century) had noticed these differences between Indian and European hemp.

The original country of the hemp-plant was doubtless in some part of temperate Asia, probably near the Caspian Sea. It spread westward throughout Europe, and southward through the Indian peninsula.[1]

Wild hemp still grows on the banks of the Lower Ural and the Volga, near the Caspian Sea. It extends to Persia, the Altai range, and northern and western China. It is found in Kashmir, and on the Himalaya, growing vigorously as far up as 6000 or even 10,000 feet.

Hemp is grown for three products—(1) the fibre of its stem; (2) the resinous secretion which is developed in hot countries upon its leaves and flowering heads; (3) its oily seeds.

Hemp has been employed for its fibre from ancient times. Herodotus (iv. 74) mentions the wild and cultivated hemp of Scythia, and describes the hempen garments made by the Thracians as equal to linen in fineness. Hesychius says the Thracian women made sheets of hemp. Moschion (about 200 B.C.) records the use of hempen ropes for rigging the ship "Syracusia" built for Hiero II. The hemp plant has been cultivated in northern India from a considerable antiquity, not only as a drug but for its fibre. The Anglo-Saxons were well acquainted with the mode of preparing hemp. Hempen cloth became common in central and southern Europe in the 13th century.

The medicinal and intoxicating properties of hemp have probably been known in Oriental countries from a very early period. An ancient Chinese herbal, part of which was written about the 5th century B.C., while the remainder is of still earlier date, notices the seed and flower-bearing kinds of hemp. Other early writers refer to hemp as a remedy. The medicinal and dietetic use of hemp spread through India, Persia, and Arabia in the early Middle Ages. The use of hemp (bhang) in India was noticed by Garcia d'Orta in 1563. Berlu in his *Treasury of Drugs* (1690) describes it as of "an infatuating quality and pernicious use." Attention was recalled to this drug, in consequence of Napoleon's Egyptian expedition, by De Sacy (1809) and Rouger (1810). Its modern medicinal use is chiefly due to trials by Dr. O'Shaughnessy in Calcutta (1838–1842). The plant is grown partly and often mainly for the sake of its resin in Persia, northern India, and Arabia, in many parts of Africa, and in Brazil.

The hemp plant grown in some parts of the United States yields the active resin so freely that less than 1 grain of the extract is a full dose. But it is as a fibre-producer that the hemp is now being more extensively cultivated in the United States. Hemp seeds were ordered for Plymouth colony as early as 1629, but the greater profit derivable from tobacco has always opposed the development of hemp-growing. The plant is chiefly grown in the States of Kentucky, Missouri, Tennessee, Ohio, Indiana, and New York. The produce of Kentucky in 1877 was 6140 tons. According to the census of 1870 the total production of the United States was 12,746 tons. In the northern part of the State of New York the crop is valued chiefly for the seeds, which may be from 20 to 40 bushels or more per acre. The produce per acre in the United States is from 700 to 1000 lb of fibre, 4 to 6 pecks of seed being usually sown.

Although the hemp-plant is grown in India chiefly for the production of its narcotic or intoxicating resin, yet a good deal of true hemp fibre is produced there. It is imported into England, however, chiefly from Russia, the United States, Italy, Holland, Germany, Hungary, and Turkey. It is grown in Ireland, and in some parts (Suffolk and Lincolnshire) of England. It thrives well in Algeria. It requires a rich deep soil and heavy manuring, and is an exhausting crop. In Great Britain about 6 pecks of seed per acre are drilled, 18 inches apart, in the middle of April. The male plants are pulled from the end of July to the end of August, the female or seed-bearing plants being gathered in September.

[1] The names given to the plant and to its products in different countries are of interest in connection with the utilization of the fibre and resin. In Sanskrit it is called *goni*, *sana*, *shanapu*, *banga*, and *ganjika*; in Bengali, *ganga*; Persian, *bang* and *canna*; Arabic, *kinnub* or *cannab*; Greek, *kannabis*; Latin, *cannabis*; Italian, *canappa*; French, *chanvre*; Spanish, *cáñamo*; Portuguese, *cânamo*; Russian, *konôpel*; Lettish and Lithuanian, *kannapes*; Slavonic, *konopi*; Erse, *canaib* and *canab*; Anglo-Saxon, *hænep*; Dutch, *hennep*; German, *hanf*; English, *hemp*; Danish and Norwegian, *hamp*; Icelandic, *hampr*; and in Swedish, *hampa*. The English word *canvas* sufficiently reveals its derivation from *cannabis*.

The British imports of hemp cannot be ascertained with accuracy, as the official returns include under that name the fibres of many hemp-substitutes. The following statement of hemp imported into the United Kingdom must therefore be taken with all necessary reserve:—

1873.....	1,247,354 cwts.	1876.....	1,174,859 cwts.
1874.....	1,240,168 "	1877.....	1,254,667 "
1875.....	1,350,758 "	1878.....	1,229,569 "

The following table gives the sources whence the supplies were chiefly drawn in the year 1877. But it must be again observed that the figures given for the imports from India, the Philippines, and other places to a less degree, include Manila hemp, Sunn hemp, and other spurious hemps.

Imports of Hemp into the United Kingdom in 1877.

From	Dressed.	Rough.	Tow or Codilla.
	Cwts.	Cwts.	Cwts.
Russia.....	4,573	347,038	18,225
Germany.....	7,033	169,744	20,689
Italy	19,477	151,632	44,602
Philippines.....	...	333,344	...
United States.....	...	10,723	...
Mexico.....	...	35,199	...
India	...	62,827	...
Other countries.....	6,357	18,636	4,568

There were sent out 11,790 cwts. dressed English-grown hemp, more than half of this going to France. 14,676 cwts of foreign and colonial dressed hemp were re-exported to British America and other countries, with 133,516 cwts. rough hemp, and 197 cwts. codilla.

Nearly all the hemp imported into the United Kingdom is landed at Liverpool, London, Hull, and Leith. Most of it is employed in the manufacture of cables, ropes, cordage, twine, sacking, tarpaulins, canvas, and sailcloth. The finest hemp comes from Italy, but it is almost equalled by the higher qualities of the Russian fibre. Russian hemp varies much in price, according to quality and market fluctuations; its price in November, 1879, was from £23 to £25 per ton, Italian or garden hemp fetching from £38 to £41.

In order to free the fibre of the hemp plant from the soft and useless parenchyma and the tissues of the bark, the stems are submitted to nearly the same processes as those described in the article FLAX. They are dried, beaten, or crushed in a hemp mill, and fermented or *retted*, preferably in soft water, after which they are again beaten with wooden mallets or in a specially constructed machine called a *break*. After breaking the stems are *scutched*, and thus the separation of the fibres furthered by the rubbing and striking to which they are subjected. The fibres are then *hackled* or *combed*.

According to Vétillart, the average length of European hemp fibres is ·86 inch, the extremes being ·2 and 2·1 inches. Dr. M'Nab gives ·0005 to ·0007 inch as the diameter of fibres, the central cavity being ·0001 in breadth. Under the microscope hemp fibres resemble those of flax, both being bast-fibres, and differ widely from those of Manila hemp or New Zealand flax; they are longitudinally striated cylinders, sometimes free and sometimes associated in small bundles. A hemp cord of 1 square millimetre section will bear, according to Haberlandt, an average weight of 34·5 kilogrammes without breaking—sometimes as much as 50 kilos.

The chief constituent of the fibre of hemp is of course cellulose, but small quantities of other substances are always present—the purest sorts, however, being richest in cellulose. A fine sample of Italian hemp gave on analysis the following percentages—water 8·9, wax 0·6, ash 0·8, matters soluble in water 3·5, lignose, albuminoids, etc., 8·4, cellulose 77·8. An ordinary sample of Russian hemp contained no less than 10·5 per cent. of moisture, and 1·5 of mineral matter, with but 72 of pure cellulose. By boiling a portion of this sample for four hours with water in a sealed tube at 150° C., a soluble extract amounting to $\frac{1}{10}$th of the original hemp was obtained, Manila hemp giving 15·4 per cent., and Phormium fibre no less than 19 per cent., when similarly treated. Dilute solutions of iodine and sulphuric acid, successively applied, give to hemp fibres a greenish hue. The ash of hemp is rich in lime.

Hemp-resin.—Hemp as a drug or intoxicant for smoking and chewing occurs in the three forms of bhang, ganja, and charas.

(1) *Bhang*, the Hindustani *siddhi* or *sabzi*, consists of the dried leaves and small stalks of the hemp; a few fruits occur in it. It is of a dark brownish-green color, and has a

faint peculiar odor and but a slight taste. It is smoked with or without tobacco; or it is made into a sweetmeat with honey, sugar, and aromatic spices; or it is powdered and infused in cold water, yielding a turbid drink, *subdschi*. *Hashish* is one of the Arabic names given to the Syrian and Turkish preparations of the resinous hemp leaves. One of the commonest of these preparations is made by heating the bhang with water and butter, the butter becoming thus charged with the resinous and active substances of the plant.

(2) *Ganja*, the guaza of the London brokers, consists of the flowering and fruiting heads of the female plant. It is brownish-green, and otherwise resembles bhang, as in odor and taste. Some of the more esteemed kinds of hashish are prepared from this ganja. Ganja is met with in the Indian bazaars in dense bundles of 24 plants or heads apiece. The hashish in such extensive use in Central Asia is often seen in the bazaars of large cities in the form of cakes, 1 to 3 inches thick, 5 to 10 inches broad, and 10 to 15 inches long.

(3) *Charas*, or churrus, is the resin itself collected, as it exudes naturally from the plant, in different ways. The best sort is gathered by the hand like opium; sometimes the resinous exudation of the plant is made to stick first of all to cloths, or to the leather garments of men, or even to their skin, and is then removed by scraping, and afterwards consolidated by kneading, pressing, and rolling. It contains about one-third or one-fourth its weight of the resin. But the churrus prepared by different methods and in different countries differs greatly in appearance and purity. Sometimes it takes the form of egg-like masses of grayish-brown color, having when of high quality a shining resinous fracture. Often it occurs in the form of irregular friable lumps, like pieces of impure linseed oil-cake.

Hemp, however consumed, acts in the most strange way upon the nervous system, but its effects differ greatly with races as well as with individuals. Generally the first effect of a small dose is to produce increase of appetite and cheerfulness. Larger doses produce hallucinations, delirium, sleep, and sometimes catalepsy. During the dreamy state induced by an average dose of hashish, the patient becomes the sport of rapidly shifting ideas. Errors of perception as to time and place are a conspicuous characteristic of its effects on the mind. For the connection of the name assassin with hashish, see vol. ii. p. 632.

Extract of hemp has been repeatedly tried in modern European medical practice without very consistent or satisfactory results. It has antispasmodic and anodyne characters, and has been employed in tetanus, spasmodic cough, hydrophobia, and some forms of mania. It is a quieter of the nervous system, but does not cause constipation, check the appetite, nor diminish the secretions like opium.

Hemp is very largely used in Eastern countries as an intoxicant and narcotic—probably by nearly 300 millions of the human race. The amount consumed cannot be estimated. Of dried hemp and churrus there was sent in 1876 not less than £86,000 worth through the Khyber Pass into British India.

There are three substances in the hemp-drug to which its activity has been attributed. Of these the resin, separated and investigated by Messrs. T. & H. Smith, is the most abundant and probably the most important, and yet its chemical nature and properties are by no means certain. It is soluble in alcohol, and has a warm, bitter, acrid taste with a slight odor. It melts between 70° and 90° C., and has a pale brown color. It is called *cannabin*. Cannabene is the volatile oil of Indian hemp obtained by distilling ganja or churrus with water. Its composition is represented by C_9H_{10}; it boils between 235° and 240°. Cannabene is accompanied by a crystalline hydrocarbon containing 84 per cent. carbon and 16 per cent. hydrogen. The supposed occurrence of nicotine in Indian hemp has not been confirmed, and would not in any way suffice to explain the properties of the drug. Moreover, tobacco is often added to hemp. That there is a volatile alkaloid in hemp, though in small quantities, is, however, established beyond doubt. The proportion of pure resin in ganja was found by Messrs. T. & H. Smith to be 6 or 7 per cent. Gastinell gives 3 per cent. as obtainable from Egyptian hemp. The volatile oil in fresh hemp probably does not exceed 3 parts in 1000. By treating the commercial resinous extract of Indian hemp with strong nitric acid, Bolas and Francis obtained (*Journ. Chem. Soc.*, vol. vii., n. s., p. 417) an oxidation product, soluble in alcohol and crystallizing in long flat prisms. The formula $C_5H_6O_2$ has been assigned to this substance, which is known as oxycannabin.

Hemp Seed Cake, and Oil.—The ripe seeds, really fruits, being nuts or achenes of the hemp plant, contain about 34 per cent. of oil and 16 of albuminoids. When the crushed seeds have been submitted to pressure, the residual cake is found to retain about 7 per cent. of oil. The value of hemp cake as a cattle-food is lessened by its purgative property. The seeds are much used as a food for singing birds. A hundred parts of the seed yield from 70 to 75 of cake and 25 to 30 of oil. This oil has drying properties, though it is in this respect much inferior to linseed oil. Its specific gravity is ·9307. The seeds are roundish ovate, about $\frac{1}{8}$ inch in length, and of a dark gray color, with a pale ash-colored network of surface-markings.

See Bentley and Trimen's *Medicinal Plants*, No. 231; Vétillart's *Études sur les fibres textiles*, pp. 72–87; Dickson's *Fibre Plants of India*; Royle's *Fibrous Plants of India*; *Cultivation of Hemp in India*; Dr. O'Shaughnessy's *Preparation of Indian Hemp or Gunjah*; Yates's *Textrinum Antiquorum*; Hugo Müller's *Pflanzenfaser*; the *Dispensatory* of the United States; Knight's *Dictionary of Mechanics*; Dr. G. Martius's *Studien über den Hanf*; and Johnston's *Chemistry of Common Life*, 1879. (A. H. C.)

HEMS, Homs, or Hums, a town of Syria, about 63 miles by road north-east of Tripoli (Tarâbulus), situated 1312 feet, according to Černik, above the level of the sea, on the eastern side of the valley of the Nahr el Asy or Orontes, which about 4 miles further down forms the lake of Hems, Atini, or Kabas. The *kala'at* or castle, a great mound "still crowned with a tiara of torn and ruined towers," forms a striking landmark well-known to the caravans journeying north from Damascus. It is about 120 feet in height, and has a breadth of 435 feet and a width of 375. According to Captain Burton, it probably occupies the site of the temple of the sun, which formed the glory of the ancient city: not only does it contain columnar masses of syenite, gray granite, and white marble, but he found, apparently in position, a Doric pilaster. Though the ancient walls of Hems, with a circuit of about a mile and a half, are greatly dilapidated and even in many places practically demolished, the town is entered by regular gates, six in number, which in olden times bore the names of the planets. Within it presents little except narrow and tortuous streets, poorly paved and foul, with houses for the most part of the meanest description; but none the less it is the seat of a Turkish vice-governor or mutesarif, as well as of a Greek and a Maronite bishop, and its cavalry barracks are capable of containing two regiments. As the market-town of the neighboring tribes it has some commercial importance: it trades in cotton, sesame, and oil; and among its craftsmen it numbers a body of skilful goldsmiths and about 3000 silk weavers, whose looms produce the finest kind of kaffiehs or head-cloths. The population is estimated at from 50,000 to 60,000, and about 7000 are Christians. Jews are conspicuous by their absence, though one of the gates of the town in the quarter which they formerly occupied is still called the "Jews' Gate."

Hems is the Emesa, Emissa, or Hemesa of the Romans, and by Ptolemy it is assigned to the district of Apamene. Its inhabitants are mentioned among the early opponents of the Roman arms. Heliogabalus or Bassianus, declared emperor in 218 A. D., was a native of Emesa, and held office as a priest of the sun. It was in the neighborhood of the town that the army of Zenobia was routed by Aurelian. The first Christian bishop is said to have been St. Silvanus. About fourteen years after the Hegira Khalid bin Walid, who was to find his grave in one of its suburbs, made himself master of Hems; and from 1098 to 1187 it was in the hands of the crusaders. It was probably Saladin, by whom they were expelled, that turned the temple of the sun, which under Christian rule had been used as a cathedral, into the chief fortress of the place. In July, 1831, Ibrahim Pasha, having defeated the governor of Aleppo at Hems, caused the fortress to be blown up.

The poet Ka'ab el Ahbár is buried in the town, and the people show another grave which they wrongly believe to be that of Ja'afar el Tayyár.

See Burton and Tyrwhitt Drake, *Unexplored Syria*, 1872.

HEMSTERHUIS, François (1720–1790), writer on æsthetics and moral philosophy, was born at Franeker in Holland in 1720. He received an excellent education from his father, Tiberius Hemsterhuis, noticed below, and completed his studies at the university of Leyden. There undoubtedly he was attracted towards the study of the Platonic philosophy, which exercised the greatest influence both on the form and on the matter of his own writings. He did not, however, devote himself to a learned life after complet-

ing his university courses, but entered upon practical affairs, and for many years acted as secretary to the state council of the United Provinces. His interests were mainly philosophical, and partly by direct social intercourse with a few similarly disposed friends, partly by correspondence with philosophical writers of other countries, mainly with Jacobi, he preserved the continuity of his philosophical work. His writings, none of which can be described as of high speculative worth, are distinguished by elegance of form and by the touch of refined sentiment which is not uncommon among the amateur or dilettante philosophers of the 18th century. Any direct contributions to philosophy made by him are in the department of æsthetics or the general analysis of feeling. He died in 1790.

His first work, published in 1769, was a *Lettre sur la Sculpture*, written, like all the others, in French. It was followed in 1770 by the *Lettre sur les désirs*, in 1772 by the *Lettre sur l'homme et ses rapports*, in 1778 by *Sophyle*, a dialogue on the relation between soul and body, in 1779 by *Aristée*, a dialogue on the existence of the Divine Being, in 1787 by *Alexis ou l'âge d'or*, by *Simon, ou des facultés de l'âme*, and by the *Lettre de Diocles à Diotime sur l'athéisme*. Collected editions of his works have been published in 1792 (2 vols.), and more completely by Meyboom, in 1846–50 (6 vols.). See Grucker, *François Hemsterhuis, sa Vie et ses Œuvres* (Paris, 1866).

HEMSTERHUIS, Tiberius (1685–1766), philologist and critic, was born on January 9, 1685, at Groningen in Holland. His father, a learned physician, recognizing the abilities of his son, gave him so good an early education that, when he entered the university of his native town in his fifteenth year, he speedily proved himself to be the best student of mathematics. After a year or two at Groningen, he was attracted to the university of Leyden by the fame of Perizonius; and while there he was entrusted with the flattering duty of arranging the manuscripts in the library. Though he accepted an appointment as professor of mathematics and philosophy at Amsterdam in his twentieth year, he had already directed his attention to the study of the ancient languages. In 1706 he completed the edition of Pollux's *Onomasticon* begun by Lederlin; but the praise he received from his countrymen was more than counterbalanced by two letters of criticism from Bentley, which mortified him so keenly that for two months he refused to open a Greek book. In 1717 Hemsterhuis was appointed professor of Greek at Franeker, but he did not enter on his duties there till 1720. In 1738 he became professor of national history also. Two years afterwards he was called to teach the same subjects at Leyden, where he died, April 7, 1766. Hemsterhuis deserves special note for reinstating the study of Greek in its honorable place among his fellow-countrymen, while he was also the founder of a laborious and useful Dutch school of criticism, of which Valckenaer Lennep, and Ruhnken are the most famous disciples.

His chief writings are the following:—*Lucian Colloquia et Timon*, 1708; *Aristophanis Plutus*, 1744; *Notæ, etc., ad Xenophontem Ephesium* in the *Miscellanea Critica* of Amsterdam, vols. iii. and iv.; *Observationes ad Chrysostomi Homilias; Orationes*, 1784; a Latin translation of the *Birds* of Aristophanes, in Kuster's edition; notes to Bernard's *Thomas Magister*, to Alberti's *Hesychius*, to Ernesti's *Callimachus*, and to Burmann's *Propertius*. See *Elogium T. Hemsterhusii* (with Bentley's letters) by Ruhnken, 1789; and *Supplementa Annotationis ad Elogium T. Hemsterhusii*, etc., Leyden, 1874.

HÉNAULT, Charles Jean François (1685–1770), French historian, was born in Paris 8th February, 1685. His father, a farmer-general of taxes, was a man of literary tastes; and young Hénault obtained a good education at the Jesuit college and the Collége des Quatre-Nations. Captivated by the eloquence of Massillon, he in his fifteenth year entered the oratory with the view of becoming a preacher, but after two years' residence he changed his intention, and, inheriting a position which secured him access to the most select society of Paris, he at an early period achieved distinction by his gay, witty, and graceful manners, and by his literary talent as manifested in the composition of various light poetical pieces, and of two discourses which respectively gained a prize at the French Academy in 1707, and at the Académie des Jeux Floraux in 1708. In 1706 he became councillor of the parliament of Paris, and in 1710 he was chosen president of the court of *enquêtes*. He was admitted into the French Academy in 1723, and subsequently into the leading literary societies of Europe. After the death of Bernard de Coubert he became superintendent of the household of Queen Marie Leczinska, whose intimate friendship he had previously enjoyed. On his recovery in his fiftieth year from a dangerous malady, he professed to have undergone religious conversion and retired into private life, devoting the remainder of his days to study and devotion. His devotion was, however, according to the Marquis d'Argenson, "exempt from fanaticism, persecution, bitterness, and intrigue;" and it did not prevent him from continuing his friendship with Voltaire, to whom it is said he had formerly rendered the service of saving the manuscript of *La Henriade*, when its author was about to commit it to the flames. The literary work on which Hénault bestowed his chief attention was the *Abrégé Chronologique*, first published in 1744 without the author's name. It is a model of its kind, and is valuable both for popular use and as a work of reference. In the compass of two volumes he has comprised the whole history of France from the earliest times to the death of Louis XIV. His information is for the most part drawn from original sources, and for such a work the number of errors committed by Hénault was remarkably small. The results of deep researches and lengthened disquisitions on public law are summed up in a few words. The moral and political reflections are always short and generally as fresh and pleasing as they are just. A few masterly strokes reproduce the leading features of each age and the characters of its illustrious men; accurate chronological tables set forth the most interesting events in the history of each sovereign and the names of the great men who flourished during his reign; and interspersed throughout the work are occasional chapters on the social and civil state of the country at the close of each era in its history. Continuations of the work have been made at separate periods by Fantin des Odoards, by Auguis with notes by Walckenaer, and by Michaud. Besides some other historical works of minor importance Hénault wrote several dramatic pieces of no particular merit. He died at Paris, 24th November, 1770. His *Mémoires*, published in 1854, are somewhat fragmentary and disconnected, but contain many interesting anecdotes and details regarding persons of note.

See the *Correspondance* of Grimm, of Madame du Deffand, and of Voltaire; the notice by Walckenaer in the edition of the *Abrégé Chronologique;* and Sainte-Beuve, *Causeries du lundi*, vol. xi.

HENBANE (in French, *jusquiaume*, from the Greek *hyoscyamus*, or hog's-bean; in Italian, *giusquiamo;* and in German, *Schwarzes Bilsenkraut, Hühnertod, Saubohne*, and *Zigeuner-Korn* or "gipsies' corn") is the common name of the *Hyoscyamus niger*, a Solanaceous plant indigenous to Britain, found wild in waste places, on rubbish about villages and old castles, and cultivated for medical use at Mitcham and other places in Surrey, and in Bedfordshire, Cambridgeshire, and Hereford. It occurs also in central and southern Europe and in western Asia, and has long been naturalized in the United States. There are two forms of the plant, an annual and a biennial, which spring indifferently from the same crop of seed,—the one growing on during summer to a height of from 1 to 2 feet, and flowering and perfecting seed; the other producing the first season only a tuft of radical leaves, which disappear in winter, leaving underground a thick fleshy root, from the crown of which arises in spring a branched flowering stem, usually much taller and more vigorous than the flowering stems of the annual plants. The biennial form is that which is considered officinal. The radical leaves of this biennial plant spread out flat on all sides from the crown of the root; they are ovate-oblong, acute, stalked, and more or less incisely-toothed, of a grayish-green color, and covered with viscid hairs; these leaves perish at the approach of winter. The flowering stem pushes up from the root-crown in spring, ultimately reaching from 3 to 4 feet in height, and as it grows becoming branched, and furnished with alternate sessile leaves, which are stem-clasping, oblong, unequally-lobed, clothed with glandular clammy hairs, and of a dull gray-green, the whole plant having a powerful nauseous odor. The flowers are shortly-stalked, the lower ones growing in the fork of the branches, the upper ones sessile in one-sided leafy spikes which are rolled back at the top before flowering, the leaves becoming smaller upwards and taking the place of bracts. The flowers have an urceolate calyx which persists around the fruit and is strongly veined, with five stiff broad, almost prickly lobes: these, when the soft

matter is removed by maceration, form very elegant specimens when associated with leaves prepared in a similar way. The corollas are obliquely funnel-shaped, of a dirty yellow or buff, marked with a close reticulation of purple veins. The capsule opens transversely by a convex lid, and contains numerous seeds. Both the leaves and the seeds are employed in pharmacy. The Mahometan doctors of India are accustomed to prescribe the seeds. Henbane yields a poisonous alkaloid, *hyoscyamine*, which is stated to have properties almost identical with those of atropine, from which it differs in being more soluble in water. It is usually obtained in an amorphous, scarcely ever in a crystalline state. Its properties have been investigated in Germany by Husemann, Schroff, Höhn, etc. Höhn finds its chemical composition expressed by $C_{18}H_{28}N_2O_3$. (Compare Hellmann, *Beiträge zur Kenntniss der physiolog. Wirkung des Hyoscyamins*, etc., Jena, 1874.) In small and repeated doses henbane has been found to have a tranquillizing effect upon persons affected by severe nervous irritability. In poisonous doses it causes loss of speech, distortion, and paralysis. In the form of extract or tincture it is a valuable remedy in the hands of a medical man, either as an anodyne, a hypnotic, or a sedative. The extract of henbane is rich in nitrate of potassium and other inorganic salts. The smoking of the seeds and capsules of henbane is noted in books as a somewhat dangerous remedy adopted by country people for toothache. Accidental poisoning from henbane occasionally occurs, owing sometimes to the apparent edibility and wholesomeness of the root.

HENDERSON, Alexander (1583–1646), a celebrated Scottish ecclesiastic, was born in 1583. He was educated at the university of St. Andrews, where he was appointed professor of rhetoric and philosophy and questor of the faculty of arts in 1610. A year or two after this he was presented to the living of Leuchars by Archbishop Gladstanes. As Henderson was forced upon his parish by an archbishop, and as he was known to sympathize with Episcopacy, his settlement was at first extremely unpopular; but he subsequently changed his views, and became a Presbyterian in doctrine and church government, and one of the most esteemed ministers in Scotland. He early made his mark as a church leader, and took an active part in petitioning against Episcopal innovations. On the 1st of March, 1638, the public signing of the "National Covenant" began in Greyfriars Church, Edinburgh. Henderson is mainly responsible for this document; and he seems always to have been applied to when any manifesto of unusual ability was required. In July of the same year he proceeded to the north, to debate on the "Covenant" with the famous Aberdeen doctors; but he was not well received by them. "The voyd church was made fast, and the keys keeped by the magistrate," says Baillie. Henderson's next public appearance was in the famous Assembly which met in Glasgow on the 21st of November, 1638. He was chosen moderator by acclamation, being, as Baillie says, "incomparablie the ablest man of us all for all things." The marquis of Hamilton was the king's commissioner; and, when the Assembly insisted on proceeding with the trial of the bishops, he formally dissolved the meeting under pain of treason. Nothing daunted, however, they sat till the 20th of December, deposed all the Scottish bishops, excommunicated a number of them, repealed all acts favoring Episcopacy, and reconstituted the Scottish Kirk on thorough Presbyterian principles. During the sitting of this Assembly it was carried by a majority of seventy-five votes that Henderson should be transferred to Edinburgh. He had been at Leuchars for about twenty-three years, and was extremely reluctant to leave it. While Scotland and England were preparing for the "First Bishops' War," Henderson drew up two papers, entitled respectively —*The Remonstrance of the Nobility*, and *Instructions for Defensive Arms*. The first of these documents he published himself; the second was published against his wish by Corbet, a deposed minister. The "First Bishops' War" did not last long. At the Pacification of Birks the king had virtually to grant all the demands of the Scots. In the negotiations for peace Henderson was one of the Scottish commissioners, and made a very favorable impression on the king. In 1640 Henderson was elected by the town council rector of Edinburgh university—an office to which he was annually re-elected till his death. The Pacification of Birks had been wrung from the king; and the Scots, seeing that he was preparing for the "Second Bishops' War," took the initiative, and pressed into England so vigorously that Charles had again to yield everything. The maturing of the treaty of peace took a considerable time; and Henderson was again active in the negotiations, first at Ripon, and afterwards at London. While he was in London he had a personal interview with the king, with the view of obtaining assistance for Edinburgh university from the money formerly applied to the support of the bishops. On Henderson's return to Edinburgh in July, 1641, the Assembly was sitting at St. Andrews. To suit the convenience of the parliament, however, it removed to Edinburgh; and Henderson was elected moderator of the Edinburgh meeting. In this assembly he proposed that "a confession of faith, a catechism, a directory for all the parts of the public worship, and a platform of government, wherein possibly England and we might agree," should be drawn up. This was unanimously approved of, and the laborious undertaking was left in Henderson's hands; but the "notable motion" did not lead to any immediate results. During Charles's second state-visit to Scotland, in the autumn of 1641, Henderson acted as his chaplain, and managed to get the funds, formerly belonging to the bishopric of Edinburgh, applied to the metropolitan university. In 1642 Henderson was engaged in corresponding with England on ecclesiastical topics; and, shortly afterwards, he went to Oxford to mediate between the king and his parliament; but his mission proved a failure. A memorable meeting of the General Assembly was held in August, 1643. Henderson was elected moderator for the third time. He presented a draft of the famous "Solemn League and Covenant," which was received with great enthusiasm. Unlike the "National Covenant" of 1638, which applied to Scotland only, this document was common to the two kingdoms. Henderson, Baillie, Rutherford, and others were sent up to London to represent Scotland in the Assembly at Westminster. The "Solemn League and Covenant," after undergoing some slight alterations, passed the two Houses of Parliament and the Westminster Assembly, and thus became law for the two kingdoms. By means of it Henderson has had an extraordinary influence on the history of Great Britain. As Scottish commissioner to the Westminster Assembly, he was in England from August, 1643, till August, 1646; and the action of the Scottish commissioners gave a fresh impulse to English Presbyterianism. Early in 1645 Henderson was sent to Uxbridge to aid the commissioners of the two parliaments in negotiating with the king; but nothing came of the conference. In 1646 the king joined the Scottish army; and, after retiring with them to Newcastle, he sent for Henderson, and discussed with him the two systems of church government in a number of papers. Meanwhile Henderson was failing in health. He sailed to Scotland, and eight days after his arrival died on the 19th of August, 1646. He was buried in Greyfriars Churchyard, Edinburgh; and his death was the occasion of national mourning in Scotland. An absurd story was at once invented to the effect that, after recanting to the king's views, he had died of remorse. A document was forged, purporting to be a "Declaration of Mr. Alexander Henderson;" and, although this paper was disowned, denounced, and shown to be false in the General Assembly of August, 1648, the fiction was used by Clarendon, and still finds a place in professedly historical compilations.

Henderson is one of the greatest men in the history of Scotland, and, next to Knox, is certainly the most famous of Scottish ecclesiastics. He had great political genius; and his statesmanship was so influential that "he was," as Professor Masson well observes, "a cabinet minister without office." He has made a deep mark on the history, not only of Scotland, but of England; and the existing Presbyterian Churches in Scotland are largely indebted to him for the forms of their dogmas and their ecclesiastical organization. He is thus justly considered the second founder of the Reformed Church in Scotland.

For further information about Henderson reference may be made to M'Crie's *Life of Alexander Henderson*, 1846; Aiton's *Life and Times of Alexander Henderson*, 1836; *The Letters and Journals of Robert Baillie*, 1841–2 (an exceedingly valuable work, from an historical point of view); Burton's *History of Scotland*; Masson's *Life of Drummond of Hawthornden*; and, above all, Masson's *Life of Milton*. (T. G.)

HENDERSON, Ebenezer, Scottish dissenting minister

and theological and miscellaneous writer, was born at the Linn near Dunfermline, November 17, 1784, and died at Mortlake, May 17, 1858. He was the youngest son of an agricultural laborer, and after three years' schooling spent some time at watchmaking and as a shoemaker's apprentice. In 1803 he joined Mr. Robert Haldane's theological seminary, and in 1805 was selected to accompany the Rev. John (afterwards Dr.) Paterson to India; but as the East India Company would not allow British vessels to convey missionaries to India, Henderson and his colleague went to Denmark to await the chance of a passage to Serampore. Being unexpectedly delayed, they ultimately decided to settle in Denmark, and in 1806 Henderson was fixed at Elsinore. From this time till about 1817 he was engaged in encouraging the distribution of Bibles in the Scandinavian countries, and in the course of his labors he visited Sweden and Lapland (1807–8), Iceland (1814–15), and the mainland of Denmark and part of Germany (1816). During most of this time he was an agent of the British and Foreign Bible Society. In 1818, after a visit to England, he travelled in company with Dr. Paterson through Russia as far south as Tiflis, but, instead of settling as was proposed at Astrakhan, he had to retrace his steps, having resigned his connection with the Bible Society. In 1822 he was invited by Prince Alexander Galitzin to assist the Russian Bible Society in translating the Scriptures into various languages spoken in the Russian empire. After twenty years of foreign labor Henderson returned to England, and in 1825 was appointed tutor of the Mission College, Gosport. In 1830 he succeeded Dr. William Harrison as theological lecturer and professor of Oriental languages in Highbury Congregational College, and though in 1850, on the amalgamation of the colleges of Homerton, Coward, and Highbury, he was excluded from office through age, he was pastor in 1852–53 of a chapel at Mortlake. His last work was a translation of the book of Ezekiel. Henderson was a man of great linguistic attainment: in the course of his labors he made himself more or less acquainted, not only with the ordinary languages of scholarly accomplishment and the various members of the Scandinavian group, but also with Hebrew, Syriac, Ethiopic, Russian, Arabic, Tatar, Persic, Turkish, Armenian, Manchoo, Mongolian, and Coptic. He organized the first Bible Society in Denmark (1814), and paved the way for several others. In 1817 he was nominated by the Scandinavian Literary Society a corresponding member; and in 1840 he was made D. D. by the university of Copenhagen. He was honorary secretary for life of the Religious Tract Society, and one of the first promoters of the British Society for the Propagation of the Gospel among the Jews. The records of his travels in Iceland (1818) were valuable contributions to our knowledge of that island. His other principal works are *Biblical Researches and Travels in Russia* (1826), *Divine Inspiration* (1836), and annotated translations of Isaiah (1840, 1857), the twelve minor prophets (1845), and Jeremiah (1851).

See *Memoirs of Ebenezer Henderson*, by Thulia S. Henderson (his daughter), London, 1859.

HENGSTENBERG, Ernst Wilhelm (1802–1869), for more than forty years one of the most conspicuous and able champions of the strictest Lutheran orthodoxy, was born at Fröndenberg, a Westphalian village near Hamm and not far from the Ruhr, on October 20, 1802; received his entire school education under the roof of his father, who was a minister of the Reformed Church, and head of the Fröndenberg Fräuleinstift; and entered the university of Bonn in 1819, shortly before the completion of his seventeenth year. There he attended the lectures of Freytag and Gieseler on Old Testament exegesis and church history, but his energies were principally devoted to philosophy and philology, and his earliest publication was an edition of the *Moallakah* of Amru' l' Kais (*Amrulkeisi Moallakah cum scholiis Zuzenii edidit, latine vertit, et illustravit E. G. H.*, 1823), which gained for him the prize at his graduation in the philosophical faculty, and the public commendation of Sylvestre de Sacy. This was followed in 1824 by a German translation of Aristotle's *Metaphysica*. On quitting Bonn it had been Hengstenberg's wish to complete his theological studies under Neander and Tholuck in Berlin; but finding himself without the means of doing so, he accepted for a year a situation at Basel as tutor in Oriental languages to J. J. Stähelin. Then it was that, suffering much from ill-health and deeply mourning the loss of his mother, he began to direct his attention, with an ardor formerly unknown to him, to the spiritual truths of the Bible. His studies and experiences at this crisis resulted in a conviction, never afterwards shaken, not only of the divine character of evangelical religion, but also of the unapproachable adequacy of its expression in the Augsburg Confession. Taking as his motto Psalm cxviii. 17, he resolved thenceforward to devote himself to the uncompromising defence of that creed. In the autumn of 1824 he joined the philosophical faculty of Berlin as a privat-docent, and in the following year he became a licentiate in theology, his theses even then being remarkable for their evangelical fervor and for their emphatic protest against every form of "rationalism," especially in questions of Old Testament criticism. In 1826 he became professor extraordinarius in theology; and in July, 1827, appeared under Hengstenberg's editorship the first number of the *Evangelische Kirchenzeitung*, a "reactionary" journal which in his hands was destined to acquire an almost unique reputation as an organ of religious, theological, and ecclesiastical controversy. It did not, however, attain a great notoriety until in 1830 an anonymous article (by E. L. von Gerlach) appeared, which openly charged Professors Gesenius and Wegscheider with infidelity and profanity, and on the ground of these accusations advocated the interposition of the civil power, thus giving rise to the prolonged "Hallische Streit" as it was called, which was at least effectual in giving the public a due impression of the energy and zeal of the new "evangelical" school. In 1828 the first volume of Hengstenberg's *Christologie des Alten Testaments* passed through the press; in the autumn of that year he was promoted to the dignity of professor ordinarius in theology; and in 1829 he married. The remainder of his life, apart from the excitement which its various literary activities imparted to it, was uneventful. He died on the 28th of May, 1869.

The following is a list of the principal works of Hengstenberg:—*Christologie des Alten Testaments* (1829–35; 2d ed., 1854–57; Eng. transl. by R. Keith, 1835–39, also in Clark's "Foreign Theological Library," by Th. Meyer and J. Martin, 1854–58), a work of much ingenuity and considerable learning, but which will be differently valued according to the hermeneutical principles of the individual critic; *Beiträge zur Einleitung in das Alte Testament* (1831–39; Engl. transl., "Dissertations on the Genuineness of Daniel and the Integrity of Zechariah," Edin., 1848, and "Dissertations on the Genuineness of the Pentateuch," Edin., 1847), in which the traditional view on each question is strongly upheld, and much capital is made of the absence of harmony among the negative critics; *Die Bücher Mosis und Ægypten* (1841), spoken of by Diestel as "perhaps Hengstenberg's most meritorious work;" *Die Geschichte Bileams u. seiner Weissagungen* (1842; translated into English along with the Dissertations on Daniel and Zechariah mentioned above); *Commentar über die Psalmen* (1842–45; 2d ed., 1849–52; Eng. transl. by Fairbairn and Thomson, Edin., 1844–48), which shares the merits and defects of the *Christologie*; *Die Offenbarung Johannis erläutert* (1841–51; 2d ed. 1861–62; Eng. transl. by Fairbairn, also in Clark's "Foreign Theological Library," 1851–52); *Das Hohe Lied ausgelegt* (1853); *Der Prediger Salomo ausgelegt* (1859); *Das Evangelium Johannis erläutert* (1861–63; 2d ed. 1867–71; Eng. transl. 1865), and *Die Weissagungen des Propheten Ezechiel erläutert* (1867–68). Of minor importance are *De rebus Tyriorum commentatio academica* (1832); *Ueber den Tag des Herrn* (1852); *Das Passa, ein Vortrag* (1853); and *Die Opfer der heiligen Schrift* (1859). Several series of papers also, as, for example, on "The Retention of the Apocrypha," "Freemasonry," "Duelling," and "The Relation between the Jews and the Christian Church," which originally appeared in the *Kirchenzeitung*, were afterwards printed in a separate form. *Geschichte des Reiches Gottes unter dem Alten Bunde* (1869–70), *Das Buch Hiob erläutert* (1870–75), and *Vorlesungen über die Leidensgeschichte* (1875) were published, from Hengstenberg's papers, posthumously. See Bachmann's *Ernst Wilhelm Hengstenberg* (1876–79); also his article in Herzog and Plitt's *Encyklopädie* (1879).

HENKE, Heinrich Philipp Konrad (1752–1809), a learned German theologian of the broad school, best known as a writer on church history, was born at Hehlen, Brunswick, on July 3, 1752, was educated at the gymnasium of Brunswick and the university of Helmstädt, and from 1778 until his death, which occurred on May 2, 1809, held a professorship of theology in that university. His principal work (*Kirchengeschichte*, in 6 vols., 1788–1804; 2d ed. 1795–1806) is commended by Baur for fulness, accuracy, and artistic composition, as one of the best in that class of literature. His other works are *Lineamenta institutionum fidei Christianæ historico-criticarum* (1783), *Opuscula Aca-*

demica (1802), and two volumes of *Predigten*. His son, Ernst Ludwig Theodor (1804–1872), has also left a name in the literature of theology and ecclesiastical history, having been the author of monographs upon *Georg Calixt u. seine Zeit* (1853–60), *Papst Pius VII.* (1860), *Konrad von Marburg* (1861), *Kaspar Peucer u. Nik. Krell* (1865), *Jak. Friedr. Fries* (1867), as well as of other works.

HENLEY, JOHN (1692–1759), an eccentric clergyman of the last century, commonly known as "Orator Henley," was born August 3, 1692, at Melton-Mowbray, where his father was vicar. After attending the grammar schools of Melton and Oakham, he in his seventeenth year entered St. John's College, Cambridge, and while still an undergraduate he addressed in February, 1712, under the pseudonym of Peter de Quir, a letter to the *Spectator* displaying no small wit and humor. After graduating B. A. he became assistant and then head-master of the grammar school of his native town, uniting to these duties those also of assistant curate. His superabundant energy was not, however, fully consumed by this plurality of offices, for besides publishing in 1714 a poem entitled *Esther, Queen of Persia*, containing many vigorous and eloquent passages, he also devoted his attention to the compilation of a grammar of ten languages entitled *The Complete Linguist* (2 vols., London, 1719–21). In his school he is said to have introduced many new methods of study, but whether it was that his innovations were not sufficiently appreciated, or that he desired a wider sphere for the exercise of his exceptional abilities, he resolved to place his services at the disposal of the metropolis, where he arrived with thirty recommendatory letters from some of the most influential persons of his native county. He succeeded in obtaining the appointment of assistant preacher in the chapels of Ormond Street and Bloomsbury, and in 1723 was presented to the rectory of Chelmondiston in Suffolk; but residence being insisted on, he resigned both his appointments, and on July, 3, 1726, opened what he called an "oratory" in Newport Market, which he licensed under the Toleration Act. Into his services he introduced many peculiar alterations: he drew up a "Primitive Liturgy," in which he substituted for the Nicene and Athanasian creeds two creeds taken from the apostolical constitutions; for his "Primitive Eucharist" he made use of unleavened bread and mixed wine; he distributed at the price of one shilling medals of admission to his oratory, with the device of a sun rising to the meridian, with the motto *Ad summa* and the words *Inveniam viam aut faciam* below. But the most original element in the services was Henley himself, who is described by Pope in the *Dunciad* as

"Preacher at once and zany of his age."

He possessed some oratorical ability and adopted a very theatrical style of elocution, "tuning his voice and balancing his hands;" and his addresses were a strange medley of solemnity and buffoonery, of clever wit and the wildest absurdity, of able and original disquisition and the worst artifices of the oratorical charlatan. His services were much frequented by the "freethinkers," and he himself expressed his determination "to die a rational." Besides his sermons on Sunday he delivered on Wednesday lectures chiefly on social and political subjects; and he also projected a scheme for connecting with the "oratory" a university on quite a novel plan, and intended to be, in a sense too utopian to be realized, the foster-mother of the arts and sciences. For some time he edited the *Hyp Doctor*, a weekly paper established in opposition to the *Craftsman*, and for this service he enjoyed a pension of £100 a year from Sir Robert Walpole. At first the orations of Henley drew great crowds, but, although he never discontinued his services, his audience latterly dwindled almost entirely away. He died 13th October, 1759.

Henley is the subject of several of Hogarth's prints. His life, professedly written by A. Welstede, but in all probability by himself, was inserted by him in his *Oratorical Transactions*. See Nichol's *History of Leicestershire*, and Disraeli's *Calamities of Authors*.

HENLEY-ON-THAMES, a market town of Oxfordshire, England, is situated on the left bank of the Thames and at the terminus of a branch of the Great Western Railway. It is 22 miles S. of Oxford and 35 W. from London by rail, and 47 miles from Oxford and 64½ from London by the river. It occupies one of the most beautiful situations on the Thames, at the foot of the finely wooded Chiltern Hills. The river is crossed by an elegant stone bridge of five arches, constructed in 1786 at a cost of £10,000. The principal buildings are the parish church, a handsome Gothic structure recently restored at a cost of over £7000, possessing a lofty tower of intermingled flint and stone, which is attributed to Cardinal Wolsey, but which was more probably erected by Bishop Longland; the grammar school, founded in 1605; the town-hall, a neat building supported by Doric columns; the reading room and library and various charitable institutions. Henley is a favorite summer resort, and also possesses some trade in corn, flour, malt, and timber. It is celebrated for the Henley Royal Regatta, the principal gathering of amateur oarsmen in England, which usually takes place in July. The population of the parish in 1901 was 5,984,

Henley existed at a very early period, and according to some authorities was a Roman station. It obtained a charter of incorporation from Elizabeth, in which it is named *Hanleygang* or *Hanneburg*. In 1643 it was occupied by the Parliamentary forces, who successfully repelled an attack made upon them by the Royalists.

See *History of Henley-on-Thames*, by John Southerden Burns, London, 1861, and *An Account of the Races at the Annual Henley Regattas from their commencement, June, 1839, to the year 1879*, Henley, 1879.

HENNA is the Persian name for a small shrub found in the East Indies, Persia, the Levant, and along the African coasts of the Mediterranean, where it is frequently cultivated. It is the *Lawsonia alba* of botanists, and from the fact that young trees are spineless, while older ones have the branchlets hardened into spines, it has also received the names of *Lawsonia inermis*, and *L. spinosa*. It forms a slender shrubby plant of from 8 to 10 feet high, furnished with opposite oval-lanceshaped smooth leaves, which are entire at the margins, and bears small white four-petalled sweet-scented flowers disposed in panicles. The four spreading petals are obovate, and furnished with claws; and alternating with them are eight stamens approximating by pairs. Its Egyptian name is *Khenna*, its Arabic name *Al Khanna*, its Indian name *Mendee*, while in England it is called *Egyptian privet*, and in the West Indies, where it is naturalized, *Jamaica mignonette*.

Henna or Henné is of ancient repute as a cosmetic. This consists of the leaves of the *Lawsonia* powdered and made up into a paste; this is employed by the Egyptian women, and also by the Mahometan women in India, to dye their finger nails and other parts of their hands and feet of an orange-red color, which is considered to add to their beauty. The color lasts for three or four weeks, when it requires to be renewed. It is moreover used for dyeing the hair and beard, and even the manes of horses; and the same material is employed for dyeing skins and morocco-leather a reddish-yellow, but it contains no tannin. The practice of dyeing the nails was common amongst the Egyptians, and not to conform to it would have been considered indecent. It has descended from very remote ages, as is proved by the evidence afforded by Egyptian mummies, the nails of which are most commonly stained of a reddish hue. Henna is also said to have been held in repute amongst the Hebrews, being considered to be the plant referred to as camphire in the Bible (Song of Solomon i. 14; iv. 13). "The custom of dyeing the nails and palms of the hands and soles of the feet of an iron-rust color with henna," observes Dr. Royle, "exists throughout the East from the Mediterranean to the Ganges, as well as in Northern Africa. In some parts the practice is not confined to women and children, but is also followed by men, especially in Persia. In dyeing the beard the hair is turned to red by this application, which is then changed to black by a preparation of indigo. In dyeing the hair of children, and the tails and manes of horses and asses, the process is allowed to stop at the red color which the henna produces." Mahomet, it is said, used henna as a dye for his beard, and the fashion was adopted by the caliphs. "The use of henna," remarks Lady Callcott in her *Scripture Herbal*, "is scarcely to be called a caprice in the East. There is a quality in the drug which gently restrains perspiration in the hands and feet, and produces an agreeable coolness equally conducive to health and comfort." She further suggests that if the Jewish women were not in the habit of using this dye before the time of Solomon, it might probably have been introduced amongst them by his wife, the daughter of

Pharaoh, and traces to this probability the allusion to "camphire" in the passages in Canticles above referred to.

The preparation of henna consists in reducing the leaves and young twigs to a fine powder, catechu or lucerne leaves in a pulverized state being sometimes mixed with them. When required for use, the powder is made into a pasty mass with hot water, and is then spread upon the part to be dyed, where it is generally allowed to remain for one night.

It has been already noted that the flowers of the *Lawsonia* are very fragrant, whence they derive in the West Indies the name of Jamaica mignonette. According to Lady Callcott, they are often used by the eastern women to adorn their hair; and Mr. Simmonds states that the distilled water from the flowers is used as a perfume. The plant is further credited with the possession of vulnerary and astringent properties.

HENNEBONT, a town of France, arrondissement of Lorient, and department of Morbihan, is situated on the Blavet, not far from its mouth, and 25 miles W. N. W. of Vannes. It is a picturesque old town, and contains some remains of its former fortifications. The church of Notre Dame de Paradis, a beautiful building of the 16th century, possesses some fine wood carving. The town has an important corn-market, and considerable shipping trade in iron, corn, honey, wax, hemp, cider, and wine. Shipbuilding, sawing, and tanning are also carried on. Hennebont is famed for the resistance which it made, under the widow of John de Montfort, when besieged by the armies of Philip of Valois and Charles of Blois. The population in 1901 was 6.232.

HENNEQUIN, Philippe Auguste (1763–1833), French painter, was a pupil of David. He was born at Lyons in 1763, distinguished himself early by winning the "grand prix," and left France for Italy. The disturbances at Rome, during the course of the Revolution, obliged him to return to Paris, where he executed the Federation of the 14th of July, and visiting his native town was at work there on a large design commissioned for the town-hall, when in July, 1794, he was accused before the revolutionary tribunal and thrown into prison. Hennequin escaped, only to be anew accused and imprisoned in Paris, and after running great danger of death, seems to have devoted himself thenceforth wholly to his profession. At Paris he finished the picture ordered for the municipality of Lyons, and in 1801 produced his chief work, Orestes pursued by the Furies (Louvre, engraved by Landon, *Annales du Musée*, vol. i. p. 105). He was one of the four painters who competed when in 1802 Gros carried off the official prize for a picture of the Battle of Nazareth, and in 1808 Napoleon himself ordered Hennequin to illustrate a series of scenes from his German campaigns, and commanded that his picture of the Death of General Salomon should be engraved. After 1815 Hennequin retired to Liége, and there, aided by subventions from the Government, carried out a large historical picture of the Death of the Three Hundred in defence of Liége—a sketch of which he himself engraved. In 1824 Hennequin settled at Tournay, and became director of the academy; he exhibited various works at Lille in the following year, and continued to produce actively up to the day of his death, which took place in May, 1833. The Orestes of the Louvre is his capital work; it shows a certain style and finish of draughtsmanship, but the attitudes are melodramatic, the composition stagey, and the color false and violent.

HENNERSDORF, or Seifhennersdorf, a manufacturing village of Saxony, in the circle of Bautzen, and 20 miles S. S. E. of the town of that name. The inhabitants are engaged in weaving and bleaching, and in the manufacture of woollen goods, satin, arnotto, machinery, bricks, and wooden shoes. There is also an iron foundry. Population in 19 5 7,999.

HENRIETTA MARIA (1609–1666), queen of Charles I. of England, born November 25, 1609, was the daughter of Henry IV. of France. When the first overtures for her hand were made on behalf of Charles, prince of Wales, in the spring of 1624, she was little more than fourteen years of age. Her brother, Louis XIII., only consented to the marriage on the condition that the English Roman Catholics were relieved from the operation of the penal laws. When therefore she set out for her new home in June, 1625, she had already pledged the husband to whom she had been married by proxy on May 1 to a course of action which was certain to bring unpopularity on him as well as upon herself.

That husband was now king of England. The early years of the married life of Charles I. were most unhappy. He soon found an excuse for breaking his promise to relieve the English Catholics. His young wife was deeply offended by treatment which she naturally regarded as unhandsome. The favorite Buckingham stirred the flames of his master's discontent. Charles in vain strove to reduce her to tame submission. After the assassination of Buckingham in 1628 the barrier between the married pair was broken down, and the bond of affection which from that moment united them was never loosened.

For some years Henrietta Maria's chief interests lay in her young family, and in the amusements of a gay and brilliant court. She loved to be present at dramatic entertainments, and her participation in the private rehearsals of the *Shepherd's Pastoral*, written by her favorite Walter Montague, probably drew down upon her the savage attack of Prynne. With political matters she hardly meddled as yet. Even her co-religionists found little aid from her till the summer of 1637. She had then recently opened a diplomatic communication with the see of Rome. She appointed an agent to reside at Rome, and a papal agent, a Scotchman named Con, accredited to her, was soon engaged in effecting conversions amongst the English gentry and nobility. Henrietta Maria was well pleased to become a patroness of so holy a work, especially as she was not asked to take any personal trouble in the matter. Protestant England took alarm at the proceedings of a queen who associated herself so closely with the doings of "the grim wolf with privy paw."

When the Scottish troubles broke out, she raised money from her fellow Catholics to support the king's army on the borders in 1639. During the session of the Short Parliament in the spring of 1640, the queen urged the king to oppose himself to the House of Commons in defence of the Catholics. When the Long Parliament met, the Catholics were believed to be the authors and agents of every arbitrary scheme which was supposed to have entered into the plans of Strafford or Laud. Before the Long Parliament had sat for two months, the queen was urging upon the pope the duty of lending money to enable her to restore her husband's authority. She threw herself heart and soul into the schemes for rescuing Strafford and coercing the parliament. The army plot, the scheme for using Scotland against England, and the attempt upon the five members were the fruits of her political activity.

In the next year the queen effected her passage to the Continent. In February, 1643, she landed at Burlington Quay, placed herself at the head of a force of loyalists, and marched through England to join the king near Oxford. After little more than a year's residence there, on April 3, 1644, she left her husband to see his face no more. At Exeter she gave birth to her youngest child, who was one day to be duchess of Orleans, and to negotiate the treaty of Dover. Henrietta Maria found a refuge in France. Richelieu was dead and Anne of Austria was compassionate. As long as her husband was alive the queen never ceased to encourage him to resistance.

During her exile in France she had much to suffer. Her husband's execution in 1649 was a terrible blow. She brought up her youngest child Henrietta in her own faith, but her efforts to induce her youngest son, the duke of Gloucester, to take the same course only produced discomfort in the exiled family. The story of her marriage with her attached servant Lord Jermyn needs more confirmation than it has yet received to be accepted, but all the information which has reached us of her relations with her children points to the estrangement which had grown up between them. When after the Restoration she returned to England, she found that she had no place in the new world. She received from parliament a grant of £30,000 a year in compensation for the loss of her dower-lands, and the king added a similar sum as a pension for himself. In January, 1661, she returned to France to be present at the marriage of her daughter Henrietta to the duke of Orleans. In July, 1662, she set out again for England, and took up her residence once more at Somerset House. Her health failed her, and on June 24, 1665, she departed in search of the clearer air of her native country. She died on August 31, 1666, at Colombe, not far from Paris.

Kings of England.

HENRY I. (1068–1135), king of England, fourth and youngest son of William the Conqueror and Matilda of Flanders, was born some time in the autumn of 1068. Local tradition fixes his birthplace at Selby in Yorkshire. Little is known of his earlier life, except that he received an unusually good education, and attained a proficiency rare among the princes of his day. In 1086 he was dubbed knight. Next year his father bequeathed to him on his deathbed a sum of five thousand pounds, and is said to have foretold that he would eventually be king. Condemned, by the division of the Conqueror's territories, to a position of inferiority to his two brothers, he used his legacy to improve that position. Robert, being in need of money, sold him the districts of the Côtentin and the Avranchin, which he held of his brother as a fief. His relations with Robert were not always friendly, but he defended Normandy against Rufus, and aided his liege lord in putting down a revolt in Rouen. Nevertheless, in the treaty between William and Robert made in 1091, he was excluded from the succession, and soon afterwards was deprived of his lands in Normandy.

The treatment he met with from Robert was not likely to make him support the terms of the treaty of 1091. Immediately after the death of Rufus, he rode to Winchester, and seized the royal hoard in that city. Next day (August 3, 1101) he was elected king by such of the witan as were present, and on Sunday, August 5th, he was crowned at Westminster. In order to conciliate the clergy and the nation, he recalled Anselm, imprisoned Ranulf Flambard, and issued a comprehensive charter of liberties. Before the year was out he married Matilda, daughter of Malcolm and Margaret, and great-granddaughter of Edmund Ironside, a step which greatly strengthened his otherwise insecure title to the crown. The alliance thus contracted with the church and the nation was his constant support in the struggle with his brother and his unruly vassals, which began immediately. It resulted in the conquest of Normandy, the temporary suppression of feudalism, and the consolidation of royal power on both sides of the Channel. Robert, as soon as he returned from the Holy Land, attempted with the aid of a conspiracy in England to wrest the crown from the usurper. He landed at Portsmouth (August 1, 1101), but before a blow was struck the brothers came to terms. Robert recognized Henry as king of England, and returned to Normandy. Henry's vengeance fell upon his brother's partisans, and Robert of Belesme and several others were banished from the country and lost their English estates. Secure in England, Henry carried the war into the enemy's country. His brother's misgovernment gave him both pretext and opportunity. After two or three expeditions, the struggle was brought to a close by the battle of Tenchebrai (September 28, 1106), in which Robert was taken prisoner. He remained in captivity till his death in 1134, and Normandy passed into the possession of the English king. This conquest at once brought Henry into collision with France. Louis the Fat was a constant supporter of Henry's rebellious vassals, and of his rival and nephew, William, son of Robert. Henceforward Henry had to spend most of his time in the duchy. A war with France (1111–1113) ended in a peace which brought some advantages to Henry. Louis gave up his claim to the sovereignty of Maine and Brittany, and Henry was able to carry his old opponent, Robert of Belesme, to England, where he was imprisoned for the rest of his life. Henry had already, though in vain, attempted to secure the aid of Flanders by two treaties with Count Robert (1103, 1108). He now sought a mightier ally in the emperor Henry V., to whom he married his daughter Matilda (January 7, 1114). Another war with France, which broke out in 1116, and in which Louis took up the cause of William, son of Robert, against his uncle, was marked by the battle of Noyon (1119). At a council at Rheims (1119) Louis accused Henry before Pope Calixtus of rebellion and usurpation. Henry, however, pleaded his own cause before the pope at Gisors so persuasively that Calixtus brought about a peace between the two kings (1120) on the basis of a mutual restoration of conquests. During the war Henry had suffered a severe loss in the death of his queen Matilda. He now felt it more than ever necessary to take measures for securing the succession to his only son William. The baronage of Normandy and England were made to do homage to the young prince (1119), who shortly afterwards married Matilda, daughter of Fulk of Anjou, an alliance by which Henry hoped to turn a dangerous foe into a firm friend, and to secure at least the chance of a rich inheritance. All these hopes were, however, shattered by the death of William (1120). Deprived of an heir to his throne, Henry now married Adeliza, daughter of Godfrey, count of Louvain (1121), but the marriage unfortunately proved childless. Shortly afterwards another rebellion, headed by Count Waleran of Meulan, broke out in Normandy (1123). The rebels were emboldened by the assistance of the king of France and the count of Anjou, but were entirely defeated at Bourgtheroulde (1124). The terrible vengeance taken by Henry on this occasion, together with the death of William, son of Robert, in 1128, seems to have finally crushed the opposition in Normandy. The death of Duke Robert in 1134 removed the last object round which the schemes of rebellion or the intrigues of France could centre. Meanwhile Henry had recalled his daughter Matilda, now a widow, from Germany. In default of an heir to the throne, he made the witan swear to accept her as Lady of England and Normandy (Christmas, 1126). Next year he gave her in marriage to Geoffrey, son of Fulk, count of Anjou, hoping thereby to secure the objects frustrated by the death of his son. Fate, however, thwarted the immediate success of these schemes.

The annals of England, after the expulsion of Robert of Belesme, are uneventful. In his ecclesiastical policy Henry, without giving up the control over the church which his father had asserted, was forced to recognize to a certain extent the advancing claims of Rome. His dispute with Anselm was conducted with good temper on both sides, and was brought to a satisfactory conclusion. Anselm had made no objection to the ecclesiastical supremacy claimed by Rufus, but the decrees of the Lateran Council (1099) obliged him to resist a similar claim when put forward by Henry I. He refused to do homage to his new king, or to consecrate the bishops whom Henry invested, according to ancient custom, with the symbols of ecclesiastical dignity. Neither side would give way. Henry continued to make bishops as before, and Anselm refused to consecrate them. In 1103 he left England. For the next three years the affairs of Normandy hindered the settlement of the question, but a compromise was effected in 1107. The pope, Paschal II., consented that homage should be done to the king, while Henry gave up his claim to investiture with the ring and staff. The question thus settled was not reopened till the days of Becket. In other respects Henry acquiesced in the tendency of the time towards ecclesiastical separatism, and countenanced the decrees of the synod of 1102, which forbade the marriage of the clergy and the tenure of temporal offices by ecclesiastics. He showed his care for the church by the establishment of two new sees, those of Ely (1109) and Carlisle (1133), taken respectively from the unwieldy dioceses of Lincoln and York. In the old quarrel between York and Canterbury, Henry supported the claims of the southern metropolitan against Archbishop Thurstan. On Anselm's death, Henry was guilty of leaving the see vacant for five years, but in his other dealings with the church he seems to have been actuated by worthy motives. He refused, however, to open her high places to Englishmen, and till near the end of his reign no native attained the dignity of prelate. The same exclusive spirit made itself felt in the appointments to temporal office. But although political liberty and influence were not granted to Englishmen under Henry I., the English nation as a whole acquiesced gladly in his rule. Its chief wants were justice and order, and protection from feudal tyranny; and these blessings it obtained. The necessities of his position compelled Henry to rely mainly on his English subjects. As a counterpoise to the local influence of the baronage, he did his best to restore to activity the old popular institutions of the hundred and the county-court, of tithings and frankpledge, of watch and ward. His frequent progresses through the country, for judicial and other purposes, form a link between the annual courts held by the Conqueror and the regular circuits of the justices established by Henry II. In the administration of justice and the toils of government he relied on new men, raised from the ranks and dependent on himself for their position. The older baronage he habitually depressed, and every unsuccessful rebellion thinned the ranks of the feudal nobility, while it tightened the link between the king and the nation.

Thus secure at home, Henry was dreaded by his neighbors within the four seas. Over Scotland, Ireland, and

Wales a sort of ecclesiastical supremacy was recognized. On the northern frontier there was peace throughout the reign; on the western there was more disturbance. Henry settled a colony of Flemings in Pembroke (1111), and made two expeditions into Wales (1114, 1121), in one of which he received the submission of several Welsh princes. The profound peace which England enjoyed for a period of thirty-four years is the best testimony to Henry's merits as a king. As a man his character is not admirable, nor yet wholly to be condemned. He was hard, merciless, and unforgiving, but not wantonly cruel. He sometimes displayed a grim humor which reminds one of his father; but he never gave way to the vices and brutality of Rufus, nor to the jovial good-humor which was so winning in his eldest brother. Regarded as the "Lion of Justice" by his people, and bitterly regretted after he was gone, he was not a popular king. He died, after bequeathing his crown to his daughter Matilda, near Rouen (December 1, 1135). His body was carried to England, and buried in the abbey he had founded at Reading.

The following *general authorities* may be consulted for this and the next five reigns here noticed:—*Statutes of the Realm;* Rymer's *Fœdera;* the *Pipe-Rolls, Rotuli Cartarum, Rotuli Litterarum Pat.* and *Claus.*, etc. (ed. Hardy); Lappenberg and Pauli, *Geschichte von England;* Stubbs, *Constitutional History of England;* Stubbs, *Documents illustrative of English History* (for Henry I., II., III.); Lingard, *History of England;* Green, *History of the English People.*

For this reign, *original authorities*:—*Anglo-Saxon Chronicle;* Florence of Worcester, *Chronicon ex Chronicis*, with its *continuation;* Simeon of Durham, *De Regibus Anglorum*, etc.; Ordericus Vitalis, *Historia Ecclesiastica;* William of Malmesbury, *Gesta Pontificum Anglorum, Gesta Regum Anglorum*, and *Historia Novella;* Eadmer, *Vita Anselmi* and *Historia Novorum;* Robert du Mont, *Chronica*, and *continuation* of William of Jumiéges; the *Magnus Rotulus Scaccarii*, 1131 A. D. (ed. Hunter).

Modern authorities.—Freeman, *History of the Norman Conquest*, vol. v.; Church, *Life of Anselm;* Palgrave, *History of Normandy and England.* (G. W. P.)

HENRY II. (1133–1189), king of England, son of Geoffrey, count of Anjou, and Matilda, daughter of Henry I., was born at Le Mans, March 5, 1133. He was left in France during the first part of his mother's struggle with Stephen, but was sent over to England in 1141. There he remained four years, in the charge of his uncle, Robert of Gloucester. In 1147 he took a more active part in the war, but was not successful. He now sought the aid of David, king of Scotland, and was knighted by him (1149), but nothing came of the alliance with that prince. On his return to Normandy (1151), Louis VII. conferred the duchy upon him, and later in the year he became, by his father's death, count of Anjou. In 1152 he married Eleanor of Aquitaine, and added Poitou and Guienne to his dominions. He again went to England in 1153, and the great position he had won on the Continent turned the scale in his favor. After a short struggle Stephen consented to negotiate. By the treaty of Winchester (November 7, 1153) it was settled, among other things, that Stephen should reign undisturbed during the rest of his life, and that Henry should succeed him. A year later Stephen died, and Henry took quiet possession of the throne. He was crowned on December 19, 1154, and at once issued a charter of liberties, in which he confirmed the charter of Henry I.

His reign falls into three main periods. During the first Henry was occupied in restoring and maintaining order. The second is that of the quarrel with Becket. The third is for the most part a period of rebellion and trouble, the consequences of that quarrel. Henry's first business was to fulfil the promises made in the treaty of Winchester, and to undo the work of his predecessor. Several of Stephen's earldoms were abolished, new sheriffs were appointed, the adulterine castles destroyed, the royal domains recovered. In this task the king met with little serious opposition, and his presence generally sufficed to ensure success. In 1156 Henry was able to go to France, where his brother Geoffrey was causing trouble by his claims on Anjou. He had to subdue him by force of arms, after which he allowed him to be chosen count of Nantes. He then exacted homage from his Continental vassals, and himself did homage to Louis VII. At Easter, 1157, he returned to England, to complete the restoration of order there. Those of the great barons who had not yet given up their castles had now to do so, and the king of Scotland surrendered the three northern counties. An unsuccessful expedition to Wales followed. In 1158, on his brother Geoffrey's death, Henry secured his inheritance. At the same time he betrothed his second son Henry (the eldest, William, being dead) to Margaret, daughter of Louis. Next year he made an attack upon Toulouse, which he claimed in right of his wife, but after some successes retired, owing to the opposition of the French king. In a peace made soon after, he retained Cahors, but gave up his claim to the rest of the county. Hostilities between him and Louis were, however, more or less continuous during this time, in spite of the efforts of Alexander III. In January, 1163, Henry returned to England after five years' absence, and his quarrel with Becket immediately began.

Becket had been consecrated archbishop of Canterbury in June, 1162. He at once resigned his temporal offices, and demanded the restitution of lands alienated from his see. At a council at Woodstock he refused to pay the tax of two shillings per hide demanded by the king. A little later the struggle was removed to still more dangerous ground. Becket refused his consent to the king's proposal for settling the dispute between the temporal and spiritual courts. Upon this Henry asked him and the bishops whether they would abide by the ancient customs of the realm. So vague a question met with an evasive answer. The bishops would only consent "saving their order." However, at the council of Clarendon (January, 1164) the disputed customs were drawn up in the form of sixteen constitutions, and after considerable hesitation accepted by Becket. He nevertheless got absolution from the pope, who refused to confirm the constitutions. Henry now attacked Becket with a series of charges connected with his chancellorship, the result of which the latter evaded by leaving England. Henry took possession of the see, and expelled Becket's friends and relations. The greater part of the next five years he spent abroad. During this time he was occupied in maintaining order among his unruly vassals, checking the intrigues of Louis, and negotiating with the pope. He also obtained possession of Brittany for his son Geoffrey, and betrothed Richard to Alice, daughter of Louis. With the object of securing the succession he had his son Henry crowned by the archbishop of York at Westminster (June, 1170). The young king's wife was not crowned with him. Louis, taking this as an insult, invaded Normandy, and only made peace with Henry on condition that he would restore Becket to favor. A meeting between the king and the archbishop ended in a compromise, and the latter returned to England. His first step was to suspend the archbishop of York and other bishops who had taken part in the coronation of the young king, and Henry, on hearing of this, uttered the angry words that led to Becket's murder. The pope was, however, in too critical a position to quarrel seriously with Henry. Negotiations between them ended in a meeting with the legates at Avranches (1172), in which Henry received absolution, and promised to abolish all the bad customs introduced during his reign. He had employed the interval in making an expedition to Ireland, and appropriating the conquests made by Strongbow a few years before.

The ecclesiastical quarrel seemed to have died away, but its consequences were felt in the great rebellion of 1173. A confederacy was organized by the French king, the count of Flanders, the king of Scotland, and Henry's sons, with the object of placing the young Henry on his father's throne. The first campaign was indecisive, but on the whole favorable to the king. In view of a general attack which was to be made next year, Henry crossed over to England and did penance at Becket's tomb. Fortunately his justiciar, De Lucy, captured the Scotch king at Alnwick, and the rebellion in England was speedily put down. William the Lion was forced to buy his release by doing homage to Henry; the other confederates made peace; and Henry was left stronger than ever. He at once proceeded to secure his position by further legislative enactments, and henceforward he had no trouble in England. But he was involved in constant difficulties with his sons and with the French king, owing to the mutual jealousies of the former and the intrigues of the latter, to which Henry's partiality for his youngest son John and his refusal to allow the marriage of Richard and Alice gave rise. A war between the brothers in 1183 was brought to an end by the death

of the young Henry in the same year. The feud broke out again in 1184, and continued at intervals, in spite of the death of Geoffrey in 1186, to the end of the reign. At length Henry's apparent intention to name John as his successor forced Richard to ally himself with Philip II., and in the war that followed Henry was beaten at all points. He was forced to make a disgraceful peace, the terms of which, together with the discovery that John was among his enemies, broke his heart. He died at Chinon, July 6, 1189, and was buried at Fontevraud.

Henry's legislative activity, which was great and constant, deserves special notice. His aim was the consolidation of royal power by means of a centralized system of justice and administration. The Constitutions of Clarendon were an essential part of this scheme, designed to bring the clergy, as well as other classes of the nation, under the rule of law, and to prevent an ecclesiastical "imperium in imperio." Other enactments, as the Assize of Clarendon (1166), were intended to perfect the judicial system and to supersede the baronial by the royal courts. The system of recognition by jury took the place of trial by battle. The grand jury was organized for the presentment of criminals for trial. The jury system was further employed for the inquiry into the conduct of the sheriffs (1170), and for the assessment of the Saladin tithe (1188). The circuits of the justices itinerant were, after repeated experiments, brought to something like perfection, and a high court of justice formed out of the Curia Regis, which was the origin of the Court of King's Bench. By the commutation of feudal service for scutage, and by the Assize of Arms (1181), which revived the national militia, Henry made himself independent of the baronage, and formed that alliance between king and people which was the surest basis of his power. Whatever may be said against his private character, the wisdom and steadiness with which he pursued these aims, and the permanence of the mark that he left upon the constitution, secure him the title of a great king.

Original authorities.—William of Newbury, *Historia Rerum Anglicarum;* Ralph de Diceto, *Imagines Historiarum;* Gervase of Canterbury, *Chronica*, etc.; *Chronicle* of Benedict of Peterborough (so called); Roger of Hoveden, *Annales Angliæ;* Jordan Fantosme, *Histoire de la Guerre*, etc.; Giraldus Cambrensis, *Expugnatio Hiberniæ, Itinerarium Cambriæ*, etc.; Ralph Glanvill, *Tractatus de Legibus*, etc.; Walter Map, *De Nugis Curialium*, etc.; *Letters* and *Lives* of Becket (ed. Giles); Robert du Mont, *Chronica; Dialogus de Scaccario;* the *Pipe-Rolls.*

Modern authorities.—Stubbs, *Prefaces* to Benedict of Peterborough and Roger of Hoveden; Robertson's *Life of Becket;* Eyton's *Itinerary of Henry II.* (G. W. P.)

HENRY III. (1207–1272), king of England, eldest son of John and Isabella, was born on October 1, 1207, and was just nine years old on his father's death. Ten days after that event he was crowned at Gloucester (October 28, 1216). His long reign falls into four periods,—that of the regency, ending with the fall of De Burg; that of government by favorites, which led to the Mad Parliament; the period of the Barons' War; and the short period between the close of the war and Henry's death. At his accession the whole country was in rebellion, and Louis with his Frenchmen held the east and south. In this crisis it was fortunate that the government fell into the hands of such a man as William Marshall, and that the pope gave him all the assistance in his power. The acceptance of the charter at once recalled many to their allegiance, and the defeat and retirement of Louis broke up the opposition. The charter was confirmed (1217) and order rapidly restored. The legate Gualo aided the earl marshal and Archbishop Langton in the work. On Marshall's death (1219) Pandulf took Gualo's place, and asserted the papal authority in a way which obliged Langton to make a personal protest at Rome. Pandulf was recalled, and Hubert de Burg, the justiciar, ruled with Langton till the latter's death (1228), and alone afterwards. The influence of Peter des Roches, bishop of Winchester, the head of the foreign party and guardian of the king's person, was successfully resisted. Meanwhile a last outbreak of pure feudalism under Falkes de Breauté was put down, and the charter again issued in its final shape (1227). But the worst plague of the reign, the influence of foreign favorites, had already made itself felt, while another great evil, the financial exactions of Rome, was causing much discontent. An expedition to Poitou, opposed by De Burg, caused the first quarrel between him and the king. Shortly afterwards Peter des Roches returned from a temporary banishment, and gained such influence over Henry that he dismissed De Burg with insult and ingratitude (1232). From this point his real reign may be said to have begun.

The bad promise of his youth was amply redeemed in the events of the next twenty-six years. Under the influence of Peter des Roches, foreigners began to flock to the court, and even foreign mercenaries were introduced into England. Richard, earl marshal, who openly rebuked the king for this conduct, was outlawed, but other barons took up his cause, and collisions between them and the king's troops took place. Civil war appeared imminent, when Archbishop Edmund persuaded Henry to dismiss Peter des Roches, and the danger was avoided for the time (1234). But the king's partiality for foreigners was a constant source of discontent. In 1236 he married Eleanor of Provence. Two uncles of the queen, William, bishop of Valence, and Peter of Savoy, came over with her, and were immediately placed in positions of honor and emolument. In 1238 Henry married his sister Eleanor to Simon de Montfort, an event which nearly produced an outbreak. Resistance already centred in the Great Council, which in 1236 had declined "to change the laws of England," and supported the bishop of Chichester in his refusal to give up the great seal at the king's demand. Henry's personal extravagance caused him much embarrassment, and the extortions of the papal see pressed heavily on the church. In 1242 the barons refused to give the aid demanded by the king for another expedition to Poitou, and when they met again after his return, they joined with the clergy in a general protest against his misgovernment (1244). In order to remedy this state of things, it was proposed that the king's advisers should be chosen by the parliament, as it now began to be called, but Henry found means of evading the demand. Hitherto his brother Richard, earl of Cornwall, had been the leader of the opposition, but Simon de Montfort, earl of Leicester, was now becoming the centre of constitutional resistance. In 1246 the king's step-father, the count of La Marche, died, and Henry's half-brothers came to England, bringing with them a fresh crowd of hungry followers. The demands made upon the great cities, especially London, upon the Jews, and upon the clergy, to meet the expenses caused by the king's favorites, were constantly on the increase. Owing to the cessation of the office of justiciar since the fall of De Burg, the judicial system was falling into decay, and crime of all kinds was rampant. At the same time the pope, engaged in his great struggle with Frederick II., regarded England as an "inexhaustible spring of wealth," and redoubled his demands. He won over most of the bishops by supporting them in their claim to inspect the monastic houses in their dioceses, and the church, deprived of its natural head,—for Boniface, an uncle of the queen, was archbishop of Canterbury,—was disunited and helpless. Grosseteste, bishop of Lincoln, was almost alone in his efforts to follow in the steps of Stephen Langton. He and De Montfort were at one in their desire for reform, but the nation was not yet ready. Two mistakes on the part of Henry brought matters to a crisis. He had conferred the government of Gascony on De Montfort in 1248, and the latter had reduced the province to obedience. But accusations made against him found ready audience with the king, who feared and disliked his brother-in-law. The result was a bitter quarrel (1252), which Henry followed up by superseding De Montfort in his government, and sending his eldest son Edward to take his place. This had the effect of throwing the earl once for all into the arms of the national party. A little later an event occurred which forced that party to take active measures. The pope persuaded Henry to accept the kingdom of Sicily for his second son Edmund, and to bind himself to pay the expenses of its conquest, together with a large debt already incurred (1255). This important scheme was entered into without the knowledge of the parliament, and the nation suddenly found itself pledged to an undertaking which had purely dynastic or papal objects. The coalition of pope and king produced a corresponding union of the church and the baronage, and the troubles of the year 1257, Scotch and Welsh inroads, together with a failure of the harvest, united the nation against the Government.

A parliament which met at Westminster (April, 1258) forced Henry to promise reform, and elected a committee of twenty-four to act for the king till a complete scheme could be drawn up. On June 11th the assembly called afterwards the Mad Parliament, met at Oxford. A coun-

cil of fifteen, of whom two-thirds were on the baronial side, was appointed, who, together with twelve representatives of the "community," were to take charge of the government and meet in parliament thrice a year. Hugh Bigod was named justiciar, other offices were filled up, the castles were entrusted to Englishmen, and four knights were summoned from each county to declare grievances. These reforms, together with certain general enactments, went by the name of the Provisions of Oxford. The king's authority was completely superseded, and the rule of a baronial oligarchy established. Next year, owing to the demands of the knighthood, who felt themselves neglected, a further series of Provisions was issued. The Sicilian project was formally repudiated, and a final peace made with France, in which the claim of Normandy and other districts was renounced. But beyond this the baronial Government did nothing. The nation testified its disappointment, and a quarrel took place between the earls of Leicester and Gloucester which divided the baronial party. The king took advantage of this state of affairs, and in 1261 obtained absolution from the Provisions at the hands of the pope. He then fortified the Tower, deposed the baronial justiciar, and soon began to rule as before. In this crisis the baronial party made a bid for popular favor by summoning representatives of the counties to a parliament, but the reaction was for the time complete, and Henry had leisure to go to France in order to win over Louis IX. to his side. In 1263 hostilities broke out on the Welsh border, and the barons seized the opportunity to renew their attack on the king. After some months of desultory warfare, it was agreed to submit to the arbitration of Louis. That king, in the Mise of Amiens, decided in favor of Henry, and annulled the Provisions. Leicester at once appealed to arms. The battle of Lewes (May 14, 1264) was a complete victory for him, and put the king and his eldest son into his hands. For a time he was master of the country, but the party he headed was not that which had been dominant six years before, and Henry now had many adherents among the greater barons. Nevertheless, for more than a year he remained practically a prisoner in the hands of De Montfort. At a parliament which met in June, 1264, and at which knights of the shire were certainly present, a constitution was drawn up, which, while preserving to the king a high position as head of the executive, placed supreme power in the hands of the "community." Early next year, in a parliament to which members from the boroughs as well as from the counties were summoned, this constitution was confirmed, and Henry swore to observe it. In accordance with the settlement made at Lewes, Edward was now to be released. His father was already supposed to be at liberty, but in reality both he and Edward were kept in restraint. Edward's escape (May, 1265) caused an immediate renewal of the war, and at the battle of Evesham (August 4, 1265) De Montfort was killed and Henry set free. Two years later the war was practically concluded by the capture of Kenilworth. Henry had little to do with the conduct of the war, and acquiesced in the arrangements made by his son for the pacification of the country. His triumph, was, however, complete, and for the rest of his reign the kingdom was at peace. He died on November 16, 1272, leaving behind him the memory of one whose virtues were of the priestly kind, and whose worst vices were those of indulgence, ill-temper, and prodigality. As a subject he would have been harmless, and even perhaps respectable; as a king he was weak, hasty, imprudent, equally incapable in the position of a ruler, an administrator, or a general.

Original authorities.—Roger of Wendover, *Flores Historiarum;* Matthew Paris, *Historia Major* (with its *Additamenta*), and *Historia Minor;* William Rishanger, *Continuation* of Matt. Paris, and *De duobus Bellis*, etc.; the *Annals* of Burton, Dunstable, Tewkesbury, Waverley, Melrose, and other places; Thomas Wikes, *Chronicon;* Nicolas Trivet, *Annales;* Walter of Gisburne (or Heminburgh), *Chronicon;* Bracton, *De Legibus Angliæ;* Robert of Gloucester, *Chronicle;* *Royal Letters* (ed. Shirley); *Letters of Grosseteste* (ed. Luard); *Monumenta Franciscana* (ed. Brewer); *Liber de Antiquis Legibus* (Camd. Soc.); *Political Songs* (ed. Wright).

Modern authorities.—Pearson's *History of England*, vol. ii.; Blaauw's *Barons' War;* Prothero's *Life and Times of Simon von Montfort;* Pauli's *Simon de Montfort;* Brewer's *Preface* to *Monum. Franciscana;* Luard's *Preface to Letters of Grosseteste.* (G. W. P.)

HENRY IV. (1366–1413), king of England, only son of John of Gaunt and Blanche, daughter of Henry, duke of Lancaster, was born in 1366. At the age of fifteen he married Mary Bohun, and in 1385 was made earl of Derby. Two years later he was one of the five lords appellant who impeached the earl of Suffolk and others, and took part in the proceedings of the Merciless Parliament. He acquiesced, however, in Richard's return to power, supported the king in his *coup d'état* of 1397, and became duke of Hereford. His quarrel with the duke of Norfolk led to his banishment shortly afterwards, and on his father's death Richard denied him the succession to his title and inheritance (1398). Next year he took advantage of Richard's absence in Ireland to reassert his rights. He landed in Yorkshire, took Bristol, and seized Richard (August 19) near Conway Castle. At a parliament which met on September 30th, he claimed the throne on the ground of his descent from Henry III., the right of conquest, and the necessity of reform. He was accepted by the parliament; Richard was forced to abdicate; and Henry was crowned (October 13, 1399). The last of his three claims gives the explanation of his policy. He had won the favor of the church by pledges in favor of orthodoxy; the circumstances of his accession and the difficulties of his government forced him to make concessions to the House of Commons, which raised that body to a position it did not again attain for more than two centuries. The first part of his reign was occupied with the suppression of the revolts, not only of the defeated party, but also of his own discontented adherents. These troubles were complicated by hostile relations with France, Scotland, and Wales. Charles VI. was inclined to take up the cause of his daughter Isabella, wife of Richard II., and on the death of the latter (February, 1400), demanded her and her dowry back. The duke of Albany in Scotland was hostile to Henry, and Owen Glendower raised a national revolt in Wales. The first attempt at insurrection was made by the earls of Richard's party early in 1400, but their plans were discovered, and their forces crushed piecemeal. Most of the leaders fell victims to popular vengeance. A more serious rebellion was that of the Percies (1403), hitherto Henry's staunchest supporters. Hotspur and his father thought themselves ill requited for their services, and made common cause with Glendower and other malcontents. A junction of the northern army with the Welsh was prevented by the battle of Shrewsbury (July 21, 1403), in which Hotspur was killed. Northumberland submitted and was pardoned. But the danger was not over. The north was still in a state of ferment, the war in Wales went on, and a French fleet ravaged the southern coast with impunity. Henry's vigilance and activity were, however, equal to the task. A plot to carry off the young earl of March (January, 1405) was foiled, and a fresh outbreak in the north was crushed. Scrope, archbishop of York, and Mowbray, earl marshal, who led the rebels, were taken and executed. The king had already got into his power the son of the duke of Albany; he now captured James, the heir-apparent to the Scotch crown, as he was on his way to France; and the murder of the duke of Orleans removed his chief enemy in that country. Thus secured from danger abroad, he put down a final rebellion in the north, drove Glendower back into his mountains, and henceforward had no trouble at home (1408). The late crisis had, however, compelled him to make important concessions to the House of Commons. He promised (1407) to act solely by the advice of a council nominated with their approval, and submitted to the appropriation of his revenue and to other limitations. Throughout his reign he was hampered by want of money, and the regular exercise by parliament of the right to withhold supplies gave that body great control over his actions. He had seized the crown as the champion of orthodoxy. He had therefore to pay for ecclesiastical support by persecuting Lollards against his will, while he did not dare to act upon the suggestion of the Commons that church property should be converted to purposes of state. Thus limited, his foreign policy was not energetic. He had enough to do at first to defend his coasts, and though he afterwards seized the opportunity afforded by civil war to invade France (1411), his efforts were in general confined to strengthening his dynasty by foreign marriages. In his later years he was a confirmed invalid, and had to entrust much power to his eldest son, with whom he was not always on the best of terms. He died on March 20, 1413, and was buried at Canterbury. A cautious, crafty, resolute man, naturally inclined to fair dealing and clemency, but on occasion unscrupulous and cruel, he was successful

in the great enterprise of his life, and has the credit of seeing that the power he had usurped could only maintain itself by resting on a constitutional basis.

HENRY V. (1387–1422), king of England, eldest son of Henry IV. and Mary Bohun, was born August 19, 1387. Early bred to arms, his first military effort was not successful, for at the age of thirteen he commanded an expedition to Wales which was defeated by Glendower. Three years later he was present at the battle of Shrewsbury, and in 1408 he revenged himself on Glendower by driving him back to Snowdon. At the same time his position in the council, at the head of which he appears after 1410, gave him experience in affairs, and proves the confidence already felt in his political ability. The stories of his youthful extravagance and dissoluteness are unfounded, and, as the above facts show, improbable. Although his father appears to have been jealous of his popularity, he was practically at the head of affairs for some years before the death of Henry IV. Three weeks after that event he was crowned (April 9, 1413), and entered upon his inheritance with the good-will of all classes of the nation. So unanimous was the support he met with in parliament that constitutional affairs cease to have any interest during his reign. In his ecclesiastical policy he followed the lines laid down in 1401, with much greater heartiness than his father had shown. His persecution of heretics caused a conspiracy to surprise him and his brothers, which was discovered and put down with some severity (January, 1414). Sir John Oldcastle, the head of the Lollards, was condemned to be burnt, and though he escaped for the time, he was again taken in 1417, and put to death. Henry's orthodoxy brought him into connection with the emperor Sigismund, then engaged in settling the affairs of the church at the council of Constance, and his assistance was very instrumental in the healing of the great schism. But the great work of his life was the conquest of France. It was with this object that he issued a kind of general amnesty on his accession, and appealed to the nation as a whole to support him. War was resolved on by parliament, and Henry laid claim to the French crown. This demand was afterwards reduced to one for all the districts which the English kings had ever held in France. Such claims as these, of course, precluded all negotiation. The expedition was not delayed by a conspiracy to carry off the earl of March, which was discovered before it was ripe, and on August 14, 1415, the English army landed at Havre. Harfleur was soon taken, but the English losses were so great that Henry resolved to retreat to Calais. On October 25th the French army that opposed his march was cut to pieces at Agincourt. The next two years were spent in preparations for continuing the war. In 1417 Henry again invaded France, took Rouen (1419), and with the assistance of the Burgundian party forced Charles VI. to grant his demands. By the treaty of Troyes (1420), it was arranged that he should marry Catherine, take the government in hand at once, and succeed on Charles's death. This disgraceful treaty had, however, the effect of reviving the national party in France, and during Henry's absence in 1421 the English began to lose ground. He hurried back to France, but before he had had time to recover his position, he died at the castle of Vincennes, August 31, 1422. A great soldier, an able politician, a skilful diplomatist, a generous, pure, and high-minded man, he was one of the noblest and most popular of English kings. But these good qualities should not blind one to the fact that he was a religious persecutor, and that he plunged his country into an unjust and hopeless war.

HENRY VI. (1421–1471), king of England, only son of Henry V. and Catherine of France, was born on December 6, 1421, and was therefore only eight months old at his father's death. He can hardly be said ever to have reigned, for his long minority passed into another kind of tutelage, during which the influence of his wife and favorites prepared the way for civil war. Ten years of anarchy culminated in his dethronement, and ten years more of wandering and imprisonment fill the interval between that event and his death. The chief interest of the first thirty years of his life lies in watching the decay of English power in France; that of the last twenty is to be found in the civil wars which resulted from the misgovernment of the preceding period. Although the English had lost some ground towards the end of Henry V.'s reign, their position, when the duke of Bedford undertook the task of continuing his brother's work, was very favorable. They held the north and centre of France, while Burgundy held the eastern districts. The alliance with Duke Philip was strengthened by a marriage between his sister Anne and the duke of Bedford. The Scotch king, James I., was released from captivity, in order that England might be relieved from danger on that side. Thus strengthened, Bedford was able to apply himself vigorously to the conquest of France, towards which the battle of Verneuil (1424) was an important step. But the English cause had already received its first great blow in the marriage of the duke of Gloucester with Jacqueline of Hainault, which destroyed the good understanding between Burgundy and England. Bedford for the time managed to stave off the quarrel, and after renewing his union with Burgundy, laid siege to Orleans, the key of southern France. The capture of the town seemed certain, when the appearance of Joan of Arc turned the scale. The relief of Orleans (1429) was followed by other French successes, and by the coronation of Charles VII. at Rheims. The capture of Joan did little for England, for the spirit she had inspired survived her loss, and her death (May, 1431) only nerved the French to fresh efforts. It was in vain that Bedford had Henry crowned at Paris (December 17, 1431). The young king remained in France nearly two years (April, 1430, to February, 1432), but his presence did not turn the tide of French success. On the side of England the supply of men and money was falling short, while on that of France a new type of commanders was coming to the front, who were not inclined to repeat the disastrous blunders of Crécy and Agincourt. The death of Bedford's wife (November, 1432) broke the link that bound Burgundy to England, and negotiations for peace were set on foot. These culminated in a great congress at Arras (July, 1435), but the demands of the two countries were found incompatible, and the war was renewed. Bedford's death (September 14, 1435) finally destroyed all hope of recovery in France. Burgundy at once made peace with Charles VII., and the English commanders who succeeded Bedford were constantly defeated. Paris was retaken, Normandy overrun. Repeated efforts on the part of England led only to further exhaustion. Meanwhile negotiations for peace had been continued at intervals, and led in 1444 to a truce, during which Henry was married (April 22, 1445) to Margaret, daughter of René of Anjou. It was hoped that this marriage, together with the cession of Anjou and Maine, would lead to a permanent peace, and save Normandy and Guienne. But though Anjou and Maine were actually surrendered in 1448, the truce was broken next year, and before the end of 1450 the whole of Normandy was lost. In 1451 Guienne was reconquered by the French, and in 1453 Calais alone remained to England. The war was practically at an end.

Its conclusion coincides with the period when the two parties that divided England were just about to appeal to arms. The civil war was in great measure the result of the defeats abroad, as those defeats themselves were in part the consequence of discord at home. Quarrels between the chief members of the reigning house were the origin of its weakness; financial embarrassment, a divided foreign policy, and a feeble administration brought disgrace on the king and his advisers; family feuds and a long tale of mutual injuries added bitterness to political differences. Eventually an outburst of popular discontent kindled the train so long prepared, and the champion of order and good government began a struggle in which the original objects were soon lost sight of, and which ended only with the death of the king whose innocent imbecility had caused the disorder. To check the rivalry of Henry's uncle, the duke of Gloucester, and his great-uncle, Cardinal Beaufort, was beyond the power of the council. Bedford alone could appease the quarrel, and Bedford's presence in England meant disaster in France. The quarrel between them and their adherents was complicated by the existence of the Lollards, and the question of peace or war. In both matters Gloucester, as persecutor of the Lollards and head of the war-party, appears to have taken the more popular side. The coronation of the young king at Westminster (November 6, 1429) put a formal end to the regency of Bedford and Gloucester, but not to the intrigues of the latter. The House of Commons was unable to interfere with any effect; the Lords were mostly engaged on one side or the other, The death of Bedford removed the only guarantee of peace, and Gloucester attacked Beaufort with

more virulence than ever after his brother's death. In the midst of these troubles Henry VI. came of age (1442). Had he been a great statesman, he would have found an almost hopeless task before him. But, unfit as he felt himself to be, he naturally shrunk from politics, and was much more intent on completing his foundations at Eton and Cambridge than on healing the disorders of his country. The work of government was left mainly in the hands of Cardinal Beaufort and the earl of Suffolk, who did their best to secure peace with France. On the other side the dukes of Gloucester and York headed the opposition, and took up the cry of reform, with the object of infusing vigor into the government at home and abroad. Suffolk, however, won a great victory in the truce with France (1444); and through the young queen Margaret, whose marriage was chiefly due to his exertions, he obtained complete influence over the king. The suspicious death of Gloucester (1447), followed in six weeks by the death of his rival Beaufort, together with the appointment of York to the governorship of Ireland, left Suffolk master of the situation. But such a position could not be long maintained in the face of the odium which always attaches to a favorite, and the complete failure of his foreign policy brought about his fall (1450). The king in vain attempted to save him, and by so doing shared his unpopularity, while the partial concessions he made to the demands of the rebels under Jack Cade only postponed the inevitable outbreak. The duke of York now made himself the mouthpiece of popular discontent. When the final loss of France had exhausted the country's patience, and the birth of an heir to the throne had destroyed his hope of the succession, he took advantage of Henry's mental derangement to claim the protectorate (1453). It was granted him early next year, but in 1455 the king recovered his senses, and York was deprived of power. Unable to endure this he marched on London, and on May 22, 1455, the Wars of the Roses began in the battle of St. Albans. The effect of the battle was to bring the queen to the front as the leader of the royalists, and to make the quarrel between her and York irreconcilable. During the four years of uneasy quiet which followed the first collision, Henry tried hard to keep the peace. But all his efforts were vain. When the struggle broke out anew, and the Yorkists won the battle of Northampton, he was forced to consent to an arrangement by which his son was excluded from the succession and York recognized as heir to the kingdom (1460). The settlement was of short duration. York himself lost his life at Wakefield, but his son seized the crown and was acknowledged king (March 4, 1461). The battle of Towton brought the struggle to an end for ten years, and the capture of Henry in 1465 seemed to secure Edward IV. on the throne. Five years later a sudden revolution hurled him from it, and restored the wretched prisoner for a while to liberty, but the battle of Barnet destroyed his hopes again. He had time to know that his son had died at Tewkesbury, that his wife was a prisoner, and that his cause was finally lost, before death released him from captivity on May 21, 1471. Gentle, pure, and generous, full of good intentions, enthusiastic in the cause of religion and learning, he was utterly without the qualities which were indispensable to a mediæval king, and he paid the penalty of incapacity in a miserable death and in the destruction of his house. But this very incapacity was an element of the utmost importance in the history of his time. The weakness of his character made him the puppet of contending factions, and his well-meant but misguided efforts to govern England as a constitutional king led only to anarchy and the temporary downfall of the constitution.

Original Authorities for the above three reigns.—Thomas of Walsingham, *Hist. Anglicana*, and *Ypodigma Neustriæ*; *Annales Henrici Quarti*; *Continuatio Eulogii Historiarum*; *Chronique de Waurin*; *Annals of St. Alban's Abbey*, by John of Amundesham and John Whethamstede; *Royal and Historical Letters* (*Henry IV.*); Capgrave's *Chronicle of England*, and *Liber de Illustribus Henricis*; *Memorials of Henry V.* (Redman, etc.); *Letters, etc., illustrative of the reign of Henry VI.*; *Political Poems*. All the above are published in the Rolls series. Also, *Henrici V. Reg. Angl. Gesta* (Eng. Hist. Soc.); lives of Henry V., by T. Livius Forojuliensis and Thomas Elmham (ed. Hearne); *English Chronicle of the reigns of Henry IV.*, etc., and *Letters of Margaret of Anjou*, etc. (both in Camd. Soc.); *Chronicles* of Hardyng, Otterbourne, Adam of Usk, Fabyan, Hall; the *Paston Letters* (ed. Gairdner); *Original Letters illustrative of Eng. Hist.* (ed. Ellis); *Rolls of Parliament; Proceedings, etc., of the Privy Council* (ed. Nicolas).

Modern Authorities.—Besides those already given above, Nicolas's *History of the Battle of Agincourt*; Gairdner's *Preface* to the *Paston Letters*. (G. W. P.)

HENRY VII. (1456–1509), king of England, was the founder of the Tudor dynasty. On his mother's side Henry belonged to the illegitimate branch of the house of Lancaster, being descended from John of Gaunt and Catherine Swinford, and it was only in the absence of nearer heirs that he was accepted as the representative of that house. On the father's side he was sprung from the marriage of Owen Tudor, a Welsh gentleman, with Catherine, widow of Henry V., and this family name became the name of the line of kings which he founded. On the complete overthrow of the Lancastrians, especially after Richard had won the throne by putting his nephews out of the way, Henry, under the name of the earl of Richmond, appeared as the centre of the opposition. From his exile in Brittany or France he schemed for the overthrow of Richard, and made an expedition to England to support the unsuccessful rising of Buckingham. The increasing unpopularity of Richard gave him greater success in his second enterprise. He landed at Milford Haven in order to profit by the good-will of his kinsmen the Welsh, and marching into Leicestershire defeated Richard at the battle of Bosworth, thus ending the Wars of the Roses (1485). Soon after he married Elizabeth daughter of Edward IV., and so the White Rose and the Red were united. Henry, however, was not allowed to enjoy the crown in peace. Two pretenders, one after another, led a rising against him. Lambert Simnel, personating the earl of Warwick, son of the duke of Clarence, gathered the Yorkists about him in Ireland, and landing in Lancashire advanced as far as Stoke in Staffordshire, where he was defeated and made captive (1487). Next arose Perkin Warbeck, a Fleming, who, pretending to be one of the princes murdered by Richard in the Tower, received much countenance abroad and in Scotland, and had many supporters among the discontented at home. But when he ventured to land in Cornwall, he was captured and finally executed (1499). These risings troubled the reign of Henry, but did not shake his throne. He ruled with a firm hand; he took care to repress the nobles, already almost exterminated in the civil war, in this case continuing the policy of Edward IV.; he put down the practice of maintenance, by which they kept bodies of retainers ready to support them in battle, and in every way sought to concentrate in the person of the king the whole power of the nation. Henry was a parsimonious and calculating ruler, who avoided war, gained by diplomacy what other sovereigns attempted by force, kept a well-filled treasury, and made two brief expeditions into France the occasion of amassing additional wealth. His avarice led him even to revive old and forgotten statutes, and to exact heavy fines from those who had transgressed them, in which evil work he was assisted by the two well-known lawyers Empson and Dudley. His reign is marked also by two marriage arrangements which had great influence on subsequent history. His son Arthur was wedded to Catherine of Aragon. When Arthur died in 1502, a few months after the marriage, Catherine remained in England in order to be united to the younger son Henry, though the nuptials did not take place till after his accession to the throne. The other marriage was that of the young princess Margaret to James IV. of Scotland (1503), which a century after resulted in the union of the crowns. Henry VII. died in 1509, leaving, it is said, a treasure of two million pounds to his successor. He was by no means an amiable or popular sovereign, but did great service in settling and consolidating the kingdom after the long troubles.

The authorities for Henry VII. are—*Memorials of Henry VII* (with which is published Bernardi's *Historia de Vita Henrici VII.*), and *Letters and Papers illustrative of Henry VII.*, both edited by Gairdner; and Bacon's *History of Henry VII.*, edited by Stebbing.

HENRY VIII. (1491–1547), king of England, was born in 1491, being the second son of Henry VII. and of his wife Elizabeth of York. On the death of his elder brother Arthur in 1502, he became heir apparent to the throne. As younger son Henry had been educated for the church, and it is said that his interest in theology was due to those early studies; but as he was only eleven when his brother died, they could not have been either extensive or profound. His training under the severe and methodical Henry VII.

must have been a very careful one; he was deeply interested in the new learning, and was a most accomplished scholar. During his father's lifetime we hear nothing of the young king except as the destined husband of Catherine of Aragon, the widow of his brother Arthur, a lady six years older than himself. It suited the plans of the old monarchs, their parents, that Catherine should be wedded to Henry, and so she remained in England during the seven years of her widowhood. Henry was only eighteen when the death of his father (1509) left the throne of England vacant, as well as set him free to shape his own career. His first important act was to fulfil the contract imposed upon him by his father to marry Catherine. His ministers, almost without exception, were in favor of the marriage. Henry expressed himself highly delighted with his wife. Catherine was fond of him to excess. The disparity of years was not so marked at that early period; Catherine was amiable, accomplished, of the bluest blood in Europe, closely connected with the most powerful dynasties, a queen of whom England with her then diminished prestige might well be proud. For the time all went well, and no one saw in such a simple event the seeds of a great revolution.

Englishmen were not in the mood to anticipate evil at the accession of Henry. In the young king all the conditions requisite for a prosperous reign seemed to be combined in a rare degree. To the dull monotony, varied only by Yorkist rebellions, to the greed, suspicion, and jealousy which made the shady side of the previous reign, succeeded an era of splendor and enjoyment in which every free and generous impulse should have free scope. As Henry united in his own person the lines of the White Rose and the Red, there was no likelihood of a revival of the old broils. Those who grudged to see his Lancastrian father on the throne were well pleased to see it occupied by a son of Elizabeth of York. The hated avarice of Henry VII. had provided means for the popularity of his successor; and to Henry VIII. fell the easy and generous rôle of squandering the treasure which his father had amassed. Nor was this the only respect in which the young Henry entered on the fruit of other men's labors. In the Wars of the Roses, and by the policy of Edward IV. and Henry VII., the old feudal nobility had been brought very low. When nothing more was to be feared from that quarter, it was Henry VIII.'s easy task to gather round him the broken remnants, to attach them to his person, and to make them the ready instruments of his will, in short, to convert the representatives of a haughty feudal baronage into submissive courtiers. In character the young Henry was a king according to the people's heart; even in his faults he was exceptionally fortunate. He was handsome, frank, extravagant, of vast muscular strength, accomplished in all the manly exercises of the time and in the new learning; he was vain, thirsting for popularity, eager to retrieve the old renown of England, the enemy of France, and dreamt always of renewing the conquests of the Henrys and Edwards. It is not surprising that Henry excited the highest expectations in all classes of his subjects, for this varied character offered an attractive side to all of them. The men of the new learning were charmed by his love of letters. Ecclesiastics saw with pleasure his punctual performance of the duties of religion. All good men were delighted with the excellence and purity of his private life. Statesmen were struck by his capacity for business; his gayety and frankness captivated the courtiers; the prospect of French conquest inspired the warlike and the ambitious. From the description of Henry by the Venetian ambassador, Giustiniani, in 1519, we can easily perceive what impression he must have made on England at his accession:—"His majesty is twenty-nine years old, and extremely handsome. Nature could not have done more for him. He is much handsomer than any other sovereign of Christendom—a good deal handsomer than the king of France,—very fair, and his whole frame admirably proportioned. On hearing that Francis I. wore a red beard, he allowed his own to grow; and as it is reddish, he has now got a beard that looks like gold. He is very accomplished, a good musician, composes well, is a most capital horseman, a fine jouster, speaks good French, Latin, and Spanish, is very religious, hears three masses daily when he hunts, and sometimes five on other days. He hears the office every day in the queen's chamber,—that is to say, vesper and compline. He is very fond of hunting, and never takes his diversion without tiring eight or ten horses, which he causes to be stationed beforehand along the line of country he means to take; and when one is tired he mounts another, and before he gets home they are all exhausted. He is extremely fond of tennis, at which game it is the prettiest thing in the world to see him play, his fair skin glowing through a shirt of the finest texture." When we take all these facts into consideration, when we remember also that erelong he had raised England from a third-rate position to a level with the greatest powers of Europe, and that for twenty years nothing serious occurred to break the harmony of his reign, we cannot be surprised that Henry was a most popular king.

The reign of Henry falls naturally into two periods, separated by the question of the divorce. During the first period Henry is the splendid and jovial king at home, abroad a figure of the first magnitude in the wars and international diplomacies of the time. Both in home and foreign affairs, but particularly the latter, Wolsey was the right hand man of the king, ready, as occasion served, either to transact the whole business of the government, or to be the humble instrument of the king, when the royal hand did actively interfere. In point of fact Henry always was master, and took a keen interest in business. The events of the first period were concerned chiefly with the foreign wars. At home, with the exception of the execution of Empson and Dudley, the instruments of his father's extortion, who suffered, however, on a trumped-up charge of treason, nothing important occurred. There were Christmas revels, May festivals, tilting matches, in which Henry always shone victorious, and in which he squandered the treasures of his father. But the serious endeavors of the time were directed abroad; Henry joined his relatives Ferdinand and Maximilian in a league against France. Though Henry took a personal share in the campaign in France of 1513, and won the easy Battle of Spurs, and though Surrey, his general, gained the great victory of Flodden, no substantial result was attained by the war. Henry was duped and then abandoned by his allies. When he was undeceived, he made peace (1514) with France, which was cemented by the marriage of his youthful sister Mary to the old and worn-out Louis XII. Soon after, when Louis was succeeded by Francis I. (1515), and Charles V. entered on the government of his hereditary dominions (1516), the three monarchs who figure so conspicuously as the contemporaries of the Reformation, and whose doings constitute so much of the history of the 16th century, found themselves face to face. With these two and with the successive popes Henry had to do during the rest of his life. Their relations at first were chivalrous and even friendly. Henry never had any chance of success in his canvass for the imperial crown. When it fell to Charles, it made him beyond a doubt the first monarch of the age; his success placed him in open rivalry to France; but to Henry, fortunate again, it gave the desirable prospect of being courted by the two rivals, and even of acting as arbiter in their disputes. Henry, however, descended from this lofty position to engage in quarrels which had no concern with the true interests of England. The chimera of French conquest again fascinated him and his people, so that when the false chivalry of the Cloth of Gold had degenerated into war, Henry took the side of Charles. In the campaign of 1523 the English forces advanced to within eleven leagues of Paris, but the war led to no durable and satisfactory result as far as Henry was concerned. The people grew sick of the heavy contributions they were called upon to make, and threatened revolt. After the battle of Pavia (1525), where the French were completely overthrown and their king made prisoner by the armies of Charles, the policy of Henry was completely disturbed. Till that event it had been clear enough. The commercial interests of the country, which were bound up with the Flemish dominions of Charles; the ambition of Wolsey, who founded his hope of the papal crown on the good-will of the emperor; the hereditary enmities and warlike instincts of the people, as well as the inclination of the king, coincided conveniently in requiring the imperial alliance. But now France was down, and the balance of power, already a working conception in politics, was destroyed, while Charles in his triumph ignored the claims of Henry, and had more than once disappointed the ambition of Wolsey. Under these circumstances English policy was forced out of its old groove, and an alliance was made with France. In a short time, moreover, interests and passions of a far more momentous nature emerged.

The dilettante politics of Henry's early career were to be superseded by occupations of a tragically earnest nature. Adventurous enterprises abroad were to give place to real interests at home, and the jovial young king was to be transformed into the stern, self-willed, and often cruel revolutionary. The serious and important part of Henry's life therefore is still to come: but before leaving the earlier period it is well to remark that it lasted twenty years, or more than half of his reign; that during these years Henry was popular in the highest degree; and especially that he had gratified the national pride of his subjects by restoring England to a leading position in Europe. This should not be forgotten during the troubled and more questionable events that were to follow.

The year 1528 may justly be fixed as the turning-point of Henry's life. By that time the divorce had become a national and even a European question, and Henry had decisively committed himself to the course which was to result in the separation from Rome. It is not clear when the plan of a divorce began to take shape in Henry's mind; it was the slow result of a variety of causes which were not clear to the king himself. We know, however, that Anne Boleyn returned to the court of England in 1522; that she made quite a sensation there as soon as she appeared; and that among other admirers, married and unmarried, Henry soon expressed a decided preference for her. On the other hand, he seems to have been alienated from Catherine long ere the question of divorce became public; if we may trust a statement of his own, he had abstained from her bed since 1524, and his coldness for her increased with his love for Anne. That his scruples regarding his marriage awoke about the same time was certainly a very convenient coincidence. The danger, however, of a disputed succession in the absence of male heirs was a real one. The situation probably justified such an extraordinary measure as a divorce, though we must recollect that the raising of a second family, rival to Mary the daughter of Catherine, might precipitate the very crisis which men feared. Still we must admit on the whole that the national interest and the inclination of Henry coincided, and that concern for his kingdom probably had a large part in the mixed motives which urged him to seek a divorce.

When the demand for a divorce was first formally laid before the pope in 1527, no one anticipated that it would encounter so many difficulties. The great opponent of it was Charles V., who loyally supported his aunt, and who, as the event proved, had the pope entirely in his power. But for the emperor, Clement would soon have arranged everything to the satisfaction of the English court. As it was, he sought safety in delay. Thus he declined giving any decisive answer himself, and when he delegated the case to Wolsey and Campeggio, he managed still further to defer the question and then to revoke it to Rome (1529). By that time Henry's patience was exhausted. As early as 1528, and as if sure of a speedy decision in their favor, the king and Anne were living familiarly together under the same roof. Their disappointment was natural, and Henry soon began to take more active measures. He appealed from the pope to the universities. Notwithstanding his life-long services Wolsey was discarded, because he was supposed not to have been sufficiently earnest about the divorce. The same year (1529) a parliament was called, which proved to be the ready auxiliary of the king in his new policy. This parliament, which sat at intervals from 1529 to 1536, had little independent or substantive power; it was made up largely of the nominees and creatures of the court, and seldom moved but at the royal initiative. Still it was well that the old forms should be recognized in the great changes that were coming, and significant that the strong-willed Tudor felt it safe to have the nation at his back. The changes themselves were gradual, and were by no means disagreeable to the advanced and influential part of the nation. Only a very small minority had any sympathy with the Lutheran movement; but many wished to see the church reformed, to have her power curtailed, and that England should take up a more independent attitude towards the pope. Under these circumstances Henry found it easy to carry the majority, especially the active and progressive part, of the nation with him. In no case was the parliament of 1529 conscious of its destiny; what it contemplated was not a revolution, but only some necessary reform; it, as well as Henry, would have been astonished to hear that they were working on the side of Luther. Yet the parliament soon proceeded to take some very decisive steps. In 1529 the probate duties and mortuaries (or burial fees) exacted by the church were curtailed; the clergy were prohibited from following secular employments; residence was enforced, and pluralities forbidden. In 1531 the clergy were laid under the charge of præmunire, which they bought off by the payment of £118,000, and the acknowledgment that the king was supreme head of the church. In 1532 the abuses of "Benefit of Clergy" were reformed, annates abolished conditionally, and the independent legislative power given up by convocation. Soon after the king took a step which precipitated the crisis; he married Anne Boleyn, an event which was quickly followed by the publication in Flanders of a threat of excommunication from Rome. After this the Act of Appeals was passed, forbidding appeals from the English ecclesiastical courts to Rome, and Cranmer, in a court at Dunstable, declared the marriage with Catherine null and void. In the following year (1534) the papal authority in England was annulled, and by the Act of Supremacy Henry was declared supreme head of the English Church. The next step was a sad one; but it convinced the world that the king was in earnest. Sir Thomas More and Fisher, bishop of Winchester, the noblest champions of the old faith, two of the best and noblest Englishmen of the time, were executed for refusing to accept the Supremacy Act (1535). Such an event produced a deep sensation in Europe, but it was decisive; when the pope drew up the Bull of Deposition in 1536, which, however, was not published till 1538, the rupture with Rome was complete. In the same year (1536) the first Articles of religion, ten in number, were drawn up; in effect they were a great simplification of the old creed, though they gave little encouragement to Lutheranism. At the same time the Act for the dissolution of the smaller monasteries, which was based upon the report of a commission of inquiry, was passed, being the final important measure of the first Reformation parliament. With such events as the abolition of the papal power in England and the dissolution of the monasteries modern England begins; they inaugurate a fundamental change in the national policy and in the structure and habits of society. While the purpose, real or ostensible, of Henry had been merely to marry a younger woman and provide for the succession, he had effected the greatest revolution which England has undergone.

Henry had indeed succeeded in the task to which he had applied himself nine years before; but the enemies he had raised were formidable, and he was destined to many a bitter disappointment. He had excited the hostility of the pope and the emperor; worst of all, he had seriously hurt the feelings and prejudices of a large class of his subjects. The danger of foreign invasion was greatly increased by the discontent both in the north and west of England, where the love of use and wont in the church and in the national habits was strongest. The death of Catherine had indeed greatly relieved him, as it made reconciliation with the emperor practicable, and deprived the English opposition of a common centre. The rising in Ireland was suppressed without much difficulty, but the discontent in the north which broke out in the Pilgrimage of Grace was a formidable danger (1536). It was averted more by skilful statesmanship on Henry's part than by open show of force. The opposition in the west was nipped in the bud by the execution of its leaders, the marquis of Exeter and Lord Montague (1538). These measures of the king and of his minister Cromwell sometimes appeared cruel and unjustifiable, but they kept the country united; Charles was convinced of the futility of an invasion; and the thunderbolts of the pope fell harmless to the ground. In all this crisis, when a wrong step or the appearance of vacillation might have occasioned a religious war, in which the conservatism at home would have been seconded by the armies of Spain, the energy and the commanding sagacity of Henry did more than aught else to save the country. To him the praise is chiefly due that this great revolution was comparatively free from blood and havoc.

Henry had defied the emperor and the pope, and he had suppressed the conservative Catholic discontent at home with a high hand; but he was never disposed to be a Protestant. Instead of following the lead of the advanced Reformers he impressed upon the English Church his own moderate and substantially Catholic theology. At thirty he had defended the seven sacraments against Luther; he was thirty-six when he took up the question of divorce, and

he was forty ere his relations to the pope had hardened into alienation and hostility. All his life he was orthodox from conviction as well as from traditional assent. Such a man could not be a revolutionary in theology. He repressed with a firm hand all excess in innovation, showing equal aversion to the iconoclastic mob and to iconoclastic preachers. The bill of the Six Articles, passed in the same year that saw the final dissolution of the monastic system of England, was the most remarkable exemplification of this spirit of Henry. It also proves that innovation in theology was a new thing to the mass of the English nation, and its penalties too clearly illustrate the fact that religion was not considered an individual and private matter, but a national interest, the violation of which was a capital offence. It is to the honor of Henry that the victims of the Bloody Statute were so few. Five hundred arrests were made by the eager Catholic party in a single fortnight after the passing of the bill; but the king interposed in time and only twenty-eight suffered under the statute during the whole reign.

In the mean time Henry had been less fortunate in the matrimonial scheme which had been the occasion of all the changes and dangers we have noted. A few months after the death of Catherine, Anne Boleyn was sent to the scaffold. Anne may have been guilty of the crimes laid to her charge, but Henry himself had taught her to cast aside all feminine reserve and self-respect, and his fickle heart had been captivated by another, long before the disclosures which were the ground of her death. Henry married his new love, Jane Seymour, the day after the execution of Anne (1536). The birth of Edward in the following year gratified the king's desire for a male heir; but the early death of Jane left him again without a queen. After an interval of more than two years Cromwell undertook to procure a suitable wife at the Protestant courts of Germany; but his ruin was not less complete than that of his patron Wolsey on a similar occasion ten years before. Anne of Cleves found no favor in the king's eyes; she was divorced and pensioned off, while the enemies of Cromwell succeeded in sending him to the scaffold. Anne's place was occupied by Catherine Howard, till she, really guilty, was also executed (1542). For his sixth and last queen Henry married (1543) Catherine Parr, who proved a patient wife and an excellent nurse. During the last few years of Henry's reign home affairs and the question of the religious revolution ceased to be the exclusive subject of interest. England and the neighboring powers were constrained to acquiesce for the time being in Henry's arrangement of things. Even the emperor cultivated his alliance. His foreign politics ended very much as they began—with a war against Scotland and France. The former arose out of certain border quarrels; the Scots were beaten at Solway Moss, but defeated an English force at Ancrum Moor. After the death of James V. Henry's course was to arrange a marriage of the infant queen of Scots with his own son Edward. The plan failed through Henry's self-will, and Scotland was ravaged to no purpose. The war with France (1543–46) was equally fruitless. Its chief feature was a threatened invasion by a formidable French fleet, which for some time was master of the Channel.

At home the most important point of interest was the struggle between the two factions, Protestant and Conservative, which had now for some years confronted each other—Norfolk and Bishop Gardiner of Winchester being the leaders of the latter, while the queen, Cranmer, and the earl of Hertford, uncle of young Edward, were at the head of the former. Cromwell had already fallen under the machinations of the Conservative party. Cranmer and even the queen were not quite safe from its attacks. The heads of that party now suffered at the close of the reign. Surrey was executed, and Norfolk was saved only by the death of the king. The effect of such measures was to make the prospects of Edward secure by confirming the power of his uncle Hertford.

Henry was anxious to arrange affairs for the accession of his son, as he felt his own life waning away. Though only in his fifty-sixth year he was unwieldy with disease and corpulency, and required to be wheeled from room to room; an ulcer in the leg had troubled him for many years. In this as in so many other respects the contrast between the beginning and end of his career is striking; the young athlete is transformed into a helpless invalid; the joviality, the enthusiasm, and the unanimity of his earlier reign gave place to a long period of gloom and contention, repressed only by the savage and imperious hand of the king. He died on the 28th of January, 1547.

The character of Henry has long been a stumbling-block to historians, and will always be a puzzle to such as classify mankind under the two heads of good and bad without recognizing the intermediate gradations to which the vast majority belong. To many it is all the more inexplicable because the contrast between his youth and declining manhood is so apparently complete. Yet it was a perfectly consistent, though a mixed character, and the later phases of it are only a natural development of the earlier. He was always strong-willed to excess, capricious, and fickle, with the sensuous part of his nature predominating. In his youth his baser tendencies were controlled by his love of popularity, his regard for his excellent wife, his own sense of duty, and the vigorous animal spirits which found congenial play in physical exercise and in foreign war. In his maturer years he was more self-reliant and therefore less dependent on popularity; after losing his regard for Catherine he fell into baser companionship; as his health began to fail, his boisterous spirits declined. Worst of all, his constitutional fickleness took the form of disloyalty to his successive wives, and to his friends and ministers. In the time of Henry there was no acuter man than Sir Thomas More. His verdict may be accepted as final on this aspect of the king's character. In the height of his favor with the king, after walking an hour with him in the garden at Chelsea, the king holding his arm about his neck, More confessed that he had "no cause to be proud thereof, for if my head would win him a castle in France it should not fail to go." Such may have been the repulsive side of Henry. Much more important, however, than the consideration of his personal character is the question as to the nature and tendency of the historic work in which he took the initiative. Was that the outcome merely of misguided self-will concealing itself under the guise of duty, or was it the true and durable expression of the claims and aspirations of the time? The passions of Henry had certainly too much to do with it; the work he did was, like his character, mixed with baser elements. But the best answer to such a question is to be found in the modern history of England. That history in its progressive spirit, in its gradual approximation to a sounder and better state of society, and in its liberal openness to the influence of truth, is only the continuation and development of the work of Henry. In his rupture with the pope, in his abolition of an idle and antiquated monasticism, and in his endeavor to establish a purified and simplified Catholicism as the permanent creed of England, he was fighting on the side of truth and light and progress. The English Reformation was too much alloyed with baser elements to serve as an ideal example of a great historic change; yet it succeeded better than any other in appropriating the good both of the old and the new, in avoiding a violent rupture with the past, in keeping the nation unanimous, and in escaping those fatal religious wars which desolated Europe for nearly a century and in Germany delayed the progress of civilization for a century more. This desirable consummation was due first of all to Henry, whose sagacity and unfaltering resolution baffled the enemies of reform both at home and abroad, who repressed the hasty movements of either fanatical extreme in England, and who, with his real reverence for the teaching of the past, had a hearty contempt for its abuses. He was no hero, no ideal man or king; he shared fully in the coarseness and indelicacy of the age; he was fickle in his personal attachments, and did not shrink from destroying those who crossed his plans; but he had a real and lofty sense of his duty as a king; he had a true insight into the men and things he had to deal with, and helped to lead the country into a new era.

Sources for the Life and History of Henry VIII.—State Papers during the reign of Henry VIII. (Record Commission); *Calendars of State Papers*, with introductions by Brewer, down to 1530 (Rolls series); Giustiniani's *Four Years at the Court of Henry VIII.*, 1515-19; Erasmus's *Letters*; Legrand's *Histoire du Divorce*; Cavendish's *Life of Wolsey*; Roper's *Life of More*; Hall's *Chronicle*.

Important Historical Works treating of Henry VIII.—Froude's *History of England*, vols. i.–iv.; Lingard's *History of England*; Hallam's *Constitutional History*, vol. i.; Burnet's *History of the Reformation*; Seebohm's *Oxford Reformers*, and his *Era of the Protestant Revolution*. (T. K.)

German kings and emperors.

HENRY I. (876–936), German king, was born in 876 in Saxony, of which his father, Otto, was duke. He distinguished himself in early youth by the courage and energy with which he warred against the Slavonic tribes to the east of his native duchy. Otto, who died in 912, appointed Henry his successor, not only as duke of Saxony but as lord of Thuringia and part of Franconia. Conrad I., stimulated by certain ecclesiastical advisers whom Henry's independent bearing towards the church had deeply offended, resisted the claims of the young duke; but he was ultimately left in possession of all the lands his father had ruled. After Conrad's death Henry was chosen king by the Franconian and Saxon nobles, and he had not much difficulty in securing the acquiescence of the rest of Germany. For some years Lotharingia or Lorraine had held an uncertain position between the kingdoms of the East and the West Franks, as Germany and France were then called, but at this time Duke Giselbert, who was an old friend of Henry, quarrelled with Charles the Simple, and transferred his allegiance to the German king. For eight centuries afterwards Lorraine remained a part of Germany. From the time of Louis the Child, Germany had been tormented by the Hungarians, who were still a savage race, and who had the advantage of fighting on horseback while the Germans resisted them on foot. In 922 an Hungarian chief was captured, and his people were compelled to purchase his release by agreeing to a nine years' truce, on condition that Henry should during this time pay an annual tribute. In the northern districts the Germans had hitherto lived for the most part in small villages or on separate settlements, after the fashion described in the *Germania* of Tacitus. Henry, perceiving that so long as they continued thus exposed to attack they could never be safe, began the building of cities throughout Saxony and Thuringia, and in the other duchies his example was extensively followed. He also trained his vassals to meet the enemy on horseback, thus giving a strong impetus to the movement which resulted in the institutions of chivalry. When his arrangements were complete he tried his new force in a contest with the Danes and with some Slavonic tribes, whom he utterly defeated. In 933 the Hungarians demanded as usual the tribute which had till then been punctually paid, and when it was refused invaded Thuringia with a great army. Henry twice defeated them, and they were so overwhelmed by this misfortune that they did not enter Germany for some years, and were never again seen in the northern duchies. Having thus broken the power of all the chief enemies of his country, Henry took precautions for the future by establishing the marches of Schleswig, of Meissen, and perhaps of Brandenburg. In his home government he acted with great caution and judgment. The dukes had become so powerful that there was some danger of their altogether overshadowing the throne. Instead of directly meeting this peril by forcing them into submission, as was afterwards done by his son Otto, he attached them to his interests by confirming them in many of their rights and by acting as a mediator in their disputes. Towards the close of his life his position was so secure that he resolved to go to Rome and claim the imperial crown. In the midst of his preparations he died in 936 at Memleben, and was buried in St. Peter's church, at Quedlinburg. He was one of the wisest and most energetic of the German kings, and through his encouragement of municipal life, and his powerful defence of Germany against her foreign enemies, his reign marks an epoch of the highest importance in early mediæval history. By his first wife, Hatburg, he had a son Thankmar, who gave Otto I., his successor, much trouble. After she was put away he married Matilda, the daughter of a Saxon count; and the gentle and noble character of this lady, who was universally beloved, was of essential service to him in his rule.

See Waitz, *Jahrbücher des Deutschen Reichs unter Heinrich I.* (Berlin, 1837; 2d ed., 1863).

HENRY II. (972–1024), Holy Roman emperor, was born in 972. He was the son of Henry the Wrangler, duke of Bavaria, a grandson of King Henry I. In 995 he succeeded to the duchy of Bavaria, and six years afterwards went to Rome with the young emperor Otto III., to whom he rendered important services. When Otto III. died, Henry, as the chief surviving representative of the house of Saxony, took possession of the insignia of the empire, and was crowned German king at Mainz on the 7th of June, 1002. Encouraged by disturbances in Germany, a rebellious party of nobles in northern Italy raised Margrave Harduin of Ivrea to the throne of Lombardy; but Henry advanced against them, and, like his immediate predecessors, made himself master of the iron crown. His most determined enemy during the greater part of his reign was Boleslaus II. of Poland. This ambitious and strong-willed prince annexed Bohemia, and during the king's absence in Italy broke into Lusatia and Meissen. Henry hurried back, defeated Boleslaus in 1005, and granted Bohemia in fief to Jaromir, son of the previous duke. Boleslaus, however, continued the war, which was not ended till 1018, when Henry was obliged to conclude peace on terms that were much more favorable to the Poles than he would have voluntarily granted. In the midst of this struggle he had to make war on Adalbero, his wife's brother, who seized the archbishopric of Trèves, and was protected in his claim by another brother of the empress, the duke of Bavaria. Both were overcome and deprived of their dignities, although Bavaria was ultimately restored to the elder of the two brothers. Henry also put down rebellions in Flanders and Meissen, and he concluded an important treaty with Rudolf III. of Burgundy, whereby after Rudolf's death the country was to be united to Germany. In 1013 Henry went for the second time to Italy, where Harduin had again raised himself to the throne. The usurper was displaced, and in 1014 Henry was crowned emperor at Rome by Benedict VIII., whom he had confirmed in the papal see in opposition to the antipope Gregory. At the request of Benedict the emperor returned to Italy in 1022 in order to drive back the Greeks, who were steadily pressing northwards. In this enterprise he associated himself with the Normans, who thus became one of the most important factors in the political life of Italy. Henry's health, which was always feeble, rapidly declined after this third visit to his southern dominions, and in 1024 he died. He was canonized by Pope Eugenius III., and at a later time his wife, Cunigunde, was also ranked among the saints. It was natural that they should be thus honored, not only because of their fervent piety, but because the church has rarely had a more splendid benefactor than Henry II., whose ruling policy was to balance the power of the great nobles by increasing that of the spiritual princes. He also founded the bishopric of Bamberg, which was placed under the immediate jurisdiction of the pope, and to which he left by will all his treasures and his magnificent allodial possessions.

See Hirsch, *Jahrbücher des Deutschen Reichs unter Heinrich II.* (Berlin, 1862–75).

HENRY III. (1017–1056), Holy Roman emperor, was the son of Conrad II., the founder of the Franconian dynasty. He was born in 1017, and his father, anxious to make the succession secure and to strengthen the authority of the crown, caused him to be elected German king in 1026, creating him in 1027 duke of Bavaria, and in 1038 duke of Swabia and king of Burgundy. He became the reigning sovereign of Germany in 1039, at the age of twenty-two. Of an upright and resolute temper, he soon made his power felt both in church and state. The policy he pursued was that which had been followed by Otto I. during the early part of his reign: that is, he granted as many of the duchies as possible either to members of his own family or to vassals on whose loyalty he could rely. Duke Gottfried of Lower Lorraine, who laid claim to Upper Lorraine also, was the only prince who gave him serious trouble, and even this impetuous opponent could not effectually resist the great emperor. Henry was as distinguished in his wars as in his home government. Duke Bretislaus of Bohemia, who gave signs of aspiring to an independent position, invaded Poland, plundered its chief cities, and as a mark of his triumph carried away the body of St. Adalbert from Gnesen to Prague. Henry proceeded against him in 1041, and forced him to appear in the following year at Ratisbon in penitent's garb, and to accept Bohemia in fief of the German crown. Having settled this difficulty, he began in 1042 a series of campaigns in Hungary, where for the first time he asserted the supremacy of Germany. In Italy he was equally successful, not only maintaining his right to the Lombard crown, but establishing supremacy over the Normans in Apulia and Calabria. At this time the moral condition of the church was regarded with regret and concern by every serious nature, and Henry

who was of a deeply religious tendency, associated himself heartily with the movement for reform which proceeded from Cluny At a council of prelates in Sutri in 1046, he caused the rival popes, Benedict IX., Sylvester II., and Gregory VI., to be deposed, and raised to the papal see, as Clement II., Suitger, bishop of Bamberg. Three other German bishops, one after the other, were appointed to the same position; and as all of them were devout men and energetic administrators, they did much to purify the ecclesiastical system of Europe. During their rule the papacy was held in strict subjection to the empire; but the very earnestness with which Henry applied himself to the task of making the church worthy of its mission created grave dangers for the state, since it was improbable that a pope of proud and independent spirit would be content with a subordinate position. The magnitude of the peril soon revealed itself when Hildebrand became pope during the reign of Henry IV., Henry III.'s son and successor. Henry died in the prime of life in 1056 at Botfeld.

See Steindorff, *Jahrbücher des Deutschen Reichs unter Heinrich III.* (Leipsic, 1874).

HENRY IV. (1050–1106), Holy Roman emperor, son of Henry III., was born in 1050, and crowned German king at the age of four during his father's lifetime. After the death of Henry III. in 1056, the government was undertaken by the empress Agnes, the young king's mother. Henry III.'s vigorous rule, while it had secured the prosperity of the nation as a whole, had excited bitter discontent among the great nobles, and immediately after his death they began to make attempts to recover some portion of the independence he had taken from them. Agnes, who was of too refined a temperament to contend with them, sought to win their support by important concessions; and the evil effects of a feeble central authority were soon felt in every part of Germany. At last, in 1062, Anno, archbishop of Cologne, succeeded in gaining possession of the king by enticing him on board a boat on the Rhine. Agnes then resigned her position, and Anno ruled in her stead. He was a harsh, bigoted, and despotic prelate, and excited Henry's bitter hatred by the sternness of his discipline. In Adalbert, archbishop of Bremen, who was of an exactly opposite disposition,—gay, worldly, and good-humored,—Anno had an influential rival. This prelate was at first entrusted with some share in the training of Henry, but ultimately completely gained his affections and became his sole guardian. In his fifteenth year Henry was declared, in accordance with the Ripurian Code, to have reached his majority, but the royal authority was really exercised by Adalbert, who aroused the jealousy of the princes both by his splendid style of living and by his opposition to their usurped powers. At a diet held in Tribur he was compelled to yield the first place once more to Anno. Trained under these diverse influences Henry became passionate and wilful; but he was endowed with considerable intellectual gifts, and when thoroughly aroused could pursue an object with unquenchable ardor. In order, if possible, to check the excesses of his private life Anno caused him to marry Bertha, the daughter of the margrave of Susa, to whom he had for some time been betrothed. At first he regarded her with strong dislike; but after she had borne him a son in 1071 she succeeded in gaining his affections, and was afterwards his most trusted friend and companion.

Henry's reign was one of the most troubled in German history. His chief anxieties began in consequence of Otto of Nordheim, duke of Bavaria, being charged with an intention of murdering him. Otto was declared to have forfeited his titles, and his lands were seized and overrun. Supported by Duke Magnus of Saxony he rebelled, but both princes were quickly subdued. A new rebellion was organized by Otto of Nordheim, who suddenly, at the head of 60,000 men, appeared before the Harzburg, a strong Saxon fortress in which Henry resided. He escaped, but he was looked upon so coldly by the princes that he found it expedient to yield nearly all the demands of his enemies. An opportunity of revenge was, however, created for him by the violence of a body of peasants, who destroyed a chapel connected with the Harzburg and violated the graves of the king's brother and infant son. He had then no difficulty in obtaining an imperial army, and after defeating the rebels at Hohenburg in 1075, he imposed on them his own terms, and seemed to be on the point of asserting the ascendency which had been exercised by Henry III.

Meanwhile Hildebrand had become pope as Gregory VII. and had already indicated his design of making the papacy supreme over all earthly authorities. Henry appealed to him to degrade those prelates who had associated themselves with the rebels. Instead of responding favorably to the appeal, Gregory called upon the king to answer to certain charges preferred against him by his subjects. Failing to realize how much power the papacy had acquired through the reforms effected by his father, Henry summoned a council of German prelates at Worms in 1076, and declared the pope deposed. The reply was a sentence of excommunication. Henry's adherents so rapidly fell away that a reconciliation with the pope was soon perceived to be absolutely necessary. Escaping from his enemies he crossed the Alps in the depth of winter, accompanied only by his wife and child and by a few faithful attendants. The nobles of Lombardy were not unwilling to take up his cause, but he preferred to hurry forward to the castle of Canossa, where Gregory was residing with his friend the Countess Matilda. There occurred the famous scene in which Henry, the highest of secular potentates, stood for three days in the courtyard of the castle, clad in the shirt of a penitent, and entreating to be admitted to the pope's presence. No historical incident has more profoundly impressed the imagination of the Western world. It marked the highest point reached by papal authority, and presents a vivid picture of the awe inspired during the Middle Ages by the supernatural powers supposed to be wielded by the church.

The ban was removed; nevertheless the German princes elected Duke Rudolf of Swabia as their king, and they were soon openly supported by the pope, who resented Henry's persistent opposition to his great scheme for the deliverance of the clergy from the system of feudal investiture. Henry renewed his sentence of deposition against Gregory, and raised Guibert, archbishop of Ravenna, to the papacy as Clement III. After the death of the anti-king Rudolf in 1080 he went to uphold his rights in Italy, and in 1084 he gained possession of Rome, where Clement III. crowned him emperor. In Germany Count Hermann of Luxembourg had been chosen as successor to Rudolf, and in 1085 he defeated Henry near Würzburg; but in 1087 he voluntarily resigned his position, and soon afterwards died. A third anti-king, Margrave Eckbert of Meissen, also died in 1089; and had Henry had no enemies outside his native kingdom there would then have been peace. But Victor III. and Urban II., the successors of Gregory VII. (who died in 1085), continued to oppose him, and in 1090 he was obliged to proceed to Italy for the third time to support Clement III., his own anti-pope. Whilst engaged in this struggle he learned that his son Conrad had been induced by the papal party to rebel against him. Stunned by this unexpected blow, the tired emperor withdrew in disgust to a remote fortress, where he remained inactive for several years. In 1096 he recovered his energy, returned to Germany, and by timely concessions managed to overcome the opposition of his leading enemies. A diet at Mainz decided that Conrad had forfeited his right to the throne, and his brother Henry was proclaimed the emperor's successor. Pope Urban II., the anti-pope Clement III., and Conrad, all died within two years, and Henry had reason to hope that he would be able to end his life in quiet. But Paschal II., pursuing the policy of his predecessors, once more excommunicated the emperor, who was driven to despair by the fact of his son Henry putting himself at the head of the pope's supporters. The aged monarch, deceived by false promises, fell into his hands, and was detained as a prisoner. He ultimately fled to Liége, where he might still have been able to bring an army together; but in 1106 he was relieved from his heavy cares by death. The bishop of Liége buried him with a splendor becoming his position; but his enemies carried the body to Spires, where it was laid in an unconsecrated chapel; and it was not properly interred until, after a delay of five years, he was delivered from the ban of excommunication.

Henry holds an honorable position in history because, notwithstanding many personal faults, he resisted the excessive pretensions both of the papacy and of the ambitious feudal lords of Germany. He was unable, however, to make good his claims. Centuries passed before the secular power of the Romish see was seriously weakened, and amid the confused struggles of the time the princes obtained secure possession of rights which they had formerly held by an uncertain tenure.

See Giesebrecht, *Geschichte der Deutschen Kaiserzeit* (3d ed., vol. iii., part 1, Brunswick, 1869); Floto, *Heinrich IV. und sein Zeitalter* (2 vols., Stuttgart, 1855); Minckwitz, *Die Busse Kaiser Heinrichs IV. zu Canossa vor dem Papste Gregor VII.* (2d ed., Leipsic, 1875). (J. SI.)

HENRY V. (1081–1125), Holy Roman emperor, son of Henry IV., was born in 1081. In 1098, his elder brother Conrad having forfeited his right to the throne by rebellion, he was appointed his father's sueeessor. Six years afterwards he himself rebelled against the emperor, towards whom he played the part of a thorough traitor. The papal party, with which he allied himself, took for granted that when he mounted the throne ehureh and state would be instantly reeoneiled; but their hopes were disappointed. The main point for which Henry IV. had eontended was the right of investing the bishops with ring and staff. When Henry V. succeeded him in 1106, Pope Paschal II. demanded that this right should be given up, but he replied that he eould not resign powers which had been exercised by his predeeessors, and the loss of whieh would imply that the ecclesiastieal lands of Germany would be removed from seeular control. In 1110 he entered Italy at the head of 30,000 men. Alarmed by this display of force, Paschal withdrew his claims, and a day was appointed for the eoronation of Henry as emperor. The opposition of the Roman prelates made it impossible for the pope to proceed with the eeremony, whereupon he and his cardinals were made prisoners. Paschal then formally recognized the right of investiture, and Henry received the imperial erown. When the Germans had recrossed the Alps Pasehal renouneed the treaty he had eoneluded, and the emperor was exeommunieated. As many of the prinees were pleased to find this opportunity of rebelling, Germany again became the seene of confused eontests like those whieh had brought misery upon it during Henry IV.'s long reign. In 1116 the emperor went a second time to Italy and drove Paschal from Rome; and after Paschal's death he eaused Gregory VIII. to be appointed pope. The extreme papal party, however, selected Gelasius II., who renewed the sentence of excommunieation against Henry. The latter returned to Germany in 1119, and at a diet in Tribur sueeeeded in allaying the hostility of the more important among his enemies. Pope Calixtus II., who sueeeeded Gelasius in 1119, now found it necessary to offer a compromise; and the controversy between the empire and the papacy was for the time closed by the coneordat of Worms, which was eoneluded in 1122. By this treaty it was agreed that at every election of a prelate the emperor should have the right of being present, either in person or through a representative, and that the ehosen bishop, before being eonseerated, should receive his lands and secular authority in fief of the crown. So far the advantage rested with the emperor; but the papaey gained by being recognized as a power which had the right of negotiating with the empire on equal terms, and by the acknowledgment of the elaim of the ehurch to nominate its own rulers. Notwithstanding this settlement Germany did not long enjoy peaee, for a number of petty wars broke out whieh Henry was not strong enough to quell. He died at Nimeguen in 1125, and with him was extinguished the Franconian dynasty.

See Giesebrecht, *Geschichte der Deutschen Kaiserzeit* (3d ed., vol. iii., pt. 2, Brunswick, 1869); Gervais, *Geschichte Deutschlands unter der Regierung Heinrichs V. und Lothars* (Leipsic, 1841–42); Kolbe, *Erzbischof Adalbert I. von Mainz und Heinrich V.* (Heidelberg, 1875).

HENRY VI. (1165–1197), Holy Roman emperor, the son of Frederiek I., was born in 1165, and received the German crown in 1169. When his father started for Palestine at the head of the third erusade, Henry was made imperial viear, and he suecceded to the throne after the news of his father's sudden death reached Germany in 1190. He shared the intellectual eulture of his time, and was distinguished for the splendor of his political schemes; but he was of a stern disposition, and in order to attain his ends was sometimes guilty of horrible eruelty. Henry the Lion, who had been banished to England by Frederick I., returned to Germany after the departure of the latter for the Holy Land. Henry resisted him, but on becoming the reigning sovereign he eoneluded peace, and hastened to Rome, where he was crowned emperor in 1191. Through his wife Constantia he had a right to the throne of Sicily; but the Sicilian nobles had made Count Tancred, an illegitimate son of Constantia's brother, king. After receiving the imperial crown Henry advaneed against Tanered, and the whole of southern Italy except Naples was quiekly in his possession. Before Naples his army was struek by pestilenee, and he was foreed to return to Germany. There he suppressed various private wars, and compelled Henry the Lion to aeknowledge his supremaey. The great ransom which he received from Riehard I. of England enabled him to fit out a fine army, and with this he deseended upon Italy in 1194, and without much difficulty eonquered the Sicilian kingdom. Tanered was dead, but he had left a number of relatives, who were so barbarously treated that the people were seized with terror, and not even a sentenee of excommunieation which the pope pronounced against Henry eould induce any one to express dissatisfaetion with his rule. On his return to Germany it was easy for him, with the prestige he had now aequired, to enforce submission; and so great was his authority that, in 1196, he made attempts to seeure that the erown should be declared hereditary in his family. He might have sueceeded had he lived some years longer; but in 1197 he died at Messina. Before his death he was engaged in eheeking disorder whieh had arisen during his absence in Sieily; and he even obliged the Byzantine emperor Alexius to pay him tribute.

See Toeche, *Jahrbücher des Deutschen Reichs unter Heinrich VI.* (Leipsic, 1867); Mücke, *Kaiser Heinrich VI.* (Erfurt, 1876).

HENRY VII. (1282–1313), Holy Roman emperor, was born in 1282. He was the son of Henry II., count of Luxembourg, and was eleeted king in 1308, seven months after the murder of Albert I. He owed his election partly to the faet that he was eomparatively unimportant, which led the eleetors to suppose that under him the powers of the princes would be exposed to no great danger. When he came to the throne Bohemia was subject to Henry of Carinthia, whom the people extremely disliked. The king at once displaeed him, and enriehed his own family by granting Bohemia, at the request of the Bohemians themselves, to his son John, whose claims were rendered seeure by his marriage with Elizabeth, the daughter of Weneeslaus II. For some time no German king had sought the imperial crown; but Henry, who was of an imaginative temperament, eould not forget the splendid dignities to whieh the wearer of the erown of Germany was entitled. He therefore resolved to revive the traditions whieh had begun to die out, and with a view to this result did what he could to compose the differenees of the nobles and to gain their allegiance. At this time there were signs of rapid progress among the eities, and had a strong king devoted himself to their interests, he might have established his throne on a solid basis. Unfortunately the easiest way in which Henry could obtain immediate power for his plans in Italy was to ally himself with the prinees against the eities; and this was in most instanees the course whieh he adopted. His visit to Italy was looked forward to with eagerness by the Ghibellins, whose hopes were expressed in words of glowing eloquence by Dante. He held aloof at first from both the great parties in the state, and was in eonsequenee liked by neither. In 1312 he was crowned emperor in Rome, having previously reeeived the iron erown in Milan. But while he was in Rome, Robert of Naples was there also with a strong army, and in order to obtain adequate support it was necessary for Henry to deelare himself on the side of the Ghibellins. He then resolved to eonquer Naples, but while advancing on this expedition he died at Buonconvento, on the 24th of August, 1313. It was generally believed at the time that he had been poisoned by a Dominiean monk, but this is not proved by satisfaetory evidenee.

See Dönniges, *Acta Henrici VII.* (Berlin, 1840–41); and *Geschichte des Deutschen Kaiserreichs im 14ten Jahrhundert* (Berlin, 1841); Thomas, *Zur Königswahl des Grafen Heinrich von Luxemburg im Jahre 1308* (Strasburg, 1875); Pöhlmann, *Der Römerzug Kaiser Heinrichs VII.* (Nuremberg, 1875).

Kings of France.

HENRY I. (1005–1060), king of Franee, son of King Robert and Constanee of Aquitaine, and grandson of Hugh Capet, came to the throne in 1031. On his aeeession his mother, who favored her youngest son Robert, allied herself with the ehief feudal nobles, and drove Henry to take refuge at the eourt of Duke Robert II. of Normandy. With the duke's help he soon broke up her league. Constanee died in 1032, and Henry, by granting him the duehy of Burgundy, secured the good

will of Robert his brother, who thus became head of the first house of Burgundy. After the death of Robert "the Devil," Henry, who had first supported William the Bastard, in 1053 and 1054, tried to weaken the power of the Normans. Leaguing himself with the count of Anjou, and calling his brother Eudes into the field, he invaded Normandy from Evreux. When, however, Eudes had been defeated at Mortemer, Henry drew back in haste, and left the Normans to themselves. In 1059 he had his eldest son Philip crowned as joint-king, and died in 1060. He was an active prince, with his sword rarely in the scabbard, being little more than a great feudal chief, who enjoyed the feudal pastime of petty war. Henry's acts and character did little to strengthen the monarchy in its relations with its feudal neighbors. His political horizon was very narrow. The Normans were independent of him, with their frontier barely twenty-five miles west of Paris; to the south his authority was really bounded by the Loire; in the east the count of Champagne was little more than nominally his subject. Henry's first wife (if indeed she was more than affianced to him) Maud, daughter (or niece) of Conrad the Salic, died childless; his second, Anne, daughter of Jaroslav, grand-duke of Russia, bore him two sons,—Philip his successor, and Hugh count of Vermandois.

See Rodolf Glaber's *Chronicle*; *Chron. Andegavense*; *Historia de Henrico I.*; *Epist. Deoduini*; Dom Bouquet, *Recueil*, tom. xi.

HENRY II. (1519–1559), king of France, the second son of Francis I. and Claude, succeeded to the throne in 1547. When only seven years old he was sent by his father, with his brother the dauphin Francis, as a hostage to Spain in 1526, whence they returned after the conclusion of the peace of Cambray in 1529. Henry was too young to have carried away any abiding impressions, yet throughout his life his character, dress, and bearing were far more Spanish than French. In 1533 his father married him to Catherine de' Medici, from which match, as he said, Francis hoped to gain great advantage, even though it might be somewhat of a misalliance. He did not then think that the dauphin would die so soon, and Catherine thereby become queen of France. Italian manners and politics entered with her into France, and long affected the history and fortunes of the country. Henry gathered round him a court which contrasted strongly with that of his father. Francis, with all his grave faults and selfishness, had fostered learning, had treated his people kindly, and had rarely checked even the Reformers. But Henry, under the influence of Diana of Poitiers, headed the strict Catholic movement; the escape of the learned from Paris to Geneva at his accession showed that not merely Huguenot doctrines but Renaissance studies were in peril. His court underwent an immediate change: the old officers were dismissed, and men whom Francis had disliked or banished returned. Immorality did not take flight, for Diana of Poitiers and Catherine de' Medici were at court, but it ceased to be gay and bright; men must be grave and severe, even in their vices. At first Diana of Poitiers and the grim old soldier Anne of Montmorency swayed the king; later, the two brothers Francis, duke of Guise, and Charles, cardinal of Lorraine, rose to power, with the marshal St. André; everything was done and given through one or other of these men. Catherine de' Medici was as yet completely in the background.

The final union of Brittany with France marks the opening year of the reign. In 1548 Henry won a great diplomatic triumph over the ministers of Edward VI. of England, by getting possession of Mary queen of Scots, then only six years old; he had her educated in France, and eventually married to his son the dauphin Francis. In 1549 he appeared in Paris for the first time, and marked his presence by a great burning of Calvinists; and soon after he claimed back Boulogne, which had been promised to Francis I. by Henry VIII. After a successful campaign, he made the English Government, then extremely weak, cede Boulogne, and Henry entered the place in May, 1550.

Hitherto he had not come into collision with Charles V.; the time was now approaching when he would enter into contest with him, and permanently advance the borders of his kingdom, while he inflicted a great blow on the emperor. Though early in his reign he had dealt with the German Protestants, and with the Ottoman power, he had taken no active steps; now the league of German princes, headed by Maurice of Saxony, offered an opportunity not to be missed; Henry made a compact with the Swiss and Turks, and concluded a secret treaty (September 3, 1550) with the German princes; in 1552, by the league of Chambord, he undertook to seize the three bishoprics,—Metz, Verdun, and Toul. And so while Maurice drove the emperor from Innsbruck, Henry sent Montmorency into Lorraine. The bishoprics were won almost without a blow, and Henry was acknowledged as "avenger of Germanic liberty;" an attempt on Strasburg failed. After the siege of Metz by Charles V. in the winter of 1552–53, this district, French-speaking, though feudally under the empire, remained in French hands,—Metz till 1870, Toul and Verdun to this day.

In 1556 Henry, supporting the anti-Spanish policy of the "Theatine" pope, Paul IV., again made war with Spain. Francis of Guise was sent early in 1557 into Italy to oppose the duke of Alva. Anne of Montmorency went to the northern frontier; Gaspard of Coligny, who commanded in Picardy, was ordered to begin hostilities. These led to the disastrous battle of St. Quentin, in which the French were utterly defeated (August 10, 1557); it was followed by the fall of the town, at that time the chief bulwark of France to the north. Francis of Guise, recalled in haste from Italy, redressed the balance at the expense of England by the capture of Calais (January, 1558), and the triumph of the house of Guise seemed complete when Mary Stewart was married to the dauphin in the same year; their niece, with her claims on the Scottish and English crowns, would now ascend the throne of France. The defeat of the French at Gravelines, the desire of Montmorency to escape from captivity, the wish of the High Catholics to have leisure to extirpate heresy, the sympathy of Philip with that aim, the accession of Elizabeth of England—all these things made peace necessary, and the treaty of Cateau Cambresis (April, 1559) closed the war. As a sequel to the peace high feast was held at Paris to celebrate the marriage of Henry's two daughters; in a tournament he received his death-wound from the captain of his Scottish guards, Montgomery. So ended Henry II., in his forty-first year. Handsome, brave, and cold, he left little mark on his age; he is all but forgotten in the stormy days which followed. By Catherine de' Medici he had ten children, three of whom succeeded to the throne,—Francis II., Charles IX., and Henry III. The legislation of his reign was slight; he reduced the number of secretaries of state to four, and arranged their functions afresh; he issued an edict in behalf of a better coinage, reserved to himself the exclusive sale of salt, and permitted the foundation of the university of Rheims. In 1555 we find the first French Reformed churches established at Paris; these were quickly followed by others. The reign saw the close of the struggle between the crowns of Spain and France.

See *Mémoires de Montluc*; *Mémoires de Tavannes*; *Mémoires de Vieilleville*; *Mémoires de Villars*; *Art de vérifier les dates*, série ii., tom. vi.; Brantôme, *Vies des Hommes illustres*, and *Dames illustres Françoises*; *Commentaires de François de Rabutin*; Thuanus (De Thou), *Hist. sui temp. Libri CXXV.*

(G. W. K.)

HENRY III. (1551–1589), king of France, third son of Henry II. and Catherine de' Medici, succeeded to the throne of France in 1574. In his youth, as duke of Anjou, he was warmly attached to the Huguenot opinions, as we learn from his sister Margaret of Navarre; but his unstable character soon gave way before his mother's will, and both Henry and Margaret remained as choice ornaments of the Catholic Church. Henry won two brilliant victories at Jarnac and Moncontour (1569), and thereby attracted the eyes of the Polish nobles, who elected him their king in 1573. He went to Warsaw, but, on the death of his brother Charles IX., in 1574, came back to France and assumed the crown. He returned to a wretched kingdom, torn with civil war. Now began that "reign of favorites" which has made his career a by-word. His mother, ever balancing between parties, first favored the favorites, then went with the Huguenot chiefs. In these days the famous League was organized (see FRANCE, vol. ix. p. 495), and Henry declared himself its head in 1576. He took but a feeble part in the sixth and seventh civil wars, and was little in earnest till, in 1584, the death of his younger brother, Francis, duke of Anjou, made Henry of Navarre next heir to the throne, and excited to the utmost the fierce passions of the Guises and the League. The Parisian development of the League under the "sixteen" (1585), with its devotion to Henry, duke of Guise, and

its determination to exclude the heretic of Navarre, to depose the wavering Henry III., and to make Cardinal Bourbon king,—this, as well as the menacing attitude of Philip II. of Spain, forced Henry III. to draw towards his distant cousin Henry of Navarre. And so he was driven to desperation by the commanding position assumed by the house of Guise; and in 1588 Henry of Guise and his brother the cardinal were assassinated by his orders. Henry III. now found himself powerless; early in 1589 he again joined Henry of Navarre, and with him laid siege to Paris. There he was murdered by one Jacques Clement, a priest. With Henry III. ended the direct line of the house of Valois. In his young days he had been enthusiastic for learning and the new religious opinions; as he grew older he grew worse; and the last of the sons of Catharine de' Medici was perhaps the most debauched of the kings who hitherto had sat on the throne of France.

See *Mémoires de Tavannes; Mémoires de Vieilleville; Mémoires de Castelnau;* Brantôme, *Dames illustres Françoises; Mémoires du Duc de la Force;* Thuanus (De Thou), *Hist. sui temp. Libri CXXV.; Journal de l'Estoile; Mémoires de la Ligue; Art de vérifier les dates,* sér. ii., tom. vi.

HENRY IV. (1553–1610), king of France, was born in the castle of Pau in 1553, being son of Antony of Bourbon, king of Navarre and duke of Vendôme, and Jeanne of Albret. By his father he was tenth in descent from Saint Louis, and only a very distant cousin to his predecessor, Henry III. His mother, a grand and noble lady, brought him up as a Calvinist. His education was rough and hard, and fostered that originality of character which so marked his life; his military training was under the great captain, Gaspard of Coligny. In 1571 he was wedded to the daughter of Catherine de' Medici, Margaret of Valois; and on his mother's death in 1572 he became king of Navarre.

The massacre of St. Bartholomew found him in Paris; but his life was spared on his making a profession of Catholicism, which lasted till he succeeded in escaping from court in 1575. Thenceforward he became acknowledged head of the Huguenots, and by his dashing bravery kept life in their dispirited forces. No man was better fitted for such work; he had all the qualities of a guerilla leader, though he was not a great general. His success at Coutras (1587) and the joyousness and generosity of his character endeared him to his followers, while it secured the respect even of his opponents. After the death of Henry III. he was recognized as king of France by only a portion of the army then besieging Paris (August 4, 1589); the Catholic "Politiques" in the army stood aloof and disbanded; the Huguenots formed the only sound nucleus of his power. At Arques (1589) and Ivry (1590) he brilliantly defeated the Leaguers, and resumed the siege of Paris; Alexander of Parma, however, prevented him from taking Rouen (1592); much less could he take Paris. Finding affairs hard, and desiring to be a king and not a guerilla-captain, in 1593 Henry allowed himself to be converted to Catholicism. By this step he struck a deadly blow at the League and made powerless the intrigues of Philip II. For between the fanatical Catholics on one side and the Huguenots on the other lay the great bulk of Frenchmen; the "Politique" party had become more and more powerful, until at length it was felt to be the true national party. The only thing which kept it from Henry was the difference of faith; that barrier removed, all France at once joyfully accepted him as king. The Leaguers became almost a foreign body; the Huguenots gloomily accepted his triumph, bought, as they held, at cost of principle. After the battle of Fontaine-Française in 1595 the Spanish and Leaguers were driven out of Burgundy, and the recovery of Amiens from the Spaniards in 1596 secured Picardy and the northern frontier. The *Satire Ménippée*, published in 1593 and 1594, had already condemned the Leaguers as hirelings of the Spanish king; and in April, 1598, by the edict of Nantes Henry assured their position to his old Huguenot followers, while by the peace of Vervins (May, 1598), he ended the Spanish war, and took from the League its last source of strength.

After 1598 the energies of Henry IV. were given to the restoration of his country, which in nearly forty years of civil war had suffered terribly; the organizing genius of Maximilian of Bethune, duke of Sully, restored the finances; agriculture, manufactures, and commerce made marvellous advances. Henry also upheld the authority of France; in 1601 he acquired Bresse, Bugey, and Valromey from Savoy. He supported the Netherlands against Spain, and he was preparing a great army, which, in combination with the Dutch under Maurice of Nassau, was to interfere in the tangled Cleves-Juliers question, when he was assassinated by Ravaillac on the 14th of May, 1610. For his character see FRANCE, vol. ix. p. 499.

Henry IV. left no children by his first wife Margaret of Valois; by his second, Marie de' Medici, he had three sons and three daughters,—Louis, who succeeded him as Louis XIII.; a child who died in 1611; Gaston, duke of Orleans, the meanest of the race; Elizabeth, wife of Philip IV., king of Spain; Christine, wife of Victor Amadeus, duke of Savoy; and lastly Henriette Marie, queen of England, spouse of Charles I. He also left behind him several natural children, of whom the most celebrated was César, duke of Vendôme, son of the famous Gabrielle d'Estrées.

See Pierre l'Estoile, *Journal du Règne de Henri IV.;* Péréfixe, *Histoire du roi Henri le Grand;* Xivrey, *Recueil des lettres missives de Henri IV.* (1839–53); Palma Cayet, *Chronologie novennaire; Mémoires de Tavannes; Mémoires de Vieilleville; Mémoires de Castelnau;* Sully, *Œconomies royales;* Cimber and Danjou, *Archives curieuses; Art de vérifier les dates,* série ii., tom. vi. The reader is also referred to the documents cited by Von Ranke in his *Französische Geschichte,* and to Olivier de Serres's *Théâtre d'agriculture et mesnage des champs.*

(G. W. K.)

Of Portugal.

HENRY I. (1512–1580), king of Portugal, born at Lisbon, January 31, 1512, was the third son of Emanuel the Fortunate, was destined for the church, and in 1532 was raised to the archiepiscopal see of Braga. In 1542 he received the cardinal's hat, and in 1578, when he was called to succeed his grandnephew Sebastian on the throne, he held the archbishoprics of Lisbon and Coimbra as well as that of Braga, in addition to the wealthy abbacy of Alcobazar. As an ecclesiastic he was pious, pure, simple in his mode of life, charitable, and a learned and liberal patron of letters; but as a sovereign he proved weak, timid, and incapable. On his death in 1580 after a brief reign of seventeen months the male line of the royal family which traced its descent from Henry, first count of Portugal (c. 1100), came to an end, and all attempts to fix the succession during his lifetime having ignominiously failed, Portugal became an easy prey to Philip II. of Spain.

Of Castile.

HENRY I. (c. 1207–1217), king of Castile, son of King Alphonso "the Noble," by Eleanor, daughter of Henry II. of England, succeeded his father in 1214, and was killed by the falling of a tile in 1217, after a reign of only two years and nine months. He was succeeded by Ferdinand III., son of his sister Berenguela.

HENRY II. (1333–1379), king of Castile, surnamed *el Bastardo* or *de la Merced,* was one of the six illegitimate sons of King Alphonso "the Avenger," and consequently half-brother to Pedro the Cruel, who legally succeeded to the throne of Castile in 1350. His mother was Leonora de Guzman. The extraordinary series of cold-blooded murders which earned for Pedro his unenviable surname encouraged Henry, then known as count of Trastamara, to lead repeated rebellions, in which, with the aid of the French under Du Guesclin, and in spite of the opposition of the English under the Black Prince, he was ultimately successful in 1369. He immediately proceeded to direct his arms against the most formidable of his numerous enemies, King Ferdinand of Portugal, and by four campaigns, during the last of which he forced his way to the very gates of Lisbon (March, 1373), succeeded in establishing a favorable peace. At the same time he entered into a treaty with the king of Navarre, which subsisted, however, for only three years; in 1375 friendly relations with the king of Aragon were formed, which were cemented by the marriage of the daughter of the latter to Don Juan of Castile. The reign of Henry II., which was devoted rather to defensive than to aggressive warfare, was not marked by any of the usual exploits against the Moors, but it is distinguished in the annals of Castile by some noteworthy improvements in legislation and reforms in the administration of justice, sanctioned in the cortes of Toro in 1369 and 1372; and Spanish historians also mention with special pride the defeat of the English by the Spanish fleet at Rochelle in 1372. Henry died, of poison it is supposed, on May 30, 1379 and was succeeded by his son John (Juan) I.

HENRY III. (1379–1406), king of Castile, surnamed *el Doliente* (the sickly), succeeded his father John I. in 1390, when only eleven years of age. During his minority, the question of the regency not having been very clearly settled by his father, the kingdom was in a constant state of disturbance, bordering upon civil war; unable to satisfy the rival claims of Don Fadrique, Don Alonso, and the archbishop of Toledo, Henry at last resolved, minor as he was, to take the reins of government entirely into his own hands (1393). By energetic measures he succeeded within two years in quelling the turbulence of his nobles, in establishing his own popularity with the body of the people, and thus in effecting the pacification of his kingdom. The only foreign war during this reign was that with Portugal, which terminated in the peace of 1399; a great expedition against the kingdom of Granada, for which extensive preparations had been made, and for which large grants from the cortes held in Toledo in 1406 had been obtained, was brought to an abrupt termination by the death of Henry at that city on December 25 of the same year. It was during this reign that the sovereignty of the Canary Islands was assumed by Castile; and an interesting indication of at least a widening interest in foreign affairs was afforded by the mission of a solemn embassy to Tamerlane in 1401. Henry III. was succeeded by John II., his eldest son by Catherine of Lancaster, whom he had married in 1393. See Davila, *Historia de la Vida y Hechos del Rey Don Henrique Tercero de Castilla* (1638).

HENRY IV. (1425–1474), king of Castile, surnamed *el Impotente* (the impotent) and sometimes *el Liberal* (the spendthrift), the eldest son of John II. by his first wife Maria of Aragon, was born at Valladolid on January, 6, 1425. As prince of Asturias he took a prominent and generally an unfilial part in most of the disturbances of his father's reign; in 1445 a pitched battle between the king and the prince was prevented only at the last moment by the intervention of the clergy and some of the nobles; and peace was not finally secured until 1450 when Pope Nicholas V. issued his bull of excommunication against all those in the peninsula who, by perplexing the affairs of the sovereign, were disastrously helping the cause of the infidels. In 1440 Henry had in accordance with a treaty signed in 1436 been united to Blanche of Aragon; but this marriage, which had not been happy and which had given cause to many scandalous reports, he dissolved in 1453 shortly before his accession to the throne on his father's death in July of that year. He began his reign with a great show of energy against the Moors; but the boldness of his intentions contrasted strangely with the feebleness of his execution; and the unsatisfactory character of the results attained tended greatly to bring to a head the discontent which his indolent inattention to home affairs, his reckless extravagance, and the disorders of his private life had not failed to create. In 1465 occurred at Avila the extraordinary scene, so often described, of the king's deposition in favor of his brother Alphonso; this was followed in 1468, shortly after Alphonso's death, by the election of his sister Isabella, who, however, declined to accept the proffered crown. In the same year Henry was forced to repudiate his wife Joanna of Portugal and to disinherit her daughter Juana (la Beltraneja) whom he had unsuccessfully attempted to put forward as also his; and thus the succession became fixed in favor of Isabella, who was married to Ferdinand of Aragon in the following year. Henry died at Madrid on December 12, 1474.

For the events of the reign of Henry IV. the contemporary authorities are Alonso de Palencia and Diego Henriquez del Castillo, each of whom has left a *Cronica del Rey Don Enrique Quarto;* the best and at the same time the most accessible modern English account is to be found in Prescott's *History of the Reign of Ferdinand and Isabella*, part i., chaps. iii. and iv.

Of Navarre.

HENRY I. (*c.* 1210–1274), king of Navarre, surnamed *le Gros*, third count of Champagne, was the youngest son of Theobald of Navarre by Margaret of Foix, and succeeded his eldest brother Theobald II. in December, 1270. His proclamation at Pamplona, however, did not occur till March of the following year, and his coronation was delayed until May, 1273. After a brief reign, characterized it is said by dignity and talent, he died in July, 1274, suffocated, according to the generally received accounts, with his own fat. In him the male line of the counts of Champagne, kings of Navarre, became extinct. He was succeeded by his only legitimate child Joanna, born in 1270, by whose marriage to Philip le Bel in 1284 the crown of Navarre became for a time united to that of France.

HENRY II. (1503–1555), or Henri d'Albret, titular king of Navarre, born at Sanguessa in April, 1503, was the eldest son of Jean d'Albret by Catherine of Navarre; and on the death of the latter in exile in June, 1516, succeeded his parents in all their claims against Ferdinand the Catholic, assuming under the protection of Francis I. of France the title of king of Navarre. After the ineffectual conferences at Noyon (1516) and at Montpellier (1518), an active effort was made in 1521 to establish him in the *de facto* sovereignty; but the French troops which, under André de l'Esparre, had seized the country were ultimately expelled by the Spanish viceroy, the duke of Najera. Henry, who along with Francis was taken prisoner at the battle of Pavia (1525) but afterwards contrived to escape, married Margaret, the only sister of the latter, in 1526, and by her became the father of Jeanne d'Albret, the mother of Henry IV. of France. He died at Pau on May, 25, 1555.

HENRY III. of Navarre. See Henry IV. of France.

HENRY, Prince (1394–1460), of Portugal, surnamed "the Navigator," to whose enlightened foresight and perseverance the human race is indebted for the maritime discovery, within one century, of more than half the globe, was born at Oporto, on the 4th of March, 1394. His father was João I., under whose reign Portugal first began to recover from her subjugation by the Moors, and to assume a prominent position among the nations of Europe; his mother was Philippa, daughter of John of Gaunt. Prince Henry and his elder brothers, Duarte and Pedro, were sent out in 1415 on an expedition against the important Moorish city of Ceuta, which, after much hard fighting, they succeeded in taking in one day. All the princes distinguished themselves at the siege, but Prince Henry so pre-eminently that, but for his own entreaties, his father would have knighted him in precedence of his brothers. His renown after this became so high that he was invited severally by the pope, the emperor, and the kings of Castile (Juan II.) and England (Henry V.) to take the command of their respective armies. The prince, however, had set his mind on other and larger plans, involving no less than the hope of reaching India by the south point of Africa. To this end he had several encouragements: the geographical position of Portugal was in his favor; the large revenues of the order of Christ, of which he was grand-master, provided him with means; and he had contrived to gather important information from the Moors with regard to the coast of Guinea and the populous nations of the interior of Africa. Accordingly in 1418–19 he took up his abode on the extreme south-western point of Europe, the promontory of Sagres in Algarve, of which kingdom he was made governor in perpetuity, with the purpose of devoting himself to the study of astronomy and mathematics, and to the direction and encouragement of the expeditions which he proposed to send forth. There he erected an observatory, the first set up in Portugal, and at great expense procured the services of one Mestre Jacome from Majorca, a man very skilful in the art of navigation and in the making of maps and instruments to instruct the Portuguese officers in those sciences. An account has already been given of his principal explorations in the article Geography, vol. x. p. 161 (*q. v.*). At first his efforts seemed to be crowned with little success, and his various expeditions called down upon him much obloquy from the nobles, who complained of such an amount of useless expenditure; but on the prince vituperation fell harmless. The king died in 1438, and the troubles which followed occupied Prince Henry until 1440. In the following year Cape Branco was reached, and in 1443 intercourse was established with negro states in Senegal and Gambia. In 1442–3 Henry VI. of England conferred on the prince the riband of the order of the garter. In 1444–5 were discovered the river Senegal, Cape Verd, Cape St. Anne, Cabo dos Mastos, and the Rio Grande. During the later years of his life Gomez and others made important voyages of discovery in Prince Henry's service (see vol. x. p. 161). He died November 13, 1460, in his town on Cape St. Vincent, and was buried in the church of St. Mary in Lagos, but a year later his body was removed to the superb convent of Batalha. His great-nephew, King Dom Manuel, had a statue of him placed over the centre column of the side gate of the church of Belem. On July 24, 1840, a monument was erected to

him at Sagres at the instance of the Marquis de Sà da Bandeira.

The glory attaching to the name of Prince Henry does not rest merely on the achievements effected during his own lifetime, but on the stupendous subsequent results in maritime discovery to which his genius and perseverance had lent the primary inspiration. The sovereigns loyally continued what the prince had begun. The marvellous results effected within a century from the rounding of Cape Bojador in 1433 formed one unbroken chain of discovery, which originated in the genius and the efforts of one man. They were the stupendous issue of a great thought and of indomitable perseverance, in spite of twelve years of costly failure and disheartening ridicule. As Mr. Major, in his *Life of Prince Henry*, has justly said, "Had that failure and that ridicule produced on Prince Henry the effect which they ordinarily produce on other men, it is impossible to say what delays would have occurred before these mighty events would have been realized; for it must be borne in mind that the ardor, not only of his own sailors, but of surrounding nations, owed its impulse to this pertinacity of purpose in him."

HENRY THE LION (1129–1195), duke of Saxony and Bavaria, son of Henry the Proud, was born in 1129. After the death in 1139 of his father, who had been deprived of his possessions by Conrad III., the bravery and energy of his mother Gertrude and his grandmother Richenza secured to him the duchy of Saxony. Shortly after coming of age he at the diet of Frankfort in 1147 demanded also the restoration of Bavaria, but was refused, upon which, along with his uncle Welf VI., he made an unsuccessful attempt to seize it by force of arms. In 1154 he, however, received from Frederick I. the formal recognition of his claims to its possession, and in 1156 Henry Jasomirgott was compelled to deliver it up to him. Besides distinguishing himself in the wars of Frederick in Italy, Henry now devoted his energies to establishing his power in his own dominions, both by conquest and by encouraging agriculture and trade. He extended the boundaries of Saxony beyond the Elbe by successful battles against the Slavs, founded Munich in Bavaria, colonized Mecklenburg and Holstein, and fostered the growth of Hamburg and Lübeck. His ambitious projects and his arrogant bearing awakened, however, the hostility of several of the secular and ecclesiastical potentates, who in 1166 concluded a league against him at Merseburg, and a stubborn contest of two years' duration ensued, which was finally ended by Frederick in 1169 deciding at the council of Bamberg in Henry's favor. In February, 1168, Henry, having previously divorced Clementia of Zähringen, married Matilda, daughter of Henry II. of England; and, elated by such an influential alliance and by the increasing resources of his dominions, he shortly after his return from a pilgrimage to the Holy Land in 1172 began to manifest a tendency to treat the emperor with coldness and to revive the traditional rivalry of his race with the Hohenstaufens. He took no part in the Italian expedition of 1174, and in 1176 his sudden desertion of Frederick in the crisis of his struggle with the Lombard cities resulted in the disaster at Legnano. On Frederick's return from Italy in 1177 Henry was summoned to appear before him at the diet of Worms, and declining to do so he was placed under the ban of the empire, and his lands were divided among other princes. For more than a year he endeavored to resist the execution of the imperial decree, but he found it necessary at last, in November, 1181, to give in his submission to Frederick, who, on condition that he remained three years in England, agreed to reinstate him in the possession of Brunswick and Lüneburg. Having in 1189 refused to accompany Frederick on his crusade, he was again compelled to withdraw to England, but shortly after Frederick's departure he returned, and, concluding an alliance with the archbishop of Bremen, made a second attempt to recover his territories; but, though at first he gained several important victories, he was ultimately compelled in July, 1190, to conclude a peace at Fulda, which secured to him scarcely any advantages from the contest. Emboldened by the hostile alliance formed against the emperor Henry VI. in 1192, he again renewed the struggle; but after Richard of England fell into the hands of the emperor in the following year, he found it necessary again to give in his submission; and shortly afterwards a pledge of amity between the two houses was given through the marriage of the eldest son of Henry the Lion to Agnes, niece of Frederick I., and cousin of the reigning emperor. Henry died 6th August, 1195, at Brunswick, and was buried in the church of St. Blaise. Otto, his second son, became emperor under the title of Otto IV. A colossal statue of Henry was unveiled at Brunswick 4th July, 1874. Though ambitious, headstrong, and pugnacious, Henry showed that while he possessed no small skill in the art of war he could appreciate the arts of peace, and he gave a powerful impetus to the development of many important cities, and furthered with judicious sagacity the material prosperity of his kingdom.

See Böttiger, *Heinrich der Löwe*, Hanover, 1819; Prutz *Heinrich der Löwe*, Leipsic, 1865: Weiland, *Das Sächs. Herzogthum unter Lothar und Heinrich dem Löwen*, Greifswald, 1866; Philippson, *Geschichte Heinrichs des Löwen*, Leipsic, 2 vols., 1867–8; and the various biographies of Frederick I.

HENRY THE DEACON,—variously called of Cluny, because he was at one time a monk of that rule, of Lausanne, because he is believed to have first appeared as a preacher of repentance there, and of Toulouse, because his later years were passed in that city and neighborhood,—founder of the anti-sacerdotal sect of *Henricians*, was of Swiss or Italian extraction (his birthplace is unknown), and was born towards the end of the 11th century. About the year 1115 he abandoned the cloister, where he had entered the diaconate, and, burning with righteous indignation against the dead mechanical ceremonialism of the dominant church and the hideous moral corruption of its clergy, began to go about as an itinerant preacher. The neighborhood of Lausanne was probably the scene of his earliest appearances, but he soon betook himself to France, where the soil had been prepared for him by Peter of Bruis (leader of the Petrobrusians), and where he at once began to attract adherents. About the beginning of Lent in 1116 he asked and received permission of the bishop Hildebert of Le Mans (Cenomani) to visit that city; the fact that he was not only tolerated but received with some degree of honor at this time shows that he had not as yet fallen under serious suspicion of heretical pravity. Soon the extraordinary fascination of his character began to make itself felt; and the rude but convincing eloquence with which he exposed the immorality of the clergy rapidly alienated the people of the town from their spiritual guides: remonstrances and inhibitions by the local ecclesiastical authorities were equally vain; and when Hildebert, who had been absent in Rome, returned to his diocese, he found his episcopal blessing treated with contempt, and was bluntly told by his flock that they had found "a father, a priest, an intercessor, more exalted in authority, more honorable in life, more eminent in knowledge." From the confused accounts of Henry's life and labors which have reached us it does not appear that even then he had come forward as the teacher of any new or strange doctrine; his efforts as a reformer of public and domestic morals are chiefly insisted on, especially the measures he took for the reclamation of fallen women, for the encouragement of early and honorable marriage among the laity, and for the promotion of a higher standard of purity among the nominally celibate clergy. It was not as a heretic but merely as a somewhat inconvenient agitator that he was ordered by Hildebert at last to leave Le Mans. We next read of Henry as conspicuously active in Provence especially after the burning in 1124 of Peter of Bruis, with whose peculiar views he is alleged, upon evidence which has not reached us, to have entirely sympathized. In 1134 he was arrested by the bishop of Arles and taken to the council of Pisa; there he was declared to be a heretic, and condemned to imprisonment. This captivity, however, does not appear to have lasted long. The scene of the third and concluding chapter of the recorded life of Henry is laid at Toulouse, where after ten years of uninterrupted activity with the result complained of by Saint Bernard (*Ep.* 241) —"the churches are without flocks, the flocks without priests, the priests are nowhere treated with due reverence, the churches are reduced to the level of synagogues, the sacraments are despised, the festivals disregarded"—it was found necessary by Pope Eugenius III. to take active measures for the defence of the church. With this view the cardinal bishop Alberic of Ostia was sent as a legate to the disaffected districts, and with him was associated Bernard of Clairvaux. Their efforts were ultimately successful; Henry died an obscure death in prison about the year 1148, and his sect soon afterwards ceased to have any separate existence.

The original authorities upon this subject are the *Acta Episcoporum Cenomanensium* ("Gesta Hildeberti"), which have been published in Mabillon's *Anal. Vet.*, and Bernard's letter (*Ep.* 241) to Count Ildephonso of St. Gilles, written in 1147. From these sources the distinctive tenets of Henry and the Henricians (if distinctive tenets there were) cannot be gathered with any clearness. The probability is that Henry and his disciples had not any definite system of doctrine to oppose to that of the church, but were anti-sacerdotalists pure and simple, "insurgents, who shook the established government, but did not attempt to replace it by any new form or system of opinions and discipline." See Milman, *History of Latin Christianity*, bk. ix. c. 8; and Hahn, *Geschichte der Ketzer im Mittelalter* (1845).

HENRY OF GHENT. The scholastic writer generally known by this name was born probably about 1217 in the district of Mude, near Ghent. His family name seems to have been Goethals, but he is always described as Henry of Mude or of Ghent. Little is known of the details of his life. He studied at Ghent and then at Cologne under Albertus Magnus. After obtaining the degree of doctor he returned to Ghent, and is said to have been the first to lecture publicly in that city on philosophy and theology. Like most of the great doctors of the age, he was drawn to Paris by the fame of the university there. In 1247 he is known to have taught at Paris; and he was distinguished by the title of *doctor solennis*. He took an active part in some of the many disputes between the orders and the secular priests, and warmly defended the latter. He died at Tournay, of which place he was archdeacon, in 1293. His most important works, *Quodlibeta Theologica* and *Summa Theologiæ* have been printed, the first in 1518, the second in 1520. Several other writings remain in MS. Henry of Ghent occupies a somewhat remarkable place in the history of scholasticism. A contemporary of the great Aquinas, he opposed several of the dominant theories of the time, and united with the current Aristotelian doctrines a strong infusion of Platonism and mysticism. Only a few of the salient points of his doctrine can here be given; the line of thinking by which they are reached is elaborate and complex. He distinguishes between knowledge of natural objects and the divine inspiration or intuition by which we cognize the being and existence of God. The first, according to Henry, throws no light upon the second. Individuals are not constituted by the material element in them, but by the fact of their independent existence, *i. e.*, ultimately by the fact that they are created as separate objects. Universals must be distinguished according as they have reference to our minds or to the Divine mind. In the divine intelligence exist exemplars or types of the genera and species of natural objects. On this subject, however, Henry is far from clear; but it deserves notice that he defends Plato against the current Aristotelian criticism, and endeavors to show that the two views are in harmony. In psychology, his view of the intimate union of soul and body is truly remarkable. The body he regards as forming part of the very substance of the soul; through this union the soul is more perfect and complete.

There is a monograph on Henry by Fr. Huet, *Recherches historiques et critiques sur la vie, les ouvrages, et la doctrine de Henri de Gand*, Paris, 1838. See also Werner, *Heinrich von Gent als Repräsentant des Christlichen Platonismus im 13ten Jahrh.*, Vienna, 1878; Stöckl, *Phil. d. Mittelalters*, ii. 738–758; Jourdain, *Phil. de St. Thomas d'Aquin*, ii. 29–46; *Histoire littéraire de la France*, xx. 144 *sqq.*; also Hauréau, Tennemann, and the general histories.

HENRY OF HUNTINGDON, an English chronicler of the 12th century, born, it is likely, between 1080 and 1090, was the son of an ecclesiastic named Nicholas, who probably held the office of archdeacon of Huntingdon, to which Henry himself afterwards attained about 1120. The celibacy of the clergy not being enforced in England till 1102, this paternity was considered no disgrace, and our author in several passages of his writings refers to his father with much filial respect. Received as a mere child into the household of Robert of Bloet, bishop of Lincoln, Henry not only continued to enjoy the advantages of its culture and affluence till the bishop's death in 1123, but he also secured the patronage and friendship of Alexander of Blois, who next succeeded to the see. There is reason to believe that he accompanied Alexander to Rome, probably in 1125 and 1144, and it was to him that he dedicated his *Historiæ Anglorum*, which was issued four times during the author's life, and in the last form came down to the accession of Henry II. (1154). The date of the author's death has not been preserved, but it is probable that the close of his life is approximately marked by the close of his history.

Henry of Huntingdon's *Historiæ* was first printed by Savile, *Rerum Anglicarum Scriptores post Bedam* (London, 1586), and it was republished at Frankfort in 1603. Books i., ii., iv., v., and vi. were edited by Mr. Petrie for the Record Commission Collection, vol. i., 1848; and the whole work has been prepared for the Rolls Series by T. Arnold, 1880. An English translation by Thomas Forester forms a volume of Bohn's Standard Library (1853). We have besides from Henry's pen an Epistle to Henry I. on the succession of the Jewish, Assyrian, Persian, Macedonian, and Roman kings and emperors (written in 1130); an Epistle to Warin (one of his friends) containing an epitome of the British History of Geoffrey of Monmouth, which he had discovered at Bec in Normandy; and, better known than either, an Epistle to his friend Walter *On Contempt of the World or on Bishops and other Illustrious Men of the Age* (written in 1135, and edited by Wharton in his *Anglia Sacra*, 1691). Nor must Henry's poetical pieces be forgotten, as they speak well for his culture and taste. Two MS. copies of his complete works preserved at Lambeth deserve to be specially mentioned; and the British Museum possesses several important rescripts of the History. See Wright, *Biogr. Brit. Litt., Anglo-Norman Period*, 1846; Forester's Preface; James Gairdner, *Early Chroniclers of Europe: England* (1879); and Arnold's elaborate introductions.

HENRY, JOSEPH (1797–1878), an eminent American physicist, was born in Albany, the capital of the State of New York, on the 17th of December, 1797. He received his education at an ordinary school, and afterwards at the Albany academy, which enjoyed considerable reputation for the thoroughness of its classical and mathematical courses. On finishing his academic studies he contemplated adopting the medical profession, and prosecuted his studies in chemistry, anatomy, and physiology with that view. He occasionally contributed papers to the Albany institute, in the years 1824 and 1825, on chemical and mechanical subjects; and in the latter year, having been unexpectedly appointed assistant engineer on the survey of a route for a State road from the Hudson river to Lake Erie, a distance somewhat over 300 miles, he at once embarked with zeal and success in the new enterprise. This diversion from his original bent gave him an inclination to the career of civil and mechanical engineering; and in the spring of 1826 he was elected by the trustees of the Albany academy to the chair of mathematics and natural philosophy in that institution. In the latter part of 1827 he read before the Albany institute his first important contribution, "On some Modifications of the Electro-Magnetic Apparatus." Struck with the great improvements then recently introduced into such apparatus by Mr. William Sturgeon of Woolwich, he had still further extended their efficiency, with considerable reduction of battery-power, by adopting in all the experimental circuits (where applicable) the principle of Schweigger's "multiplier," that is, by substituting for single wire circuits, voluminous coils (*Trans. Albany Institute*, October 10, 1827, vol. i. pp. 22, 23). In June, 1828, and in March, 1829, he exhibited before the institute small electro-magnets closely and repeatedly wound with silk-covered wire, which had a far greater lifting power than any then known. Henry appears to have been the first to adopt insulated or silk-covered wire for the magnetic coil; and also the first to employ what may be called the "spool" winding for the limbs of the magnet. He was also the first to demonstrate experimentally the difference of action between what he called a "quantity" magnet excited by a "quantity" battery of a single pair, and an "intensity" magnet with long fine wire coil excited by an "intensity" battery of many elements, having their resistances suitably proportioned. He pointed out that the latter form alone was applicable to telegraphic purposes. A detailed account of these experiments and exhibitions was not, however, published till January 1, 1831 (Silliman's *Am. Jour. Sci.*, xix. 400–408). Henry's "quantity" magnets acquired considerable celebrity at the time, from their unprecedented attractive power,—one (August, 1830) lifting 750 pounds, another (March, 1831) 2300, and a third (1834) 3500.

Early in 1831 he arranged a small office-bell to be tapped by the polarized armature of an "intensity" magnet, whose coil was in continuation of a mile of insulated copper wire, suspended about one of the rooms of his academy. This was the first instance of magnetizing iron at a distance, or of a suitable

combination of magnet and battery being so arranged as to be capable of such action. It was, therefore, the earliest example of a true "magnetic" telegrapb, all preceding experiments to this end having been on tbe galvanometer or needle principle. About the same time he devised and constructed tbe first electromagnetic engine with automatic polechanger (Silliman's *Am. Jour. Sci.*, July, 1831, xx. 340–343; and Sturgeon's *Annals Electr.*, 1839, iii. 554). Early in 1832 he discovered the induction of a current on itself, in a long helical wire, giving greatly increased intensity of discbarge (Silliman's *Am. Jour. Sci.*, July, 1832, xxii. 408). In 1832 he was elected to the chair of natural philosophy in the New Jersey college at Princeton. In 1834 he continued and extended his researches "On the Influence of a Spiral Conductor in increasing the Intensity of Electricity from a Galvanic Arrangement of a Single Pair;" a memoir of wbich was read before the American Philosophical Society, February 6, 1835 (*Trans. Am. Phil. Soc.*, v. 223–231, n. s.). In 1835 he combined the short circuit of his monster magnet (of 1834) with tbe small "intensity" magnet of an experimental telegraph wire, thereby establisbing the fact that very powerful mechanical effects could be produced at a great distance by the agency of a very feeble magnet used as a circuit maker and breaker, or as a "trigger"—the precursor of later forms of relay and recciving magnets. In 1837 he paid his first visit to England and Europe. In 1838 he made important investigations in regard to tbe conditions and range of induction from electrical currents,—showing that induced currents, although merely momentary, produce still other or tertiary currents, and thus on through successive orders of induction, with alternating signs, and with reversed initial and terminal signs. He also discovered similar successive orders of induction in the case of the passage of frictional electricity (*Trans. Am. Phil. Soc.*, vi. 303–337, n. s.). Among many minor observations, he discovered in 1842 the oscillatory nature of the electrical discharge, magnetizing about a thousand needles in the course of his experiments (*Proc. Am. Phil. Soc.*, i. 301). He traced the influence of induction to surprising distances, magnetizing needles in the lower story of a house through several intervening floors by means of electrical discharges in the upper story, and also by tbe secondary current in a wire 220 feet distant from the wire of tbe primary circuit. Tbe five numbers of his *Contributions to Electricity and Magnetism* (1835–1842) were separately republished from tbe *Transactions*. In 1843 he made some interesting original observations on "Phospboroscence" (*Proc. Am. Phil. Soc.*, iii. 38–44). In 1844, by experiments on tbe tenacity of soap-bubbles, he showed that the molecular cohesion of water is equal (if not superior) to tbat of ice, and hence, generally, that solids and their liquids have practically the same amount of cohesion (*Proc. Am. Phil. Soc.*, iv. 56, 57, and 84, 85). In 1845 he sbowed, by means of a thermo-galvanometer, that the solar spots radiate less heat than the general solar surface (*Proc. Am. Phil. Soc.*, iv. 173–176).

In December, 1846, Henry was elected secretary and director of the Smitbsonian Institution, then just established. While closely occupied with tbe exacting duties of that office, he still found time to prosecute many original inquiries,—as into the application of acoustics to public buildings, and the best construction and arrangement of lecture-rooms, into the strength of various building materials, etc. Having early devoted much attention to meteorology, both in observing and in reducing and discussing observations, he (among his first administrative acts) organized a large and widespread corps of observers, and made arrangements for simultaneous reports by means of the electric telegraph, which was yet in its infancy (*Smithson. Report* for 1847, pp. 146, 147). He was tbe first to apply the telegraph to meteorological research, to have the atmospberic conditions daily indicated on a large map, and to utilize the generalizations made in weather forecasts, and the first to embrace a continent under a single system,—British America and Mexico being included in the field of observation. In 1852, on the reorganization of the American lightbouse system, he was appointed a member of tbe new board; and on the resignation of Admiral Sbubrick as its chairman, Henry, in 1871, became tbe presiding officer of the establishment—a position he continued to hold during the rest of his life. His diligent investigations into the efficiency of various illuminants under differing circumstances, and into tbe best conditions for developing their several maximum powers of brilliancy, while greatly improving the usefulness of the line of beacons along tbe extensive coast of tbe United States, effected at the same time a great economy of administration. His equally careful experiments on various acoustic instruments also resulted in giving to bis country the most serviceable system of fog-signals known to maritime powers. In the course of these varied and prolonged researches from 1865 to 1877, he also made important contributions to the science of acoustics; and he establisbed by several series of laborious observations, extending over many years and along a wide coast range, the correctness of Professor Stokes's hypotbesis (*Report Brit. Assoc.*, 1857, part ii. 27) that tbe wind exerts a very marked influence in refracting sound-beams. The complex conditions of such acoustic refraction he found to be exceedingly variable and curious (*Report American Lighthouse Board*, 1874, 1875, and 1877). From 1868 Henry continued to be annually chosen as president of the National Academy of Sciences; and he was also president of tbe Pbilosopbical Society of Washington from tbe date of its organization in 1871.

Henry was by general concession the foremost of American physicists. He was a man of varied culture, of large breadth and liberality of views, of generous impulses, of great gentleness and courtesy of manner, combined with equal firmness of purpose and energy of action. He died at Washington, May 13, 1878. (S. F. B.)

HENRY, Matthew (1662–1714), the author of the well known and justly popular *Exposition of the Old and New Testaments*, was born at Broad Oak, a farm-house on the confines of Flintshire and Shropshire, on the 18th of October, 1662. He was the son of Philip Henry, one of the 2000 ministers who were ejected from their livings in 1662 for refusing to conform to the Act of Uniformity. Unlike the majority of his fellow-sufferers, Philip Henry, who through his life was the possessor of private means, was spared all personal privation or hardship, as the consequence of his nonconformity, and was thus enabled to give a good education to his son. Having received his preliminary education from his father and a tutor named Turner, Henry was next removed to an academy at Islington, whence he proceeded to become a student of law at Gray's Inn. His legal studies, however, had not advanced far when he relinquished them for theology, to wbich he thenceforth devoted himself. In 1687 he became minister of a Presbyterian congregation at Chester, whence in 1712 he was translated to Hackney. Two years later (June 22, 1714), he died suddenly of apoplexy at Nantwich, while on a journey from Chester to London. Henry's *Exposition*, the work by which he is now chiefly remembered, is a commentary of a practical and devotional rather than of a critical kind, ranging over the whole of the Old Testament and extending into the New as far as to the end of the Acts. At this point it was broken off by the author's death, but the work was finished by a number of clergymen, whose names are recorded in most editions of the book. In a critical point of view, it may be said to be quite valueless; yet its unfailing good sense, its discriminating thought, its high moral tone, its simple piety, and its altogether singular felicity of practical application, combine with the well-sustained flow of its racy English style to secure for it, and deservedly, the foremost place among works of its class.

Besides the *Exposition*, Matthew Henry wrote a *Life of Mr. Philip Henry; The Communicant's Companion; Directions for Daily Communion with God; A Method for Prayer;* and *A Scriptural Catechism*, all of which, along with numerous sermons, have been frequently reprinted, both separately and in complete editions of his *Miscellaneous Works*. His life has been written by W. Tong (London, 1816), by Davis (prefixed to *Exposition*, ed. 1844), by Hamilton, (*Christian Biography*, 1853), by C. Chapman (1859), and by J. B. Williams (1828, new ed. 1865).

HENRY, Patrick (1736–1799), an American statesman and orator, was born at Studley, Hanover county, Virginia, May 29, 1736, the second son in a family of nine children. His father, John Henry, an emigrant from Aberdeen, Scotland, was a nephew of Robertson the historian, and had risen to some eminence in the county, filling the offices of surveyor and presiding magistrate. Patrick Henry was educated at a little school near his home; and, after the age of ten, by his father, who had opened a grammar school at his residence. In early life he showed no marked proficiency in his studies, except perhaps in mathematics, but was noted chiefly for a love of outdoor sports. At fifteen he became clerk in a country store; and at sixteen he entered into partnership as storekeeper with his elder brother, but the business was unsuccessful, and a second attempt at storekeeping ended likewise in failure. Meanwhile the indifference to learning which marked his boyhood was replaced by a love of history, especially that of Greece and Rome; and his habitual indolence was overcome by his admiration for Livy, whose history he thenceforth read through once every year. At twenty-four, by his admission to the bar, Henry entered on the career that eventually brought him fame and fortune, although his income for some years was in keeping with his lack of previous preparation. At twenty-seven he won his first triumph, as counsel for the collector of the county, in what became known as "the parson's cause." His unexpected

display of eloquence on the side of the people procured him an extravagant recognition and the title of "the orator of nature." Business poured in upon him, his popularity concealing his deficiencies; and his success was assured. In 1765 he was elected to the House of Burgesses, where he distinguished himself as the author of certain resolutions against the Stamp Act, the last of which,—providing that "the General Assembly of this colony have the sole right and power to lay taxes and impositions upon the inhabitants of this colony,"—though passed by a majority of only one, was the key-note of the struggle for independence. In 1769 he was admitted to practice in the general court, where he attained eminence in criminal cases before juries. In 1773 he was a member of the "committee of correspondence for the dissemination of intelligence between the colonies." In the following year he was chosen delegate to the Virginia convention, which was the first public assembly to recommend an annual "General Congress," and to the "Old Continental Congress;" but his success there as an orator failed to conceal his defects as a practical statesman. In 1775, in the Virginia convention, he delivered a remarkable speech in moving that the "colony be immediately put in a state of defence," and at the head of a body of militia he forced the royal officials to pay £330 for powder clandestinely removed by order of Governor Dunmore. He was appointed by the convention colonel of the first regiment and commander of all the forces to be raised in Virginia, but a misunderstanding with the "committee of safety" led to his resignation. He was a member of the second Continental Congress of 1775, and of the Virginia convention of 1776, which had been elected "to take care of the republic," the royal governor having fled. They framed a new constitution, and elected Henry the first republican governor, on the first ballot. He was re-elected in 1777 and 1778. In 1780 he became a member of the legislature, where he continued until he was again elected governor in 1784. In 1786 he withdrew through the pressure of debt, having "never been in easy circumstances." In 1787 he was chosen a delegate to the "Federal Constitutional Convention," but did not attend. He had resumed his practice to better his fortunes. In 1788 he was a delegate to the Virginia convention for ratifying the Federal Constitution, which he vehemently opposed as dangerous to the liberties of the country. In 1791 he declined re-election to the legislature, continuing, "through necessity rather than choice," the practice of the law, but usually in great and remunerative cases only. Finally, in 1794, having not only paid his debts but secured affluence, he withdrew to private life. In 1795 he declined the position of secretary of state in Washington's cabinet, in 1796 the nomination for governor of Virginia, and in 1797 the mission to France, offered by President Adams. In 1799, however, he suffered himself to be elected to the State legislature, where he wished to oppose what he deemed the dangerous doctrine of the Virginia resolutions of 1798; but he did not take his seat, his death occurring on the 6th June. Henry's manners were plain, his temper cheerful, and his habits temperate. His eloquence, of which some fragmentary specimens have become household words among his countrymen, was vivid and startling. Almost entirely a gift of nature, it was equal to every occasion, and, with the aid of a clear voice and perfect articulation, it was of marvellous power in bringing his hearers to a quick decision.

HENRY, Robert (1718–1790), the author of the *History of Great Britain written on a new plan*, was the son of a farmer, and was born in the parish of St. Ninians near Stirling, 18th February, 1718. He received his early education at the school of his native parish, and at the grammar school of Stirling, and after completing a course of study at Edinburgh University became master of the grammar school of Annan. In 1746 he was licensed to preach by the Annan presbytery, shortly after which he was chosen minister of a Presbyterian congregation at Carlisle, where he remained until 1760, when he was removed to a similar charge at Berwick-on-Tweed. It was during his stay at Berwick that the idea of his *History* first occurred to him, but the dearth of books and the difficulty of consulting original authorities compelled him to postpone the execution of his design till his removal to Edinburgh, as minister of New Greyfriars, in 1768. The first volume of his *History* appeared in 1771, and the others followed at irregular intervals until 1785, when the fifth was published, bringing down the narrative to the Tudor dynasty. The work was virulently assailed by Gilbert Stuart, but the attack was overdone, and although it for a time hindered the sale, the injury effected was only temporary. For the volumes published in his lifetime Henry realized as much as £3300, and through the influence of Lord Mansfield he was in 1781 rewarded with a pension of £100 a year from George III. In 1784 he received the degree of D. D. from the university of Edinburgh. He died in 1790 before his tenth volume was quite ready for the press. Four years after his death it was published under the care of Malcolm Laing, who supplied the entire chapters v. and vii., and added an index. A life of the author by Sir Henry Wellwood Moncreiff was prefixed to the volume. The novel feature in Henry's *History* was that he combined with the narrative of the great political events of each era an account of the domestic state and social progress of the people within the same period. His researches were conducted with great care, and his work embodies much novel and curious information; but the comprehensiveness of his plan, and the limited character of the historical sources then available, greatly militated against the accuracy of his narrative. Notwithstanding also that the work is well arranged, and written with clearness and simplicity, its defects as an authority are not compensated for by any peculiar excellences of style, by originality or vigor of reflection, or by any special skill in the delineation of character.

A Continuation of Henry's History to the Accession of James I., by J. Petit Andrews, appeared in 1796. An account of the attack of Gilbert Stuart on Henry is given in Disraeli's *Calamities of Authors*.

HENRY, William (1775–1836), a distinguished chemist, son of Thomas Henry, an apothecary and author of some works on chemistry, was born at Manchester, December 12, 1775. After completing his education at an academy in Manchester, he was for some years private secretary to a physician, and in 1795 he began the study of medicine at the university of Edinburgh. Prudential considerations compelled him, however, to interrupt his studies at the conclusion of his first session, and he did not resume them till 1805, two years after which he received the diploma of M. D. For some time he practised as a physician in Manchester, but on account of delicate health, caused by an accident, he was ultimately compelled to retire from his profession. He nevertheless carried on his original researches in chemistry, for which he found great facilities in connection with his father's business, and from 1797 till his death he continued to enrich the *Transactions* of the Royal Society with contributions on his favorite science, especially in regard to aeriform bodies. His first communication was an attempt, in opposition to Austin, Beddoes, and others, to establish the title of carbon to rank among the elementary bodies, but discovering afterwards a fallacy in his reasoning he corrected it in a subsequent paper. In 1800 he published in the *Philosophical Transactions* his experiments on muriatic acid gas, made with the view of disengaging an imaginary unknown element supposed to be associated with oxygen in the composition of the gas; but after the discovery of the real nature of the acid by Davy he was one of the earliest converts to the new theory. In 1803 he published his elaborate experiments on the quantity of gases absorbed by water at different temperatures and under different pressures, with the result of establishing the law that "water takes up of gas, condensed by one, two, or more additional atmospheres, a quantity which would be equal to twice, thrice, etc., the volume absorbed under the common pressure of the atmosphere." In 1808 he described in the *Philosophical Transactions* a form of apparatus adapted to the combustion of larger quantities of gases than could be fired in eudiometric tubes. In the same year he was chosen a fellow of the Royal Society; and in 1809, for his valuable contributions to the *Transactions* of the society, he was awarded the Copley gold medal. For the next fifteen years he continued his experiments on the gases, making known the results of them from time to time to the society. In his last communication, in 1824, he claimed the merit of having conquered the only difficulty that remained in a series of experiments on the gaseous substances issuing from the destructive distillation of coal and oil, and proved the exact composition of the fire-damp of mines. But though Henry's experiments had reference chiefly to aeriform bodies, his acquaintance with general chemistry is proved by his *Elements of Experimental Chemistry*, a work which com-

bines great literary elegance with the highest standard of scientific accuracy. He had also collected materials for a history of chemical discovery from the middle of last century, but did not live to carry out the project. It is indeed to be regretted that he did not contribute more to the literature of science. His biographical notices of Priestley, Wollaston, and Davy may be regarded as models in that species of composition. At intervals during his lifetime Henry suffered much from neuralgic pains. These became so severe as to render the extirpation of the principal nerves of the hand necessary, but this failed to afford the expected relief; and ultimately the irritation of the whole nervous system deprived him of sleep, and caused his death on September 2, 1836.

HENRYSON, Robert (c. 1425–c. 1506), one of the early Scottish poets, and the author of the first specimen of the pastoral poetry of his country, is usually designated schoolmaster of Dunfermline; and according to tradition he was the ancestor of the family of Henryson or Henderson of Fordell, in the county of Fife, one of whom, James Henryson, was king's advocate and justice-clerk in 1494. Of the poet's parentage and early history, however, no certain information can be discovered. From various circumstances known about him he must have been born about the year 1425. He seems to have been educated abroad, as his name does not appear in the registers of the university of St. Andrews, the only one then existing in Scotland; and from an allusion in one of his poems, his attention was probably given to the study of law. In 1462 his name appears in the list of members of the newly-founded university of Glasgow as "Magister Robertus Henrysone in artibus licentiatus et in decretis Bachalarius." Henryson seems, in addition to teaching, to have practised at Dunfermline as a notary public. His decease in or shortly before 1506 is alluded to by Dunbar, who, in his lament for the "makaris" or poets, says of Death—

"In Dunfermline he hes done roun
Gud Maister Robert Henrisoun."

Of the writings of Henryson that have come down to the present time, his *Testament of Cresseid* may be considered the chief. It was composed as a continuation or supplement to Chaucer's *Troilus and Creseide*, which was one of the most popular poems in the English language. Henryson resumes the story where Chaucer leaves off, and completes it by inflicting a suitable punishment on the false Creseide. This continuation displays so much skill that it has been included in all the early editions of Chaucer, as if it had been the work of that poet himself. Another poem, *Robene and Makyne*, though short, is remarkable as the first known specimen of pastoral poetry in the Scottish language, while his *Bludy Serk*, is amongst the oldest examples of ballad poetry. His metrical version of thirteen of the *Fables of Æsop* is perhaps the best known of his works. To each fable is appended an application or moral. In these he alludes to the oppressions of the people and the unsettled state of the country during the feeble reign of James III. His classical *Tale of Orpheus*, though a languid performance, exhibits his familiarity with the scholastic learning of his time. Several of the poems of Henryson have been preserved in the Asloan MS. in the Auchinleck Library, the Bannatyne MS. in the Advocates' Library, Edinburgh, the Maitland MS. in the Pepysian Library, Cambridge, and the Harleian MSS., British Museum. His *Orpheus and Eurydice* was printed at Edinburgh by Chepman & Myllar in 1508. The *Testament of Cresseid* was printed at Edinburgh by Henry Charteris in 1593. The poem of *Robene and Makyne* and the *Testament of Cresseid* were reprinted for the Bannatyne Club in 1824. The *Moral Fables* were printed at Edinburgh by Lekprevik in 1570, at London by R. Smith in 1577, and again at Edinburgh by Andrew Hart in 1621. This last edition was reprinted for the Maitland Club in 1832. A collected edition of the works of Henryson, leaving nothing to be desired, was printed at Edinburgh in 1865, under the editorial care of Dr. David Laing.

HENSLOWE, Philip, a contemporary of Shakespeare, whose name continues of interest from his intimate association with the history of the theatre during the great dramatist's career. Originally, it would appear, a dyer and afterwards a starch maker, and ready to turn to any profitable speculation, he probably began his connection with the stage in 1584 by becoming "joint lessee of the Rose theatre on the Bankside, or of the ground on which it stood." From 1591 to his death in 1616 he was in theatrical partnership with the more famous Edward Alleyn, who in 1592 married his step-daughter Joan Woodward. In 1613 he was appointed sergeant of the king's bear-garden, to take charge of a lion and certain other beasts, presented by the duke of Savoy. Henslowe's business diary from 1593 to 1609 has happily been preserved in Alleyn's College at Dulwich, and, though evidently the work of an ignorant man, it is of prime importance for its miscellaneous store of items in regard to the first appearance of plays, the sums paid to the authors, the theatre receipts, and so on. It was edited for the Shakespeare Society in 1841 by J. Payne Collier, who, however, found that the MS. had suffered considerable mutilation at the hands of miscreant autograph hunters since the time when it was employed by its original discoverer Malone. See Alleyn.

HENZADA, a district in Pegu division, British Burmah, lying between 16° 49′ and 18° 30′ N. lat., and between 94° 51′ and 96° 7′ E. long., with an area of 4047 square miles. It is bounded on the N. by the Prome district, on the E. by the Pegu Yomas, on the S. by Rangoon, Thonkhwa, and Bassein districts, and on the W. by the Arakan Yoma range. Henzada district stretches from north to south in one vast plain, forming the valley of the Irawadi, and is divided by that river into two nearly equal portions. This country is protected from inundation by immense embankments, so that almost the whole area is suitable for rice cultivation. The chief mountains are the Arakan and Pegu Yoma ranges. The greatest elevation of the Arakan Yomas in Henzada, attained in the latitude of Myan-oung, is 4003 feet above sea-level. Numerous torrents pour down from the two boundary ranges, and unite in the plains to form large streams, which fall into the chief rivers of the district, viz., the Irawadi, Hlaing, and Bassein. The forests comprise almost every variety of timber found in Burmah.

The inhabitants of Henzada district in 1876 numbered 501,213. The number of immigrants into the district during the ten years ending 1876 was 90,797. The chief occupation of the people is agriculture. Nearly all the large towns are on the right bank of the Irawadi. The chief towns have populations as follows:—Henzada, 15,307; Kyan-kheng, 8761; Myan-oung, 5859; and Meng-gyí, on the left bank of the Irawadi, 15,770. The staple crops of the district are rice, sesamum, cotton, and tobacco. The total area under cultivation in 1876 was 363,048 acres. The other products are cotton, indigo, oil-seeds, pease and pulses, cocoa and betel nuts, *pán*-vine, etc. The revenue in 1876–77 was £132,733. In 1876 the police force consisted of 400 men.

The district was once a portion of the Talaing kingdom of Pegu, afterwards annexed to the Burmese empire in 1753, and has no history of its own. During the second Burmese war, after Prome had been seized, the Burmese on the right bank of the Irawadi crossed the river and offered resistance to the British, but were completely routed. Meanwhile, in Tharawadi, or the country east of the Irawadi, and in the south of Henzada, much disorder was caused by a revolt, the leaders of which were, however, defeated by the British, and their gangs dispersed.

HEPATICA. See Liverwort.

HEPHÆSTION, son of Amyntor, a Macedonian of Pella, is celebrated as the friend of Alexander the Great. The two, according to Quintius Curtius (iii. 12), were companions in childhood, but beyond this old-standing connection we find no evidence of such qualities in Hephæstion as deserved the passionate attachment of Alexander. The king, however, seems never to have been blind to his real character, and to have made a marked distinction between him, as the friend of his private life and his leisure hours, and such men as Craterus, whom he could entrust with important enterprises. We do not hear again of Hephæstion till 334 B. C., when he accompanied the king on his visit to Troy. Many tales are told of the close intimacy subsisting between them; for example, Plutarch says that, when a letter of very delicate and private nature from Olympias was handed to Alexander, Hephæstion according to his custom was reading it over his shoulder, when Alexander without uttering a word took his ring off his finger and pressed it on his friend's lips. In the later campaigns of Alexander in Bactria and India, we find Hephæstion charged with important commands. He was rewarded with a golden crown and the hand of Drypetis, the daughter of Darius and sister of Alexander's own wife Statira (324 B. C.). In the end of the same year he died very suddenly at Ecbatana. Alexander tried to relieve his grief by paying the most extravagant honors to his friend. A general mourning was ordered over Asia; at Babylon a funeral pile was erected at a cost of 10,000 talents; and temples were erected to him as a hero.

HEPHÆSTION, a grammarian of Alexandria, author

of a work on Greek metres called ἐγχειρίδιον περὶ μέτρων. This work is most valuable as the only complete work on the subject that has been preserved. The author is probably the same as the grammarian that acted as tutor to the emperor Verus about 150 A.D.

HEPHÆSTUS, a word of uncertain derivation but certainly pre-Greek in formation (Kuhn, *Zeitschr.*, v. 214), denotes among the Greeks a god who represents the power of fire and its appliance in the operations of daily life, corresponding to the Latin Vulcan. A clear distinction must be drawn between the Hellenic god and the deity worshipped by the Pelasgic races. Though the word Hephæstus is used by Homer in the sense of fire, yet in the Hellenic god no elemental idea is at all prominent. The Hellenic religion had raised itself far above such conceptions of the divine power, and its gods were moral powers. Zeus, the ruler of the world, whose will, according to the finest Hellenic conception, is fate, is surrounded by a court in which Hephæstus appears as the divine artificer, an object rather of laughter than of respect to the other gods. No worship was paid him, for his altar at Olympia seems not to have been an ancient institution. The fire of the hearth, as the centre of family and city unity, is now personified under a purely Greek name, Hestia; but here again it is not the elemental but the moral conception that is the predominant idea in the goddess (see HESTIA). The similarity between the divine artificer of the Greeks and the Finnish Ilmarine or the German Wieland, who has degenerated finally into the Wayland Smith of Scott's *Kenilworth*, has been often pointed out, and the starting-point of them all is the smith who makes the new sun every morning (see Mannhardt, *Zeitschr. f. Ethnol.*, 1875, p. 221). The round disk of the sun has in poetic treatment become the shield of Achilles, whose fabrication is the great deed of Hephæstus in the *Iliad*. This artificer is naturally represented as married to the dawn, Aphrodite or Charis (see GRACES), as Wieland marries the Swan-maiden; and the girdle of Aphrodite which Hephæstus made is the halo of rays that heralds the rising sun. All wonderful works came to be attributed to the divine smith; in particular the house of the gods has been made by Ilmarine and by Hephæstus; and they also, like Wieland, have made metal figures that move and almost equal living beings. In general the art of working metals by the hammer is under his patronage—a fact which points out this art as one of the very oldest known to the race (Conze, *Götter- und Heroen-Gestalten*, s. v.). In local traditions a set of elfish creatures like the Idæan Dactyls or the dwarfs in German legend were often put in place of this divine smith. The belief which in Lipara and Strongyle was associated with Hephæstus, that any one that put a lump of iron in a certain spot at night found next morning the article he wished ready made, provided he paid the required price, is in some parts of Germany attached to a corresponding set of dwarfs. An ill-omened character often attached to the works of Hephæstus, as to that of the Telchines or the German dwarfs. Other points in the Hellenic Hephæstus can be explained only by a reference to the worship of the older Pelasgic tribes. When Homer (*Il.*, i. 569) says that he was hurled by his father Zeus down to the earth, the reference to the lightning is unmistakable (Welcker, *Gr. Gött.*, i. 661). Again the weak legs always attributed to Hephæstus remind us of the serpent legs of his son Erichthonius; and serpents occur often as symbols of lightning. Homer (*l. c.*) says that Hephæstus fell on Lemnos, whose inhabitants tended him; he evidently considers that the Hellenic deity was identical with the Pelasgic god. Wherever a Pelasgic race is most certain, there the god is found, associated with the Cabiri: he is the Cabirus *par excellence* (Herod., vi. 138). Among these tribes the power of fire was considered the life-giving and reproductive power of nature, and the deity in whom it was embodied became the chief object of their worship. Hence on the coins of Imbros an ithyphallic Hephæstus appears. As Greek influence prevailed among the kindred Pelasgic tribes, their native worship survived in the form of mysteries, and their proper gods, whose nature was revealed to the initiated, became in popular tradition heroic or demoniac figures who were the founders of the mysteries (v. HARMONIA, and comp. Lenormant in D'Aremberg's *Dict. des Antiquités*, art. "Cabeiri"). This Hephæstus or Cabirus is the lightning that has descended to earth and become there the origin of all life, and according to Pindar (*Fr.* 162) the first man. The original conception, vague and wide like all primitive ideas, is that the heavenly and the subterranean fire are identical with the fire on earth. In both thunderstorm and dawn the fire of the sun is relighted after being for a time extinguished. In both the alternation of light and darkness was the prominent fact. In the thunderstorm the sparks emitted from the sun descend as the lightning to earth. This original power of fire has been developed in various ways; the higher thought of the Greeks rejected such a naturalistic deity as the Pelasgic found congenial, while in Athens, where the Pelasgic element was very strong, Hephæstus occupied a correspondingly high place, and is in close relationship with Athene. In many ceremonies, as the Lampadephoria, they were associated; and at the Apaturia honor was paid to Zeus Phratrius, Athene, and Hephæstus. In the oldest traditions they were perhaps married, and their son Erichthonius was the parent of the Athenian people. When the Hellenic conception of the maiden-goddess Athene prevailed, this connection was transformed into an unsuccessful attempt of Hephæstus at a union with Athene. But the marvellous birth of Erichthonius is an ancient feature, as it occurs in Vedic tradition (Kuhn, *Zeitschr.*, i. 443).

Small images of Hephæstus stood on every hearth at Athens, and the Amphidromia round the hearth-fire was the rite whereby the newly-born child was adopted into the family. In the oldest Greek art Hephæstus is a bearded man fully clad, carrying a hammer. This hammer, which the Cabirus of Thessalonica carries, is doubtless in its origin, like the hammer of Thor, the thunderbolt or hammer with which was shattered the tower where the sun was hid during the winter darkness. An undignified and comic character is, however, often apparent, when he wears short, workman's clothes, and wants the dignity proper to a god. The ruling type in later art is a bearded man with a certain resemblance to Zeus, wearing a close cap, carrying the traditional hammer, and clad in a short, girt tunic which leaves the left shoulder free. (W. M. RA.)

HERA, a word of which many different derivations have been proposed, is the name of a Greek goddess, corresponding to the Latin Juno, who according to the conventional type is the wife of Zeus and queen among the gods of Olympus. In the literature of the Greeks Hera fills a very conspicuous place—the strong, haughty, and rebellious character, full of intense hatreds and likings, which was associated with her, made her a picturesque and dramatic figure. According to this conception of her, she was daughter of Cronus and Rhea, and at once sister and wife of Zeus. She was always the bitter enemy of all the heroines who were the successive objects of her husband's love, and her persecution of them and of their children often forms the theme of poets from the *Iliad* (xxiii. 119) downwards. This type, which is the familiar one in all literature, had never any real existence in religion; but had been gradually elaborated by poets from the actual deity worshipped in various parts of Greece, and from the legends transmitted to the Greeks from earlier races.

The most characteristic and fundamental point in the worship of Hera is the ἱερὸς γάμος, her marriage with Zeus; and from this any explanation of the conception involved in the goddess must start. Again in Greek legend we learn that a close connection exists between Hera and the cow, and that probably she was originally thought to have the form of a cow. These facts at once direct us to the ancient Aryan idea, described in detail by Gubernatis (*Zoolog. Mythol.*, i.), that the divine power as the origin of all life is embodied in a pair of gods male and female, whose fertility leads to the conception of them as a bull and a cow. This pair, the bull and the cow, appear in various fantastic developments in Greek legend. For example, Zeus himself in the form of a bull carries off Europa; and we learn from Hesychius that Europia is an epithet of Hera. Looking at the matter from this point of view, we find that the question so much disputed among mythologers, whether the naturalistic conception out of which the Greek goddess has developed be earth or moon, is a mere matter of words, and that there is no real discrepancy between the two views. The free and vague conceptions of primitive men refuse to be shut into the precise circumscribed terminology of modern thought. Ideas which to us are very different were once expressed by the same root (see Curtius, *Grundz.*, iii. 284, No. 415). Thus we have in the *Rig Veda*, vi. 51, 5, a clear trace of the view so common in all mythologies, whether in the theogony of Hesiod or of the New-Zealanders, that Heaven and Earth are the primitive pair of

deities, parents of all existence and first of the gods. This view is of peculiar importance in old Roman religion (*cf.* Schwegler, *Röm. Gesch.*, i. 328, 422, etc.), and also among the older Pelasgic tribes of Greece. But this same divine power the primitive Aryans beheld in all the great operations of nature; in each they saw the prototype of all earthly works, and in seeking here the origin of life, they found it in the same divine pair, the bull and the cow. In particular, the various alternations of light and darkness appealed to their minds most strongly, and occupy great part of their mythology. In the transitions between light and darkness, and especially in the struggle between night and day, the idea of a pair is not so prominent; and in legends the marriage of moon and sun does not figure very conspicuously. Yet we sometimes find the marriage of the moon and sun described exactly in the way of this *ἱερὸς γάμος*. In *Rig Veda*, x. 85, it is the type of all earthly marriage (see Weber, *Ind. Stud.*, v. 178). A Slavonic story makes the marriage of moon and sun annual; they part every winter and meet again in the first days of spring; and a Lettish song makes the marriage of moon and sun in spring (Mannhardt in *Zft. f. Ethnol.*, 1875, p. 316). The moon too is often symbolized as a cow. The mystic union takes place in the spring when life returns to the earth, and the voice of the cuckoo is heard in the land. Hence in the legend Zeus, enamored of his sister Hera, is said to have flown to her in the form of a cuckoo dripping wet, and to have been in pity received into her bosom. In various parts of Greece where traces of the ruder tribes are strongest, there remains a coarser conception of this union, and in the popular accounts the marriage customs of the country are reflected (see Welcker, *Gr. Götterl.*, i. 364 *ff.*). Lectum in the Trojan Ida and Ocha in Eubœa, on the summits of which this union is placed by the legends of the countries, received their names from it. As we might expect, this idea is too purely naturalistic to form any part of the moral Olympian religion. Hera appears there as the wife of Zeus, but all deeper meaning has disappeared. The old tale remains in the mythological legends, which always clung as a degrading appendage to this religion, and we find it in Homer (*Il.*, xiv. 294) transformed into an incident of the Trojan war. In the popular religion, however, Hera, as first the virgin, then the sacred bride, and finally the lawful wife of Zeus and the patron of all marriage, is a very prominent figure. Every year the festival of Hera was celebrated with special reference to this union in Argos, Samos, Elis, Platæa, and many other parts of Greece. The festival took place in a month named Γαμηλιών at Athens, Ἡραῖος in some other parts of Greece. Hence we have such epithets of Hera as *Νύμφη*, *νυμφευομένη*, *τελεία*, *γαμηλία*; and the bridal veil is one of her most frequent attributes. Hera was married to Zeus in early youth, and knew no other marriage. Hence she is the patron goddess of all married women, the protectress of the sanctity of marriage; and she demands the utmost purity from her votaries. In this respect Hera approaches closely to Demeter Thesmophoros. As the winter is a time of barrenness and separation, so we have in Arcadian, Argive, and Samian legend the angry Hera, the widow Hera, separated from her husband.

Other points in Hera again point directly to the moon. Like all other forms of the moon-goddess (see HECATE), she presided over child-birth, and under the epithet *εἰλείθυια* was invoked by women in labor. This idea arises from the moon's use as measurer of time and numberer of the months. Then the epithet became gradually developed as a daughter, or set of daughters, of Hera, named Eileithyiæ. Beauty is another characteristic of all moon-goddesses, and of Hera also. In her festival at Lemnos prizes were assigned after a contest to the most beautiful woman. Large eyes were part of the artistic type, and *βοῶπις* is one of her most constant epithets in literature.

Eubœa, the very word being an epithet of the goddess, was one of the chief seats of the worship of Hera. So in Bœotia, her temples both at Thespiæ and at Platæa were famous. In the *Iliad*, Argos, Sparta, and Mycenæ are the cities which she specially protects and loves. Argos was always one of the chief seats of her worship, and the Heraion there was one of the chief temples of Greece. At Olympia also was a very ancient temple, the Heraion, the ruins of which have been recently brought to view by the German exploring expedition. At the Lacinian promontory Hera was the patroness of the union first of the Achæan cities and afterwards of a wider circle of the Greek colonies. But the Hera of Samos was perhaps the most famous and most characteristic appearance of the goddess. There the Greek goddess was amalgamated with another, who was worshipped by the kindred tribes among whom the Greeks settled, and who is clearly the same as the Artemis of Ephesus or Clazomenæ; and so on coins of Samos we find Hera standing with the sun and moon on either side of her head, exactly like Artemis on coins of Ephesus.

We find such rude images of Hera as a plank at Samos, or a branch at Thespiæ. A very ancient statue by Smilis stood in her temple at Samos; the goddess, veiled, stood erect, clad in a long chiton, holding in each of her outstretched hands a *φιάλη*. In the earlier vase-paintings she is hardly to be distinguished from Artemis. She appears, just like Artemis, carrying torch and bow, and wearing the kalathos or the stephanos, and several figures which others consider to be Artemis, are by Overbeck explained as Hera. In representations of the Judgment of Paris there is often nothing to distinguish her from Aphrodite. Her characteristic symbols are the veil or sceptre, and she often carries a fruit. Numerous vase-paintings, representing a bridal procession, which Förster (*Zeus und Hera's Hochzeit*) believes to represent the *ἱερὸς γάμος*, are by Jahn and Overbeck shown to be an earthly marriage escorted by deities. Overbeck (*Hera*, p. 174) maintains that only three certain representations of this scene exist. The colossal statue by Polycletus in the Heraion at Argos showed her enthroned, wearing the *στεφάνη*, holding in one hand a pomegranate and in the other a sceptre, on the top of which was a cuckoo. There is no evidence to determine what was the character of the face, nor what share it had in determining the ideal type of Hera (Overbeck, *l. c.*, p. 51). The Farnese bust at Naples represents a type more antique than the style of Polycletus. Praxiteles made three great statues of Hera, at Megara, Mantinea, and Platæa. The last, which represented Hera Teleia standing, is known to us by many imitations in the Vatican and elsewhere. From the works of these two great artists we may suppose that the highest type of Hera was elaborated in the Athenian school about the middle of the 4th century, and in the famous bust of the Villa Ludovisi it is probable that we have the actual work in which this type was first attained. This bust, which has been often described, and especially by Goethe, was probably once the head of a colossal seated statue. (W. M. RA.)

HERACLEA, or HERACLEIA (in French, *Héraclée*), the name of several ancient cities in various parts of the area of Greek colonization, so called in honor of Heracles or Hercules.

I. HERACLEA, a city of Magna Græcia, which lay between the rivers Aciris and Siris, not far from the shores of the Gulf of Tarentum, near the site of the modern village of Policoro. It appears to have been a joint colony of the Tarentines and the Thurians, and to have risen after the destruction of the neighboring city of Siris. That it attained to no small prosperity and became the seat of the great politico-religious assembly of the Italian Greeks is nearly all that can be said of its earlier history. By Alexander of Epirus it was deprived of this privilege in favor of Thurii. Pyrrhus was victorious in its vicinity in the first battle he fought with the Romans, 280 B. C., and two years later the city formed an alliance on advantageous terms with the conquerors. In the time of Cicero it was still comparatively prosperous. The *Tabulæ Heracleenses*, found at Luce near the ruins of the city in 1753, are two bronze tablets, or rather fragments of tablets, containing on one surface a Greek inscription relating to temple domains and on the other surface a copy of the famous Lex Julia Municipalis published by Julius Cæsar in 45 B. C. They are preserved in the Museo Nazionale at Naples, and one of them is distinguished as the *Æs Britannicum* and the other as the *Æs Neapolitanum*. Both inscriptions are given in Mazzocchi, *Commentaria in Regii Herculanensis Musei aeneas tabulas Heracleenses* (Naples, 1754–55), and the Latin one will be found in Muratori, *Inscriptiones* (vol. ii.), and Haubold, *Monumenta legalia*. See also Savigny, *Zeitschrift für geschicht. Rechtswiss.* (vol. ix.) and *Vermischte Schriften* (vol. iii., Berlin, 1850).

II. HERACLEA, a city of Sicily, at the mouth of the Halycus (the modern Platani), not far from the promontory now known as Capo Bianco. It was distinguished from the other Heracleas by the surname of Minoa, which was explained as referring to its foundation by Minos of Crete. Its name frequently occurs in connection with the Carthaginian occupation of Sicily, and it was in the neighboring sea that the Carthaginian fleet was routed by Regulus and Manlius in 256 B. C. The Romans introduced a colony.

III. Heraclea Pontica, a city on the coast of Phrygia in Asia Minor, easily identified with the modern Bender Eregli or Erekli, at the mouth of the Kilidj-su on the Black Sea. It was founded by a Megarian colony, which soon subjugated the native tribe of the Mariandynians, and extended its power over a considerable territory. The prosperity of the city, rudely shaken by the Galatians and the Bithynians, was utterly destroyed by Aurelius Cotta in the Mithridatic war. It was the birthplace of Heraclides Ponticus. The modern town is best known for its coal mines, from which Constantinople receives a good part of its supply. See Polsberw, *De Rebus Heracleæ*, Brandenburg, 1833; and O. Kämmel, *Heracleotica: Beiträge zur alten Gesch. der griech. Colonisation im nördl. Klein-Asien* (Progr. des Gymn. zu Plauen, 1869).

IV. Heraclea Sintica, a town in Thracian Macedonia, to the south of the Strymon, the site of which is marked by the village of Zervókhori, and identified by the frequent discovery of local coins.

V. Heraclea, a town on the borders of Caria and Ionia, near the foot of Mount Latmus, whence it is usually distinguished as the Latmian. In its neighborhood was the burial cave of Endymion. See Rayet and Thomas, *Milet et le Golfe Latmique*, Paris, 1877.

For Heraclea Trachinia see Trachis, and for Heraclea Perinthus see Perinthus.

Heraclea was also the name of one of the Sporades, between Naxos and Ios, which is still called Raklia, and bears traces of a Greek township with temples to Tyche and Zeus Lophites. See Baumeister in *Philologus*, vol. ix.

HERACLEON, a Gnostic who flourished about 125 A. D., probably in the south of Italy or in Sicily, is generally classed by the early heresiologists with the Valentinian school of heresy. In his system he appears to have regarded the divine nature as a vast abyss in whose *pleroma* were æons of different orders and degrees,—emanations from the source of being. Midway between the supreme God and the material world was Demiurgus, who created the latter, and under whose jurisdiction the lower, animal soul of man proceeded after death, while his higher, celestial soul returned to the pleroma whence at first it issued. Heracleon seems to have received the ordinary Christian Scriptures; and Origen has preserved fragments of a commentary by him on St. John's gospel, while Clement of Alexandria quotes from him what appears to be a passage from a commentary on St. Luke's gospel. These writings are remarkable for their intensely mystical and allegorical interpretations of the text. The portions of the commentary on St. John's gospel have been brought together by Grabe in the second volume of his *Spicilegium*.

HERACLES. See Hercules.

HERACLIDES, surnamed Ponticus, a Greek miscellaneous writer who flourished in the 4th century B. C., was born at Heraclea in Pontus. Removing to Athens, he is said to have been a disciple successively of Speusippus, Plato, and Aristotle. According to Suidas, the second of these philosophers, on departing for Sicily, left his scholars in the charge of Heraclides. The latter part of his life was spent at Heraclea. Of his private history we have few authentic details. He is said to have been vain and fat, and to have maintained such state in Athens that the wits changed his surname into Pompicus, or the Showy. Various idle stories are related about him. On one occasion, for instance, Heraclea was afflicted with famine, and the Pythoness at Delphi, bribed by Heraclides, assured his inquiring townsmen that the dearth would be stayed if they granted a golden crown to that philosopher. This was done; but just as Heraclides was receiving his honor in a crowded assembly, he was seized with apoplexy, while the dishonest priestess perished at the same moment from the bite of a serpent. On his death-bed he is said to have requested a friend to hide his body as soon as life was extinct, and, by putting a serpent in its place, induce his townsmen to suppose that he had been carried up to heaven. The trick was discovered, and Heraclides received only ridicule instead of divine honors.

He wrote on a great variety of subjects, but only one fragment, *On Statecraft*, is now extant. This was published with the *Varia Historia* of Ælian at Rome in 1545; but the best editions are those of Köller (Halle, 1804), Coray (Paris, 1805), and Müller. See Fr. W. Schmidt, *De Heraclidæ Pontici et Dicæarchi Messenii dialogis deperditis*, Breslau, 1867.

HERACLITUS of Ephesus, one of the most subtle and profound of the metaphysicians of ancient Greece, has only of late years had his true position assigned to him in the history of philosophy. To this the obscure and epigrammatic character of his style and the fragmentary condition of his works have in the main contributed, together with the fact that not only his immediate disciples but also his critics, including even Plato, have systematically laid stress upon those features of his doctrines which are least indicative of his real point of view. The true position of Heraclitus is that of the founder of an independent metaphysical system, which sought to get rid of the difficulty, so prominent in the Eleatic philosophy, of overcoming the contradiction between the one and the phenomenal many, by enunciating, as the principle of the universe, "Becoming," implying, as it does, that everything is and at the same time, and in the same relation, is not.

The descendant of a family of leading importance in Ephesus, Heraclitus was born about 535 B. C. His cast of mind was so intensely aristocratic that, filled with contempt for the councils and capacities of his fellow citizens, he made over the hereditary office of *βασιλεύς*, which had fallen to him in right of his birth, in favor of his younger brother, and betook himself to a life of solitary meditation. The date of his death was probably about 475 B. C.

To appreciate the significance of the doctrines of Heraclitus, it must be borne in mind that to Greek philosophy the sharp distinction between subject and object which pervades modern thought was foreign, a consideration which suggests the conclusion that, while it is a great mistake to reckon Heraclitus with the materialistic cosmologists of the Ionic schools, it is, on the other hand, going too far to treat his theory, with Hegel and Lassalle, as one of pure Panlogism. Accordingly, when he denies the reality of Being, and declares Becoming, or eternal flux and change, to be the sole actuality, Heraclitus must be understood to enunciate not only the unreality of the abstract notion of being, except as the correlative of that of not-being, but also the physical doctrine that all phenomena are in a state of continuous transition from non-existence to existence, and *vice versa*, without either distinguishing these propositions or qualifying them by any reference to the relation of thought to experience. "Every thing is and is not;" all things are, and nothing remains. With Heraclitus the principle of continuity is opposed to the principle of discretion taught by the Eleatics, and consequently for him "Being and Nothing," as well as "Union and Separation," are logically and physically incapable of distinction. This being so, he naturally enough selects Fire, according to him the most complete embodiment of the process of Becoming, as the principle of empirical existence, out of which all things, including even the soul, grow by way of a *quasi* condensation, and into which all things must in course of time be again resolved. But this primordial fire is in itself that divine rational process, the harmony of which constitutes the law of the universe. Real knowledge consists in comprehending this all-pervading harmony as embodied in the manifold of perception, and the senses are "bad witnesses," because they apprehend phenomena, not as its manifestation, but as "stiff and dead." In like manner real virtue consists in the subordination of the individual to the laws of this harmony as the universal reason wherein alone true freedom is to be found. "The law of things is a law of Reason Universal, but most men live as though they had a wisdom of their own." Ethics here stands to sociology in a close relation, similar, in many respects, to that which we find in Hegel and in Comte. For Heraclitus the soul approaches most nearly to perfection when it is most akin to the fiery vapor out of which it was originally created, and as this is most so in death, "while we live our souls are dead in us, but when we die our souls are restored to life." The doctrine of immortality comes prominently forward in his ethics, but whether this must not be reckoned with the figurative accommodation to the popular theology of Greece which pervades his ethical teaching, is very doubtful.

The only extant work, purporting to have been written by Heraclitus, which can be regarded as genuine, is the treatise *Περὶ φύσεως*, which has come down in a fragmentary condition. It has been edited by Bywater (*Heracliti Ephesii Reliquiæ*, Clarendon Press, 1877). The Epistles are in all probability spurious.

The school of disciples founded by Heraclitus flourished for long after his death, the chief exponent of his teaching being Cratylus. A good deal of the information in regard to his doctrines has been gathered from the later Greek philosophy, which was deeply influenced by it.

By far the most complete exposition of his system is that of Lassalle (*Die Philosophie Herakleitos des Dunkeln von Ephesos*, Berlin, 1858), although his interpretation is decidedly too strongly dominated by modern Hegelian conceptions. See also Hegel, *Gesch. d. Phil.*; Zeller, *Gesch. d. Phil. d. Griechen*; Bernays, *Die Heraclitischen Briefe*, Berlin, 1869; and Schuster, *Heraklit von Ephesus*, Leipsic, 1873.

HERACLIUS (*c.* 575–641), emperor of the East, was

born in Cappadocia about 575. He was brought into notice by his heading a successful revolt against the emperor Phocas in 610, when he usurped the usurper's throne. At that period the eastern provinces of the empire were being ravaged by the triumphant armies of Chosroes (Khosru) II., which in the first twelve years of Heraclius's reign continued their unresisted progress to the Bosphorus and the Nile, pillaging Asia Minor and Syria, and reducing Constantinople to the utmost distress by cutting off its Egyptian corn supplies. In 618 the public distributions of grain, which had been carried on since Constantine had instituted them as a bribe to attract citizens to his new city in 330, were suspended; and the bankrupt emperor was hardly dissuaded by the almost imperative prayers of his people from quitting his capital in shame and fear for Carthage. Taking courage, Heraclius appears to have set himself to the task of reorganizing both state and army, a labor which had probably occupied him since his accession. He was menaced on the west by the fierce tribe of the Avars, who were casting longing eyes on the riches of the imperial city; but in 620 he succeeded in making a treaty with them, and interposed a human barrier against their further encroachments by inviting the Serbs and Croats to settle in the intervening regions, which they have never since left. In 621 Heraclius led an army into camp in Asia Minor, and devoted himself with ardor to the drilling of his inexperienced troops. Every military manœuvre, every useful exercise and even hardship, was ordered and shared by the emperor. He kindled the enthusiasm of his soldiers by his stirring words, and excited their admiration and affection by his deeds. Next year he led his forces against Persia, and within five years, in a series of brilliant campaigns that place him side by side with the greatest generals of the world, he overthrew the pride of that empire, drove its monarch a fugitive from his throne, and enriched his exulting troops with untold wealth. Siroes, the son of Chosroes, revolting against his unhappy father, put him to death in 628, and speedily made a peace with Heraclius, according to which the Persian empire retired to its former limits, prisoners were mutually given up, and the true cross, carried from Jerusalem by the Persians, was restored to Christian hands. Heraclius returned in triumph to Constantinople, which had in his absence two years before successfully repulsed a combined assault by the Avars and Persians; and in 629 he proceeded to Jerusalem to restore solemnly the holy relic to its ancient place. But he was not long to enjoy the peaceful fruits of victory. A mighty power had been steadily growing up in the hot sands of Arabia, and was now coming to measure its strength with that of the Roman empire. In 632 the Mahometans invaded Syria; and overthrowing the armies sent to oppose them, in six years they made themselves masters of the country. Egypt next fell before Islam, and in 640 that fair province of the empire was Mahometan. The people of Asia Minor alone successfully resisted the advancing Saracens. Heraclius seems meanwhile to have sunk into a sort of lethargy, as though his efforts in Persia had completely exhausted him. While his generals and armies were being cut to pieces he was engaged at Constantinople, whither he had retreated in 634, with speculative theological questions. In 638 his *Ecthesis* appeared, which, tinctured with the heresy of Monothelism, was probably drawn up by the patriarch Sergius. The energy of his earlier life never returned, and in 641 he sank under a long-continued disease. He had been twice married; the second time to his niece Martina, an illicit union which he compelled the reluctant Sergius to celebrate. His eldest son, Heraclius, succeeded him, taking the title of Constantine III.

The character of Heraclius is a curious riddle, which it is not easy to solve. Personally brave, and possessed of tried ability as a diplomatist and a general, in his latter years he passively allowed his empire to fall to pieces before his eyes,—presenting in the periods of his life a contrast that would almost seem to argue the possession of not merely contrary but contradictory qualities. But we must not forget that our information regarding the inner details of his latter reign is very imperfect, and that possibly there may be some reason, though hardly an excuse, for his conduct. It would have been better for his fame if he had died immediately after his Persian campaigns.

See Gibbon's *Decline and Fall of the Roman Empire;* Le Beau's *Histoire du Bas-Empire;* and the works of George of Pisidia (*cf.* vol. x. p. 386).

HERALDRY, though etymologically denoting all the business of the herald, has long in practice been restricted to one part of it only, and may be defined as the art of blazoning or describing in proper terms armorial bearings. It treats also of their history, of the rules observed in their employment and transmission, of the manner in which by their means families and certain dignities are represented, and of their connection with genealogies and titular rank.

Particular symbols have in all ages been assumed by the various families of mankind, civilized and uncivilized. Such were the lion of the tribe of Judah, the S. P. Q. R. upon the standards of ancient Rome and the eagle surmounting them, the tattoo marks of the savages of America and the Pacific, the Danish raven, and the white horse of Saxony, which still remains carved upon the chalk downs of western England.[1] Heraldry, however, is a purely feudal institution, coeval with close armor, devised possibly in Germany, adopted and improved in France, Spain, and Italy, and imported into England by the Norman invaders and settlers. Its figures have little or nothing to do with the older symbols, though these have occasionally been incorporated into its charges, and an apparent connection thus established between them. These symbols, as has been well said, were the precursors and not the ancestors of heraldic bearings. The supposed connection, however, misled the credulous heraldic writers of the 16th and 17th centuries, and caused them to attribute coats of arms to the heroes of sacred and profane history, who were certainly as ignorant of heraldry as ever was Adam of genealogy.

"Arms" or "armories," so called because originally displayed upon defensive armor, and "coats of arms" because formerly embroidered upon the surcoat or camise worn over the armor, are supposed to have been first used at the great German tournaments, and to have reached England, though to a very moderate extent, in the time of Henry II. and Cœur de Lion. To "blazon," now meaning to describe a coat of arms, is the German "blasen," to blow as with the horn, because the style and arms of each knight were so proclaimed on public occasions. The terms employed in heraldry are, however, mostly French or of French origin. Though now matters of form and ceremonial, and subject to the smile which attaches to such in a utilitarian age, armorial bearings were once of real use and importance, and so continued as long as knights were cased in plate, and their features thus concealed. At that time leaders were recognized in the field by their insignia alone, and these—both figures and colors—became identified with their fame, from personal became hereditary, were subject to certain rules of descent, and to the laws of property and the less certain rules of honor.

Froissart mentions a case in which a knight of the Scrope family could with difficulty be restrained from putting to death a prisoner because he wore the same bearings with himself. The last De Clare owed his death on the field of Bannockburn to his having neglected to wear his cotte d'armes; had he been recognized, his great value as a prisoner would have saved him. Also the loss of the battle of Barnet was in part attributed to the similarity between the royal cognizance of a sun and that of John de Vere, a star with streamers,—Warwick charging Oxford by mistake for the king.

The best if not the only absolutely safe evidence for the origin of armorial bearings is that afforded by seals. Seals were in common use both before and after the introduction of armorial bearings, and they are not so likely as rolls of arms or monumental effigies to be the work of a later age. There are said by Courcelles to be extant, appended to charters of 1030 and 1037 A. D., two seals of Adalbert, duke of Lorraine, which bear on a shield an eagle with wings closed. This however wants confirmation; but Anna Comnena, describing the shields of the French knights who visited Constantinople about 1100, gives their surfaces as of metal only, polished but plain; nor have any decided traces of arms been discovered among the early crusaders. Louis le Jeune, who seems first of the French kings to have used the fleur-de-lys, caused it to be represented in gold over the azure mantle and chaussures worn by his son at his coronation. Also, in 1180, he seals with a fleur-de-lys, but it is placed in a circle, not upon a shield. Planché cites

[1] The subject of ancient and especially of Greek "heraldry" is discussed by Curtius in a learned and interesting paper "Wappengebrauch und Wappenstyl im Alterthum" in the *Abhandlungen der Königl. Akad. d. Wissenschaften zu Berlin* (1874). See also article GEMS, vol. x. p. 122.

two seals of Philip, count of Flanders, one plain, in 1157, and another in 1164 charged with a lion, their subsequent bearing. Seton mentions the seal of John de Mundegumbri in 1170 as bearing a fleur-de-lys, which, like that of Louis, has two intermediate flower-stems, as seen on Florentine coins. He also gives the seal of Falconer (1170) as bearing a falcon; and that of Corbet bore two ravens perched upon a fleur-de-lys, while his brother bore them upon a tree. This indeed was at a period when fleurs-de-lys, stars, and various animals were commonly represented as mere ornaments on seals, but the peculiarity of the instances named is that the falcon and the raven, like the fleur-de-lys of France, were afterwards the heraldic bearings of those families. The seals of the close of the 12th century, though not generally heraldic, certainly betray many of the elements of heraldry. No doubt, when once introduced, armorial bearings were felt to supply a real and serious want, and came rapidly into use, but Wace, the poet of the reign of Henry II., although he tells us that

> "N'i a riche home ne Baron,
> Ki n'ait lez li son gonfanon,
> U gonfanon u altre enseigne,"

can scarcely be seriously held to mention armorial bearings.

It is uncertain at what period armorial bearings found their way into England. The Conqueror and his successors certainly did not use them; they do not appear upon their seals, nor are they shown upon the banners of the Bayeux tapestry. The monk of Marmoutier, probably a contemporary, describes Henry I., upon the marriage of his daughter to Geoffrey of Anjou in 1122, as hanging about the bridegroom's neck a shield adorned with small golden lions, "leonculos aureos;" and, making mention of a combat in which Geoffrey was engaged, he describes him as "pictos leones præferens in clypeo." It is true that the number, attitude, and position of these lions on the shield are not specified, but considering that not long afterwards two lions became the arms of Plantagenet, and so of England, this may fairly be taken as their introduction. Stephen is said to have used a centaur, Sagittarius, as an emblem, because he landed in England when the sun was in that sign, but on his great seal his shield is quite plain, save a ridge down the centre, evidently a part of its construction. On the seals of the Conqueror, Rufus, and Henry I., only the hollow or under side of the shield is shown; so there probably was no design upon the front. There is no seal of Duke Robert, but William, earl of Flanders, his son, shows a plain shield on his seal. His monumental effigy (1128) bears a large pavesse shield, and upon it an escarbuncle, apparently a highly ornamented clamp. The seal of Henry II. also shows the hollow of the shield. The first great seal of Richard I. bears a lion rampant, who from his position may be inferred to be fighting with a similar lion upon the sinister and concealed half of the shield, blazoned in a MS. cited by Mr. Way as "two lions confrontés."

Up to this time the kings, though represented on horseback and in full armor, have the face uncovered, and therefore their persons would be known. The seal of Richard I. in 1189 shows a close helmet, and upon the shield two lions passant gardant in pale, "leones lopardés," as they were then or soon after called. On a later seal, after his return from captivity in 1194, Richard added a third lion. John, while earl of Mortaine, sealed with two lions, but his seal as king bears three, and the coat has so remained. That the two lions were more than a mere ornament is evident from their having been adopted by John's natural son, Richard de Warren, who seals with two lions passant regardant. The seals of the great barons show the growth of the practice. Richard, constable of Chester, contemporary with Stephen, bears a shield covered over with small plates, tegulated, like his armor; but Stephen, earl of Richmond, as early as 1137, seals with seven fleurs-de-lys, a very early heraldic seal. Walerau, earl of Meulan (died 1166), also used an heraldic seal. Duchesne gives a seal of Bouchard de Montmorenci (1182), a contemporary of Louis le Jeune, with a cross between four alerions on his shield, and another in which the cross is charged with roundels. Mathieu, his son, seals also with the cross and alerions, which had evidently become, as they remained, hereditary. In England, William, earl of Essex (died 1190), seals with the escarbuncle of his family. In 1187 Gervase Paganel, a great Anglo-Norman baron, seals with two lions passant, which his family continued to bear.

With the 13th century arms came rapidly into use. The second seal of Mathieu de Montmorenci in 1209 has them introduced upon his horse furniture, but this practice does not appear upon the seals of the kings of England until the second seal of Edward I. Baldwin de Bethune, earl of Albemarle (died 1214), sealed with three martlets in chief, and many other early examples of regular heraldic seals occur at this period attached to extant charters. The earliest roll of arms is of the reign of Henry III.; of a second of the same reign a copy is preserved in the Harleian collection; and a third, in the next reign, is the roll of Caerlavrock, 1300 A. D. So that for the reign of Henry and his son the evidence for armorial bearings is copious and excellent. Other rolls exist carrying the practice through the 14th and 15th centuries, before the middle of which there is no known work on heraldry, nor any trace of heraldic regulations save what may be deduced from recorded practice.

Coats of arms were not at first strictly hereditary, nor even always permanent in the same person. Thus William de Ferrars, 6th earl of Derby (died 1246), seems to have borne "argent, 6 fers de cheval, or horse shoes, 3, 2, 1, sable." William, his son, in consequence of a match with Peveril, who bore "vair," changed his bearing to "vair, or and gules, on a border azure 8 horse shoes argent." Robert his son, 8th earl (died 1278), dropped the horse shoes, and bore "vair, or and gules."

> "Ferrars his tabard with rich vair yspread."

After the match with Quincy, the Ferrarses laid aside their own coat and bore that of Quincy, "gules, 7 mascles conjoined 3, 3, 1, or." Their male heir through a younger branch,—Ferrers of Baddesley-Clinton,—commemorates these various changes by bearing "quarterly,—(1st) vair, or and gules; (2d) sable, 6 horse shoes, 3, 2, 1, argent; (3d) gules, 7 mascles, 3, 3, 1, or, a canton ermine." Hugh Lupus, earl of Chester (died 1101), is fabled to have borne a wolf's head, and not improbably his surname arose from some such emblem. Richard, his son, is said to have borne "azure, semée of crosslets or, a wolf's head erased argent." Ranulph Meschines, 3d earl (died 1128), was sister's son to the first earl, and to him is assigned "or, a lion rampant gules." Hugh Cyfelioc, 5th earl (died 1180), certainly bore "azure 6 garbs of wheat, 3, 2, 1, or;" and Ranulph Blondeville, his son, bore "azure, 3 garbs or." With him the line failed, but as the wheat-sheaf is a common Cheshire bearing, it is probable that arms came into general use in the palatinate in the time of the last two earls.

Sir Nicholas Carru (died 1283) seals with a tricorporate lion, but at Caerlavrock in 1300 is found with a

> "Banière et jaune bien passable,
> O trois passans lyons de sable,"

the arms of the Carews of our day. The fess and label of Saher de Quincy, earl of Winchester, in 1170, were changed by Roger his son for the mascles by which they were best known, and which he repeats upon his housings. The fact is that, at the close of the 13th century, arms, though on the whole hereditary, had not quite acquired that fixed character that belonged to them half a century later. That the changes were the exception rather than the rule is, however, clear from the roll of Henry III., and from the arms of the forty great barons which he caused to be painted on the walls of Westminster Abbey, almost all of which, so far as they are on record, are the same with those borne or quartered by their representatives. There exist also in England a few families of Norman origin, the period of whose arrival in England is known, and whose arms are the same with those of the present stock in the parent country. Such are Harcourt of Ankerwyke and D'Aubigny, who therefore bore their arms before the separation from Normandy under Henry III.

Early bearings were usually very simple, the colors in strong contrast, and their form and outline such as could readily be distinguished even in the dust and confusion of a battle. They are mostly composed of right lined figures known in heraldry as ordinaries. The favorite beast is the lion.

The earliest and most valuable records relating to English armorial bearings are undoubtedly the rolls of arms of the reigns of Henry III. and the first three Edwards, which have been well edited by Sir H. Nicolas. That of Henry III. known as Glover's roll, drawn up between 1243 and 1246, describes or blazons 218 coats of arms, and therefore

shows very sufficiently the heraldry of the period. Of these coats nearly one-half are composed solely of the ordinaries and subordinaries, and other simple lines and figures. About two score of them exhibit lions, chiefly rampant, and leo-pardés, a form of the same animal. The only other beast is the "teste de sanglier" borne by Swinburne. Of birds there are but the eagle and the papagay, several martlets, and single examples of the raven, the cock, the heron, and the horiole. The luce or pike is the only fish. The cinquefoil and sexfoil, the fleur-de-lys, the rose, and the wheat-sheaf, used very sparingly, represent the vegetable world. For the rest there are annulets, barnacles, cresecnts, estoiles, escallops, fers de eheval, mullets, and water budgets. There is one ray of the sun, and one whirlpool.

The coat of Mortimer "barrè, a ehef palée, a eorner gerennée d'or et d'azur, a ung escucheon d'argent,"—or, in modern terms, "barry, a ehief paly, its eorners gyronny or and azure, an cseutcheon argent" (fig. 63),—is the only one at all of a eomplex eharaeter, and this is eomposed of ordinaries and subordinaries; and though many of the ordinaries bear the smaller eharges, or are plaeed betwcen them, there are very few examples of an ordinary so charged also placed between eharges, a common usage in later eoats. An exception is Chandos, who bears three estoiles on a pile, whieh again is placed between six others; but this stands alone.

The roll of Edward II. blazons 957 coats of the bannerets of England, so that the use of arms had inereased eonsiderably. The lions have risen to 225, the eagles to 43, and there are 102 erosses of various kinds. Of new beasts, fabulous or real, there are the griffin, the wyvern, the stag, wolf, goat, and greyhound; of new birds, the faleon; of fishes, the dolphin. Of other objeets the additions are the millrind, buckle, eovered cup, chaplet, gauntlet, arrow, trumpet, hammer, battle-axe, palmer's staff, pots, winnowing fans or vans, pens, cushions, and ehessrooks. The eharaeter of the arms remains very simple, and the blazon employed agrees in the main with that still in use, and is in general perfeetly intelligible. These rolls give various examples of changes of eoats, either altogéther or by the introduction of a difference to distinguish members of the same family; and it is observable that when the figures are altered the eolors are usually adhered to, as though it were considered undesirable to change them. Thus Gilbert de Segrave (died 1254) bore "sable, 3 garbs argent." Of his grandsons John and Nicholas, John bore the paternal coat, but Nicholas, at Caerlavrock, had exchanged the garbs for a lion. This afterwards became the family bearing as "sable, a lion rampant argent, erowned or," the colors being retained.

No sooner had the great barons assumed arms for themselves than they began to grant them to their followers. Arms so granted commonly bore some resemblance to those of the grantor, and hence certain charges prevailed in certain districts. Thus the chevron of De Clare was common in South Wales, in the Honors of Gloucester and Clare, and about Tonbridge. The garb or wheat-sheaf was found in Cheshire; the cinquefoils of the Bellomonts in Leicestershire; the annulets of Vipont in Westmoreland; the lion all over England, and the tressure in Scotland, both from the royal arms. Some of these grants remain; others can with certainty be inferred. Stephen Curzon, who held under the earls of Derby, bore "vair, with a border of 8 popinjays argent," and Richard, his brother, bore "vair, on a fess 3 horse-shoes." Hubert, earl of Kent, bore "7 lozenges vair;" and Anselm de Guise, on taking under him lands in Berks and Gloucester, assumed the same coat, with the addition of a canton or, charged with a mullet sable. In 1349 Robert Morle granted to Robert de Corby and his heirs the arms "d'argent, ove un saltier engrailé de sable," whieh he himself had inherited from Baldwin de Manoirs. In 1356–7 William, baron of Greystock, who bore "barry of 6 argent and azure, 3 chaplets gules," granted to Adam de Blencowe and his heirs for ever "an escuteheon sable with a bend closetted [or barred] argent and azure, with 3 chaplets gules." In 1391–2 Thomas Grendale granted to William Morgne his heirs and assigns, "argent, on a cross azure 5 garbs or," which, as cousin and heir, he himself had inherited from John Beaumeys. Finally, in 1442, Humphrey, earl of Stafford, who bore "or, a chevron gules," granted to Robert Whitgreaves "un escue d'azure, à quatre points d'or, quatre chevrons de gules," to him and his heirs of lineage, —in modern terms "azure, a cross quarter-piereed or, on each limb a chevron gules." A coat of arms was not only heritable, subject to certain heraldic customs, but could be willed or granted away, wholly or in part, like chattel property.

The crusades, by bringing together soldiers of different nations, tended to produce a certain assimilation in their heraldries, but their influence upon the arms themselves has been exaggerated. The stories as to bearings adopted to commemorate feats of arms in Palestine are mostly inventions. The cross no doubt was a crusading bearing, but it was so because it was the emblem of Christianity, and primarily popular as such. The stars, torteaux, water budgets, and other charges attributed to the crusaders, were of earlier date and of independent origin. There is no evidence that the crosses patée of the Berkeleys, or the crosslets of Beauchamp, Clinton, Windsor, and Howard, were added to their simpler bearings in token of services in the Holy Land. The star of De Vere, always attributed to an adventure there, was evidently a mark of cadency, adopted by Robert de Vere, brother of Alberic, 2d earl of Oxford. The fact appears to be that most of the additions to or alterations in the earlier coats of arms were made for some genealogical reason, to commemorate a match with some great family or to distinguish between the several branches from the parent tree. After, usually long after, the period of the crusades, arms were invented for "fabled knights in battles feigned," and but few of the Saracens' heads which figured so formidably in many coats of arms are contemporary with any Saracenic war.

The diversion of the tournament did even more than actual war to promote the glories of heraldry. On these occasions the presence of spectators, and especially of ladies, encouraged all sorts of heraldic display. At a tournament at Calais in 1381 Richard Beauchamp, earl of Warwick, one of the most accomplished knights of the reigns of Richard II., Henry IV., and Henry V., suspended on three shields three several coats of arms, as representing three several knights who professed to be ready successively to meet all comers. Three French knights appeared to the challenge. Against the first the earl came forth as the green knight with a black quarter, bearing "silver, a maunch gules," the arms of De Tony, a maternal ancestor, and so overcame his adversary and retired unknown to his pavilion. On the second day he appeared as the green knight, and bearing "silver, two bars gules," the arms of Mauduit of Hanslape, another ancestor, he met a second knight with equal success. On the third day he appeared in his proper person bearing the arms of Guy of Warwick and Beauchamp on his shield, and those of De Tony and Mauduit on his caparisons, and thus with great honor won the third day also.

The shield, as the most obvious piece of the defensive armor, was that upon which arms were first displayed. The Norman shield was of wood covered with hide, and clamped and stiffened in a fashion which is thought to have given rise to the first simple bearings. It was 3 to 4 feet long, pointed below, and 18 inches broad. This shield is common on early monumental effigies armed in chain mail, and it is unusual to find it with armorial bearings. It was succeeded by the small triangular heater shield, and that, in the reign of Edward III., by a somewhat larger and full bottomed shield, which by degrees ceased to be used in war, and became more and more an architectural ornament. The arms were also displayed upon the breast-plate, and upon the camise or surcoat that covered the armor, and were repeated upon the housings of horses both before and behind the saddle. When the Comte d'Artois fell at Damietta, the Saracens showed in triumph his "cotte d'armes toute dorée et fleur-de-lisée." The emperor Henry of Luxembourg is described in the *Chronicle of Flanders* as bearing "an aigle noir, sur un torniele d'or qui pendoit jusq' a mi-jambe." Sir Alexander Nevile appeared at Halidon Hill in a surcoat of his own arms, the quarters filled up with the arms of his friends. The fine effigy of William de Valence at Westminster is decorated with small escutcheons of his arms on various parts of his dress and weapons. An actual remnant of the richly embroidered surcoat of William de Fortibus, earl of Albemarle (died 1261), is still preserved, and has been engraved in the *Archæologia*. It was against the embroidery of the surcoat that the severe sumptuary enactments of Richard and Philip Augustus were mainly directed.

The importance attached to armorial bearings is strongly

shown in the uses to which they were applied. A sovereign who wished to assert his claim to a kingdom placed its arms upon his shield. In 1479 when Alphonso of Portugal resigned his claim to Castile, he was required to lay aside its armorial ensigns. It appears that when Edward III. assumed the French lilies, he at first did so simply as representing his mother, who was an heiress, and placed her arms in his second quarter; when, however, he claimed the kingdom of France in her right, he removed the lilies to the first quarter as representing the more important kingdom. A grant of arms at the hand of a sovereign had great value. Among the more solid bribes which Louis XI. bestowed upon the courtiers of Edward IV. occurs a grant of three fleurs-de-lys to a knight of the Croker family. Thus also when Juan de Orbieta captured Francis I. on the Ticino, he was rewarded by a grant of arms from Charles V., though of so complex a character as to do little credit to Spanish heraldry. In later times John Gibbon, the heraldic author, having a quarrel with two maiden ladies of his name, obtained a license to convert the scallops in their common coat into the black balls called ogresses,—a most heraldic revenge.

Armorial bearings were largely painted, enamelled, and embroidered upon personal ornaments, furniture, and weapons. The sword of Edward, prince of Wales (died 1483), is a curious example of this; it bears on its pommel the words "aves fortes" and five shields:—(1) England, (2) the duchy of Cornwall, (3) England and France with a label, (4) Mortimer quartering Ulster, (5) the earldom of Chester. In the middle is the cross of St. George. The citizens of London were bound to provide their banner bearer, Lord Fitz Walter, with "a saddle with his arms," and the seal of one of that family, about 1300, shows the arms upon the back or rest of his war saddle. The seal of Sir Hugh le Despenser (1292) also shows his arms. Various bequests of plate and furniture with arms occur in the 14th century. In 1368 William, Lord Ferrars of Groby, bequeathed his green bed "with his arms thereon, and his furniture bearing the arms of Ferrars and Ufford, impaled." In 1380 Edward Mortimer devised "à notre tres chier friere John Gilbert, evesque de Hereford, une plate de argent pour espices et enamillés ove les armes de Mortimer en la face."

Richard, earl of Arundel, in 1392, bequeathed a canopy of the arms of Arundel and Warren quarterly. In 1399 Eleanor Bohun, duchess of Gloucester, had a psalter with her father's arms upon the clasps. In the Decorated and Perpendicular styles of architecture shields of arms are common ornaments. Those of benefactors were set up in church windows in glass, and those of a family in their houses. In the Scrope roll is a list of sixty-six churches in which the Scrope arms were set up, and the histories of Dugdale and Burton show us that nearly every church in Warwickshire and Leicestershire had a multitude of arms on its windows. Those still remaining in the east windows of Bristol cathedral are early and good examples of the arms of great barons, Berkeley, Clare, and Warren. They are also seen upon floor tiles of the same period.

As arms became hereditary, and their use ceased to be confined to the battle-field, but was largely extended to seals and ornaments, it was natural that some notice should be taken of the arms of females, and that the wife's coat should be combined in some way with that of the husband, especially when she was the last of, and represented, her family. This seems first to have been managed by giving the wife a separate shield. The kings of France so bore the arms of Navarre after the marriage with the heiress of that kingdom. Another very early plan was to form a composite coat. Thus the old coat of Willoughby was fretty, but on their marriage with Bec of Eresby they adopted the coat of Bec, and Sir John Willoughby (13th Edward III.) bears the cross moline of Bec, but the wings of his crest are fretty for Willoughby, and on either side is a buckle taken from the arms of Roscelin, his wife. Rose of Kilravock bore "or, 3 water budgets sable," but on a marriage with the heiress of Chisholm they added "a boar's head couped gules" from her arms. So also Halyburton of Pictur, who bore "or, on a bend azure 3 lozenges of the field," after a marriage with another Chisholm heiress, added to their coat "3 boars' heads erased sable." Bohun, who bore "azure, a bend argent, cotised or, between 6 lioncels rampant of the third," is thought to have added the bend on the occasion of a marriage with Maud, daughter and heïr of Milo, earl of Hereford. As this, however, led to complexity and indistinctness in the bearings, and the introduction of a second shield was obviously inconvenient, the method of impalement was devised, by which the sinister half of the shield was appropriated to the lady's arms, at first under the process known as dimidiation. When, however, the lady was an heiress, a different plan was adopted which ultimately led to quartering or the marshalling of many coats in one shield, a practice, when pushed to any extent, quite inconsistent with the original use of coat armor. This also led to a corresponding alteration in the shape of the shield, which was expanded to contain the arms of each heiress who had married into the family, together with such other heiresses as her family had previously been allied with, so that when a Percy heiress married a Seymour, she added her heiress ancestors' arms with her own arms to those of her husband, expanded in a similar fashion by the previous matches of his family. Thus the great shield of a family became a compendium of the family pedigree which, to those who could read its language, conveyed a considerable mass of semi-historical information. The defect of this system was that it only took account of heiresses, and did not provide for the purity of the whole descent, so that under it the children of a man of no birth who married a great heiress, would display all her quarterings, and no account would be taken of the absence of any on his side; and further, if it happened, as was actually the case in the last century with the Rodneys of Rodney-stoke, that a family, though ancient, had never intermarried with an heiress, they could display no quarterings.

In France and Germany and to some extent in Scotland a far more perfect system was pursued. There the genealogical escutcheon included the arms of every ancestor and ancestress, whether an heiress or not; thus one generation gave two coats, two generations four coats, and so on. "Seize quartiers" gave evidence of pure blood for four generations, and thirty-two quarters, the qualification for a canon of Strasburg, for five.

As the combinations out of which the early coats were formed were limited, it occasionally happened that two persons of the same nation bore the same arms, and this gave rise to disputes which, as matters connected with military discipline, came under the jurisdiction of the earl marshal. One of the earliest of these disputes is mentioned in the roll of Caerlavrock—

> "Le beau Bryan de Fitz Aleyne,
> De courtesie, et de honneur pleyn,
> Ivi o baniere barrée,
> De or et ja gouls bien parée,
> Dont le chalenge estoit le pointz,
> Par entre lui et Huc Poyntz,
> Ki portoit cel ni plus ni moins,
> Dont merveille avoit meinte et meins."

Cases of a similar character were decided between Harding and St. Loo in 1312, Warburton and Gorges in 1321, and Sytsylt and Fakenham in 1333, when Sir William Fakenham disputed the arms, "le champ de dise barretz argent et azure, supportez de cinq escocheons sables, chargés ovesque tant de lyons primers rampant ineensés gules." They were adjudged by a commission to Sytsylt. Hugh Maltby and Hamon Beckwith had a similar dispute in 1339. But by far the most celebrated dispute of this nature arose in 1384 between Sir Richard Scrope of Bolton and Sir Robert Grosvenor, for the right to bear the arms "azure, a bend or." The greatest men in the country, including John of Gaunt, gave testimony on one side or the other, and it was shown that each family had used the coat beyond the memory of man. It was finally adjudged to Scrope, and Grosvenor was directed to bear "les ditz armes ove une pleyne border d'argent." Grosvenor, however, declined to accept the arms so differenced, and assumed "azure, a garb or," retaining his colors and marking his connection with the old earls of Chester. It was proved, incidentally, that an ancestor of Grosvenor's had granted his coat, with a difference, to William Coton of Coton. It is remarkable that both disputants are still represented in the male line, and continue the arms as then settled. Both families had previously had disputes with other parties, and the Scropes long afterwards had a quarrel with the Stanleys for the right to bear the arms of the Isle of Man. The matter was compromised by Edward IV. The Hastings and Grey de Ruthyn case, which rises to the rank of a tragedy, illustrates still more forcibly the value attached to a coat of arms. On the death, childless, in 1389, of John de Hast-

ings, earl of Pembroke, a dispute arose for his heirship between Reginald Grey, his heir-general and Edward Hastings, the heir male and of the name, but of the half-blood. A court military decided in favor of Grey. Pending the trial Hastings had ceased to difference his arms as a cadet, and assumed them unbroken. He was, however, ordered to bear them with a label, and for contumacy was imprisoned for sixteen years. A suit for arms was decided as lately as 1720 in Blount *versus* Blount, in the earl marshal's court.

The same necessity that made it important to prevent the use of similar bearings by different families in the same country made it also necessary to distinguish between the bearings of different members of the same family, all of whom had a right to the paternal coat. As this right was strongest in the eldest son he alone bore the paternal arms unaltered (in French heraldry "sans brisure"); and the other sons were obliged to introduce some sufficient change, called in heraldry a "difference." This was at first managed by inverting the colors or substituting one ordinary or one inferior charge for another, as a bend for a fess, martlets for mullets, and the like, and sometimes by the use of a coat compounded of the paternal bearing with that of an heiress. A multitude of these early differences occur in the rolls of Henry III. and Edward II. and in various early lists of arms. The family of Grey, always numerous, differenced their cadets in at least fourteen different ways, almost all preserving in some tangible form the paternal coat; and this was also the case with the very numerous family of Basset. Generally no rule is followed, save that on the whole some reference is retained either to the charges upon, or the colors of, the paternal coat. Very frequently, even in the earliest times, the eldest son differenced his father's coat by a label. In the roll of Henry III. the label occurs fifteen times, though not always as a difference. Gradually, however, it came to be used almost entirely for that purpose, and finally a set of marks, called of cadency, were devised for each of the sons, the label being the mark of the eldest during his father's life.

All these rules and alterations were, however, the growth of a later age, and came into use as the bold and simple heraldry of the 13th and 14th centuries began to be overlaid with florid fancies. So long as heraldry represented a real want, its expressions were simple and intelligible, but as "villainous saltpetre" came into use and closed helmets were laid aside, and as skill and strategy rather than personal valor became the attribute of a leader, armorial bearings fell into disuse in war, and were no longer worn upon the person, or upon the horse trappings. But though armorial bearings ceased to be of actual use, they continued to be emblems of rank and family, and a mark of gentle blood. They became, however, exceedingly and often absurdly complex, partly because simplicity was no longer necessary, and partly because it was scarcely practicable, owing to the enormous increase in the number of the gentry, which produced a demand for new combinations.

The glories of heraldry reached their zenith in the reign of Richard II., with "youth at the prow and pleasure at the helm" of the vessel of the state, but it was not till the reign of Richard III. that it was thought necessary to place under specific control the whole heraldry of the kingdom; and this, in close imitation of the example of France, was done by the incorporation of the heralds into a college placed under the presidency of the earl marshal.

The office of the herald as the messenger of war or peace between sovereigns or between contending armies in the field is of far earlier date than the introduction of armorial bearings, but as these came into use they were gradually placed under his charge, and he took his specific name sometimes from that of the noble or leader who employed him, sometimes from one of his castles or titles of honor, and sometimes from one of his badges or cognizances, which the herald wore embroidered upon his dress and by which he was known. In the pages of Froissart and other chroniclers frequent mention is made of heralds-at-arms and their attendants the pursuivants, and we read of Somerset and York, Windsor, Chester, and Lancaster heralds, Clarencieux, Arundel, Fleur-de-Lys, and Leopard; and of pursuivants, Antelope, Blanch Lion, Falcon, Portcullis, and many more. At an early period the principal heralds, and especially those attached to sovereigns, were called kings-at-arms, and as early as Edward I. an officer, called from his jurisdiction, Norroy, was placed in charge of the heraldries north of the Trent. It is probable that a herald was always attached to each order of chivalry, as Toison d'or to the Fleece, and Garter to the chief English order. Garter, however, was only officially appointed by Henry V., when he seems to have been recognized as the principal king-at-arms—"Principalis rex armorum Anglicanorum." At the institution of the college, or soon afterwards, it was decided that its officers should be Garter, principal king-at-arms; Norroy and Clarencieux, provincial kings north and south of Trent; six heralds, Windsor, Chester, Lancaster, Richmond, Somerset, and York; and four pursuivants, Rouge Croix, Blue Mantle, Rouge Dragon, and Portcullis; who constitute the present establishment, though some special officers have since been appointed, as a king-at-arms to the revived order of the Bath, and some others, not members of the college.

It became the duty of the new incorporation to take note of all existing arms, to allow none without authority, and to collect and combine the rules of blazoning into a system. To effect a supervision of the armorial bearings throughout the kingdom, it was necessary to visit the several counties. Such a commission of visitation seems to have been issued by Henry IV. as early as 1412, but the first regular commission acted upon was issued by Henry VIII., 1528–9, and the last early in the reign of James II. The visitations were taken about every thirty years, and for contemporary events are most valuable records. The provincial king, either personally or by deputy, visited the capital town of each county in his division, and summoned the surrounding gentry to record their pedigrees, and show a title to their armorial bearings. The earl marshal's court survived the fall of the house of Stuart, and a few causes relative to a right to particular arms were decided in the course of the last century, but its powers fell into disuse, and not long since it was finally abolished, and with it fell any pretence on the part of the college to regulate, by compulsory authority, the heraldry of the kingdom. At present, however, notwithstanding the democratic tendencies of the age, armorial bearings are in greater demand than ever in England, and more or less coveted in the United States, and a good deal of the proper business of heraldry is still transacted within the college of arms, and a good deal more, irregularly and improperly, outside it. A considerable number of persons still bear arms derived from an ancestor who bore them before the institution of the college; others bear them under grants and patents from that body; and others still more numerous, who or whose fathers have risen from obscurity, have assumed arms according to their fancy, or under the uninstructed advice of some silversmith or finder of arms. The Smiths, said a distinguished member of the family, had no arms; they sealed their letters with their thumbs. It is to avoid so inconvenient a signet that the new men have recourse to the demi-lions and demi-griffins now so much in vogue, and possibly because they are not aware that Garter and his colleagues are still willing to grant arms, crest, and motto, on terms within reach of almost every aspirant to chivalry

There is no college or corporation of heralds in Scotland or Ireland, but in Scotland heraldry has been to the full as much considered, and at least as well regulated as in England. "Lyon-king-at-arms," "Lyon rex armorum," or "Leo fecialis," called from the lion on the royal shield, is the head of the office of arms in Scotland. When first the dignity was constituted is not known, but Lyon was a prominent figure in the coronation of Robert II. in 1371. The office was at first, as in England, attached to the earl marshal, but it has long been conferred by patent under the great seal, and is held direct from the crown. Lyon is also king-at-arms for the national order of the Thistle. He is styled "Lord Lyon," and the office has always been held by men of family, and frequently by a peer. His powers have been declared by statute, and extend to fine and imprisonment. He is supreme in all matters of heraldry in Scotland. Besides the "Lyon depute," there are the Scottish heralds, Islay, Rothesay, Marchmount, Albany, Ross, and Snowdown, with precedence according to date of appointment; and six pursuivants, Kintyre, Dingwall, Carrick, Bute, Ormond, and Unicorn. Heralds and pursuivants are appointed by Lyon.

In Ireland also there is but one king-at-arms, Ulster. The office was instituted by Edward VI. in 1553. The patent is given by Rymer, and refers to certain emoluments as "prædicto officio . . . ab antiquo spectantibus." The al-

lusion is to an Ireland king-at-arms mentioned in the reign of Richard II. and superseded by Ulster. Ulster holds office by patent, during pleasure; under him are two heralds, Cork and Dublin; and four pursuivants, Athlone, and St. Patrick Nos. 1, 2, and 3. Ulster is king-at-arms to the order of St. Patrick. He held visitations in parts of Ireland from 1568 to 1620, and these and other records, including all grants of arms from the institution of the office, are kept in the Birmingham Tower, Dublin, under the charge of the present most courteous and learned Ulster, Sir B. Burke. The precedence of the three chiefs has been the subject of dispute, but is now generally arranged, Garter being followed by Lyon, and he by Ulster.

Heraldry should be studied with reference to the period in which it was a useful art, and in the simple examples of the 14th and 15th centuries. Before that period it was in a changing and elementary state; after it, it became merely ornamental, and its examples are complicated and debased. In a general treatise on the subject notice must of course be taken of the later as well as the earlier conditions of the art, but the greater number of the illustrations in the following pages are taken from the earlier and best examples.

A curious evidence of the vitality of heraldry, and of the desire of all mankind for ancestral distinctions, is afforded by its extension among the republics of the New World. The United States boast some excellent genealogical societies, and a great and very general desire is shown by individuals to trace their pedigrees to the stocks of the Old World, and to assume the arms proper to their name. The national emblem of the stars and stripes, now so widely and honorably known throughout the world, has been traced back to the paternal coat of the first and greatest president, George Washington, whose English ancestors bore "argent, 2 bars gules, in chief 3 mullets of the second." In Canada, Australia, and other English colonies, the assumption of arms by individuals and by the community is not less general; and the republics of South America, of Spanish origin, almost all have adopted coats of arms. The Peak of Teneriffe, the Beaver, the Red Indian, contribute to the list of charges, and the clear firmament of Chili is indicated by a star. "Coupé d'azur sur gules, à une étoile d'argent en abîme."

Divisions of Arms.

Armorial bearings may be conveniently divided into those of dominion, of a community, of office, of concession, family or paternal arms, and arms of alliance. To these may perhaps be added arms of attribution. There is also another division, or rather peculiarity, called canting arms, of which many of the former divisions present examples.

1. *Arms of Dominion* are those of a kingdom or a feudal lordship. The origin of such arms is often obscure. Those of the Isle of Man are three legs conjoined in triangle at the thigh (fig. 116), probably borrowed from the emblem of Sicily, the ancient Trinacria, found upon Greek vases. The Irish harp is an emblem probably allusive to the instrument of Brian Boroimhe. The origin of the lion of Scotland is also obscure, and of the tressure equally so, though fabled to be

"First by Achaius borne."

Not unfrequently the arms of kingdoms were those of an early sovereign, adopted by succeeding dynasties to the exclusion of their own coat. The lions of England were certainly personal to the Plantagenet kings, if not to Henry I.; but they have become national to the exclusion of the arms of the Tudor, Stuart, Brunswick, and Saxon dynasties, just as neither the arms of Baliol, Bruce, nor Stuart ever became the arms of Scotland. The lion rampant azure, crowned gules, so long borne by the head of the German empire, belonged originally to the house of Hapsburg, and was not used by such of the early emperors as were not members of it; and the bend and alerions of Lorraine only became a part of the arms of the empire after the marriage of Francis of Lorraine with Maria Theresa. It seems indeed to have been the custom of elected sovereigns, as those of the empire and of Poland, to place their paternal arms on a shield of pretence over those of the dominion. Cromwell so placed his arms over those of the commonwealth, and William of Nassau over those of England, but they disappeared with the individual who introduced them. On the other hand the arms of kingdoms and lordships are sometimes continued to be used as personal arms by the descendants of their former lords. The great shield of Mary of Burgundy quarters the arms of a number of duchies and provinces. Simon de Montfort thus used the arms of the Honor of Hinkley. Richard de Monthermer (who married the countess of Gloucester, and was, by courtesy, earl of that name) at Caerlavrock, while he bore on his shield his own arms, "or, an eagle displayed vert," on his banner displayed "or, three chevrons gules" for the earldom. So also Humphrey, duke of Gloucester, (died 1446), used on one of his seals the three fusils of Montacute, because he held lands which belonged to that barony. The *Book of St. Albans* says that, if the king grant a lordship to a yeoman entitling him to bear arms, he may take those of that lordship.

Under this head may be described the armorial shield of Great Britain (fig. 1). The arms, gules 3 lions passant in pale or, are for England, and are so borne by the kings of England till the reign of Edward III., who in 1340 quartered with them, in the first quarter, the arms of France, azure, semée of fleurs-de-lys or. Thus they continued till the latter part of the reign of Henry IV., when the fleurs-de-lys were reduced to *three*. No alteration occurred in the royal achievement during any of the succeeding reigns till the accession of James VI. of Scotland to the throne of England, when that sovereign introduced the royal arms of Scotland into the second quarter, and the arms of Ireland into the third quarter. The royal arms were thus borne by all the monarchs of the house of Stewart till the reign of Anne, though William III. bore over the quarterings of the royal arms those of his Dutch dominions—the house of Nassau. In the reign of Anne a change again took place, occasioned by the union of England and Scotland; and the arms of these kingdoms were impaled in the first and fourth quarters (England on the dexter, Scotland on the sinister); France was removed to the second; and Ireland retained its former position. On the accession of the house of Brunswick in 1714, the fourth quarter in the royal shield gave place to the arms of his Majesty's German dominions, an arrangement which continued till 1st January, 1801, when, upon the Union of Great Britain and Ireland, the arms of France were excluded, England occupied the first and fourth quarters, Scotland the second quarter, and Ireland its old position in the third quarter; while over all, on an escutcheon of pretence, were placed the arms of Hanover, ensigned with the electoral bonnet, in 1816 exchanged for the Hanoverian crown. On the death of William IV. Hanover passed away, and its arms were withdrawn, and the present arrangement introduced. In Scotland, and in Scotch official documents, the Scottish coat is placed in the first quarter. It bears "or, a lion rampant, within a double tressure flory-counterflory, gules." There is no positive authority for any early coat of arms being used for Ireland, though the bearing "azure,

Fig. 1.—Arms of Great Britain.

3 crowns in pale or" granted by Richard III. to De Vere has been so regarded. From the reign of Henry VII., "azure, a harp or, strings argent," has been regarded as the Irish coat, and as such is inserted into the imperial shield. There is no authority of any standing for a coat of arms for the whole of the principality of Wales, but the coat usually attributed to it is "quarterly azure and gules, 4 lions passant gardant, counterchanged." The ancient princes of Wales would scarcely have adopted the lions of England. Moreover, this coat was never used by any leading chief in either middle or south Wales.

In Scotland arms territorial are much recognized. The dukes of Athole quarter Man. The garbs are quartered by the Erskines for the earldom of Bute. When Archibald Douglas was created duke of Touraine, he placed the arms of that duchy, three fleurs-de-lys, on his first quarter, before those of Douglas, Annandale, and Galloway. The dukes of Richmond bear three buckles for the dukedom of Aubigny. "Paly of 6 argent and sable" are the reputed arms of the earldom of Athole, and "a saltire between 4 roses" those of that of Lennox.

To this head belong arms of pretension, where a sovereign claims *de jure* a possession which he no longer holds, and sometimes never held, *de facto*. Thus the kings of England from Edward III. to George III. bore the French lilies, and claimed to be kings of France, and the kings of Sardinia and Naples used the arms of Cyprus and Jerusalem. In fact, nearly all the older sovereigns of Europe used arms of this character. The armorial shield of the house of Austria at the dissolution of the empire affords a number of curious examples of arms of pretension. Besides Hungary, Bohemia, Dalmatia, and Slavonia, it contained Aragon and Sicily, Brabant, Swabia, Antwerp, Flanders, Burgundy, Naples, Jerusalem, Lombardy, and Milan.

2. *Arms of Communities* are borne by corporations, religious houses, colleges, cities and boroughs, the Cinque Ports, guilds, and inns of court, some of which were allowed arms from an early period. These are very generally adopted in honor of some founder, great benefactor, or early and distinguished member of the body. Thus Birmingham bears the arms of the barons of that name, Manchester of the Byrons, Leicester of the Bellomonts, Cardiff of the De Clares. Of religious houses Atherstone bore the arms of Basset; Garendon of the earls of Leicester; Kirby-Bellers of Bellers. Of colleges, Balliol, All Souls, and Pembroke at Oxford, and Clare at Cambridge, so commemorate Balliol, Chichele, Valence, and De Clare. The Cinque Ports all bear a part of the arms of England. The arms of the guilds and city companies usually contain some allusion to their trade, those of the grocers are 9 cloves; of the fishmongers, 3 dolphins, of the blacksmiths, 3 hammers. Of the inns of court, the Inner and Middle Temples bear badges of that order; Lincoln's Inn uses the purple lion of the De Lacys, earls of Lincoln; Furnival's Inn the bend and martlets of the Barons Furnival. A bishop, as a corporation sole, represents his see and bears its arms. These usually contain some ecclesiastical emblem, keys, crosses, mitres, martyrs' crowns, or the like. Hereford bears the arms of Cantilupe, possibly from its canonized bishop of that family. The arms of Lichfield and Coventry are founded upon those of Jerusalem; London, Winchester, and Bath and Wells assert their temporal power by bearing swords. The English sees were early provided with arms, but in Scotland they were of very late introduction. Bishops before the 17th century seem to have used their personal arms. Thus Gawain Douglas, bishop of Dunkeld,

"Who gave fair Scotland Virgil's page,"

and Alexander Douglas, bishop of Moray in 1606, placed the Douglas arms upon their seals. Sometimes, however, this seems to have been combined with some ecclesiastical emblem, for the archbishops of St. Andrews placed the cross of St. Andrew on their seals, while below were their paternal arms, and the bishops of Glasgow so bore a figure of St. Mungo.

3. *Arms of Office* are not uncommon. The electors and chief officers of the empire each bore some token of their office. The crossed swords so well known on Dresden china were borne by the electors of Saxony; the sceptre by those of Brandenburg; the crown of Charlemagne by the electors of Hanover as arch-treasurers. The ancestors of the dukes of Ormond were hereditary butlers of Ireland, and bore three covered cups. The kings-at-arms bear arms of office. Garter, the principal king, bears "argent, a cross gules, on a chief azure a crown or encircled with a garter of the order buckled and nowed between a lion of England and a lily of France," by no means such an example of heraldry as might be expected from the chief herald of England. The knights of St. John of Jerusalem augmented their paternal arms with a chief gules, charged with a cross or. Several civic offices in France gave a right to bear arms. Ménage observed of a mayor of Angers who died upon his election, and was buried with his newly acquired arms—

"Il étoit de bonne nature,
Et ne fut armé qu'en peinture."

4. *Arms of Concession* were granted by a sovereign or some feudal superior, sometimes in memory of some great deed, but more frequently to indicate the connection between the lord and his follower, when they are called arms of patronage. Of the former character was the heart in the arms of Douglas, first used by William I., earl of Douglas, 1356, in memory of James Lord Douglas's mission with Robert Bruce's heart; and to this a crown was added in the time of William II., earl of Angus, in 1617. Also the families of De la Warr, Pelham, Vane, and Fane bear arms in allusion to the share of the ancestors of each in the capture of John of France at Poitiers. Sir James Audley, after Poitiers, not only divided the Black Prince's present between his four squires, but allowed them to bear portions of his coat armor, "gules, a fret or," in memory of which the family of Delves still bear "argent, a chevron gules, fretty or, between 3 billets sable" (fig. 82); and that of Dutton, "quarterly, argent and gules, on the 2d and 3d quarters a fret or." It was probably in memory of the same event that John Touchet, Lord Audley, granted to John and Thomas Mackworth, for services performed by their ancestors and themselves to his ancestors and himself, to bear "party dentelle de sable et d'hermines, un chevron de gules fretté d'or,"—arms still used by the Mackworths, with a slight addition, and now blazoned "per pale indented sable and ermine, on a chevron gules 5 crosses patée or." Among many similar instances may be mentioned Tatton of Cheshire, who bears "quarterly argent and gules," evidently derived from Massy. Harvey of Ickworth bears "gules, on a bend argent 3 trefoils slipped vert," derived from Foliot, who bore "gules, a bend argent." Staunton of Longbridge, who held by the service of repairing a tower of Belvoir Castle, bore "argent, 2 chevrons within a border engrailed sable," derived from Albini of Belvoir, who bore "or, 2 chevrons and a border gules." Lowther and Musgrave derive their annulets from Vipont. Moton of Peckleton, Brailsford, Astley of Hillmorton, Besington, bore "argent, a cinquefoil azure;" "or, a cinquefoil sable;" "azure, a cinquefoil ermine;" and "azure, a cinquefoil or," all derived from the bearings of the Bellomonts, "gules, a cinquefoil ermine." Hardress, who held under De Clare at Tonbridge, bore "gules, a lion rampant debruised by a chevron or;" and the lords of Avan, Welsh barons under De Clare, bore the three chevrons. Thus also Flamville and Wharton used the maunch of Hastings. "Ermine and checquy," from the Newburgh earls, were common in Warwickshire, and the "canton" in Westmoreland, derived from the Lancasters, barons of Kendal. In Douglasdale the "stars" of Douglas preponderate, and in Annandale the "saltire" of Johnstone.

Arms also passed from one friend to another by deed or will, even when there was no blood relationship. Henry de Lacy, the last earl of Lincoln, bequeathed to his friend and executor Sir H. Scrope a lion passant purpure, in augmentation of his coat, and Sir Henry wore it accordingly, though for life only. Maud Lucy, heiress of her brother Anthony Lord Lucy of Cockermouth, married Henry Percy, earl of Northumberland, 1414. She died childless, but bequeathed her lands to the Percys on condition they bore her arms, "gules 3 luces," quarterly with Percy, which they continued to do, and indeed, though without any right, often styled themselves Barons Lucy. To this class also belong arms of augmentation, sometimes called additions of honor. Thus Richard II. chose to impale with his own the imputed arms of the Confessor, "gules, a cross patonce between 5 martlets or," and he granted to Thomas Holland, duke of Surrey, to impale them within a border argent with his own arms. Thomas Mowbray, duke of Norfolk, was

also allowed to impale the entire arms of the Confessor, a fatal gift, as it was one of the charges brought against his ambitious descendant Henry Howard. Richard also allowed De Vere, duke of Ireland, to bear for life "azure, 3 golden crowns within a bordure," which seems then to have been regarded as the arms of Ireland. They are found on tiles marshalled quarterly with De Vere. After the victory of Flodden, Henry VIII. granted to the earl of Surrey to augment his arms with a "demi-lion gules pierced through the mouth with an arrow, within a double tressure flowered of the same," to be placed on the Howard bend. Henry used both the pile and the flaunch in his augmentations to the families of his English wives. Seymour bore "quarterly, 1 and 4, or, on a pile gules between 6 fleurs-de-lys azure 3 lions of England; 2 and 3, Seymour." The augmentation to Catherine Howard includes 2 flaunches, that to Catherine Parr a pale. Manners of Belvoir bore "or, 2 bars argent, a chief quarterly azure and gules, in the 1st and 4th quarter 2 fleurs-de-lys, in the 2d and 3d a lion of England, or." The bars were no doubt taken from the Muschamps. The chief and its contents were an augmentation from Henry VIII.

In Scotland an early Lord Seton had a concession from Robert Bruce of a sword supporting a crown, and his descendant in 1601 received as an augmentation "azure a blazing star of 8 points within a double tressure or."

Most of the earlier grants or concessions seem intended to commemorate some territorial or genealogical concession, those of later date some connection with royalty, or some deed of arms in the field. Thus Sir Cloudesly Shovel received 2 fleurs-de-lys in chief and a crescent in base in memory of two victories over the French and one over the Turks, and Nelson and other naval commanders received additions rather to be described as sea pieces than as heraldic augmentations.

5. *Family* and *Paternal Arms* and arms of succession are such as descend by custom to the male heir. The descendants of females, heiresses, save by special license, can only quarter their arms. This rule has indeed been much abused, and on every side are seen good maternal names and arms adopted to the exclusion of those less distinguished on the paternal side. Paternal arms are of very various dates and origin. There seem, however, always to have existed certain recognized rules which the earl marshal had power to enforce. One of the most important of these was that no two persons in the same kingdom should bear the same arms, a practice clearly subversive of the main use of such insignia. Many were the disputes and challenges that arose out of this regulation, of which two of the most remarkable have already been mentioned.

6. *Arms of Alliance* or heirship were used when those of a great heiress were allowed to supersede the paternal coat. Thus the heiress of Mandeville, earl of Essex, married Say, and their heiress, Beatrice de Say, married Geoffrey Fitz Piers. Geoffrey (died 14 John) became earl of Essex, and their descendants took the name and bore the arms of Mandeville exclusively. William II., earl Warren (died 1148), left a daughter and heiress Isabel, who married Hamelin, natural son of Geoffrey of Anjou and brother to Henry II. He became earl of Surrey, and bore the name and arms and continued the line of Warren. The De la Bisse family, who claimed to descend from the male stock of the De Clares, bore the 3 chevrons differenced with a label of 3 points, though when, in the reign of Richard II., they intermarried with the Staffords, they laid this aside, and adopted a "chevron between three roses." When Gilbert Talbot (died 1274) married Gwenllian, or Gwendoline, the heiress of the Welsh prince Rhys ap Griffith, he laid aside his paternal coat, "bendy of 10 pieces, argent and gules," and adopted that of the lady, "gules, a lion rampant, or within a border engrailed of the field," as still used by the earls of Shrewsbury.

7. *Arms of Attribution* are altogether fictitious, and such as the heralds of the 15th and 16th centuries indulged in to an absurd extent, providing every hero of antiquity with a coat of arms. The same age that represented the Virgin Mary as versed in the canon law declared that Solomon, as the wisest of men, must have been a good herald, and described the armorial bearings of Achilles and Hector. Perhaps the most extravagant example of this fashion is contained in the work of Dame Juliana Berners, who says: "Of the offspring of the gentielman Japhet, comes Habreham, Moyses, Aron, and the profetys, and also the kyng of the right lyne of Mary, of whom the gentilman Jhesus was borne, very God and man; after his manhode King of the londe of Jude, and of Jues, gentilman by is modre Mary, prynce of coat armure;" and again, "The four doctors of holy chirch, Scynt Jeromy, Ambrose, Augustyn, and Gregori, war gentilmen of blode and of cotarmures." At an earlier period, in the reign of Richard II., it was believed that many of the bearings in use had been borne ever since the Conquest, as appears from the evidence in the Scrope and Grosvenor controversy. Almost all the older genealogists attribute coats of arms to ancestors long before they were in use. On the tomb of Queen Elizabeth are emblazoned the arms of William the Conqueror and Matilda of Flanders, and of Henry I. and Matilda of Scotland, all of course pure inventions. It is only of very late years, since a critical spirit has found its way even into heraldry, that these absurdities have been exposed.

8. *Canting Arms*, the "armes parlantes" of French heraldry, are common to all the preceding classes of arms, and most common in those of the earliest date. Such were the castle and lion for Castile and Leon, the fers de cheval of Ferrers, the lion (löwe) of Louvaine, the luces of Lucy, the sharp-pointed row of fusils of Montacute, the corbeau or raven of Corbet, the herons of Heron, the falcon of Falconer, the greyhounds (levriers) of Mauleverer, the barnacles of Bernak, the castle of Chastil, the swine's head of Swinbourne, the penfeathers of Coupenne, the hirondelles of Arundel, the storm-finches of Tempest, the hammers of Hamerton, the tyrwhits of Tyrwhitt, the hanks of cotton of Cotton, the fusils of Trefusis, the oxen of Oxenden, the fer de moline of Molyneux, the hazel leaves of Hazlerigge, the Danish axes of Hakluyt, the bozons or bird bolts of Boltesham and Bozon, the bend wavy of Wallop, or Well-hope, the whelk-shell of Shelley, and many more, mostly early coats, and borne by considerable persons and families. In fact the practice was introduced whenever the name admitted of it, and sometimes when the allusion is very far-fetched indeed, as in the boar pig "verres," the crest of De Vere, and the cock for Law, alluding to his cry, cock-a-leary-law! Canting arms were equally common in other countries. In Italy the Colonne, Frangipani, and Ursini families bore a column, a piece of broken bread, and a bear. They were also common in France, Spain, and Germany.

Tinctures.

Tinctures (in French, *émaux*) include metals, colors, and furs. The *Metals* are—

Or	Yellow	Topaz	Sol.
Argen	White	Pearl	Luna.

The *Colors*—

Azure	Blue, azur	Sapphire	Jupiter.
Gules	Red, gueules	Ruby	Mars.
Purpure	Purple, pourpre	Amethyst	Mercury.
Sable	Black, sable	Diamond	Saturn.
Vert	Green, sinople	Emerald	Venus.

The *Furs*—

Ermine, Vair, Ermines or Counter-ermine.
Erminois, Erminites, Pean, Vair-en-point, Counter-vair, Potent counter-potent.

Gules is thought to come from the Persian *gul*, "a rose,' but more probably from *gula*, "the throat." The other terms are French. To the older colors have been added "sanguine" and "tenné" or tawny, a compound of red and yellow. They are almost unknown in English heraldry, and are symbolized, the one by sardonyx and dragon's tail, and the other by jacinth and dragon's head. The blazoning by precious stones and planets, and even by the virtues, was a foolish fancy of the heraldic writers of the 16th century, and applied to the arms of peers and princes. Gwillim condescends to use it.

A shield is rarely of one tincture only. In the roll of Caerlavrock, however, Sir Eurmenious de la Brette

"La banière eut toute rougeate."

The original bearing of the Gournays of Norfolk seems to have been sable. De Barge of Lorraine bore "azure." The Captal de Buch, who figures in Froissart as a Guyenne knight, bore "or," and Boguet, a Norman knight, bore "argent."

The furs (fig. 2) are all supposed to be formed of the

skins of small animals fastened together. Ermine and vair were long the only furs acknowledged, and even now the rest are not common. Ermine (*a*) represents the skin of the animal of that name, and is white powdered with black spots.

In vair (*b*) the skins in shape resemble small escutcheons, the wings representing the forelegs and the point the tail. The fur is that of a sort of squirrel, bluish-gray on the back and white on the belly, and thence called "varus." The skins are arranged alternately argent and azure; and if of other colors they must be specified. There are varieties of vairs, as vair-en-

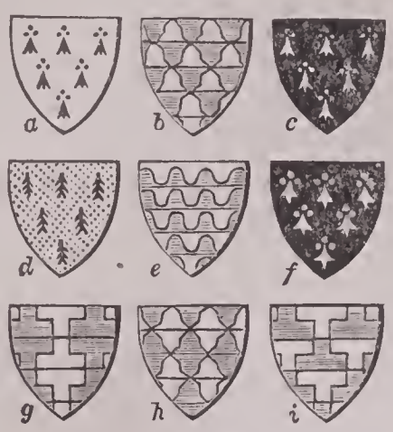


Fig. 2.—Furs.

point, where the point of one escutcheon is placed opposite to the base of that below; counter-vair (*h*), where those of the same color are placed base to base and point to point. At first the vair was drawn bell shaped (*e*).

In ermines (*c*) the field is sable and the spots white, in erminois (*d*) the field or and the spots sable; pean (*f*) is the reverse, having golden spots on a black field. Erminites resembles ermine, save that the two lateral hairs of each spot are red. This fur, however, is seldom if ever used in English heraldry. Guillim in blazoning a fur prefixed the word "purfled."

Potent (*i*) is a variety of vair, and often blazoned as "vair-potent." There is also a form of it called "potent-counter-potent" (*g*). Manchester, of the county of Stafford, bore "potent-counter-potent, argent and sable, a bend gules." The escutcheons or skins are T-shaped, and resemble a "potence," that is, a gallows or a crutch head.

Ermine and vair are used almost to the exclusion of all other furs. Even erminois is very rare.

The dukes of Britanny, earls of Richmond, bore "ermine" (this was the coat of John de Montfort, duke of Britanny, whose widow married Henry IV.); Lattin, "per pale argent and sable, a saltire engrailed ermines and ermine;" Beauchamp (old), "vair, a label gules;" Gresley of Drakelow, "vair, ermine and gules;" Calvert, "paly of 6 erminois and pean, a bend engrailed counterchanged."

Of the colors, gules, azure, and sable are by far the most common in early bearings. They contrasted strongly with each other and with the metals. To preserve this contrast, arose the very early and general rule not to place metal upon metal, or color upon color. Scott takes the license of a poet to break this rule in *Marmion*, whose falcon

"Soar'd sable on an azure field,"

and in *Ivanhoe*, where the blackknight bears "a fetter lock and shakle bolt azure, on a field sable." He pleasantly defended himself by quoting the arms of the kingdom of Jerusalem, "argent, a cross potent between four crosses, all or," which thus violates this fundamental canon. The French call such coats "armés à engueris." There are a few other less illustrious but early instances.

Venour, warden of the Fleet, 1480, bore gules on a fess sable, five escallops or, 2, 2, 1.
Leycester of De Tabley: azure, a fess gules between three fleurs-de-lys or.
Sir Richard de Rokesle, *temp.* Edward II.: "d'azure, a six lioncels d'argent, a une fesse de gules."

When an object is given of its natural color it is blazoned as "proper." Thus in the insignia of the order of St. George and St. Michael we have "the archangel encountering Satan, all proper;" though the German family of Teufel displays a teufel or devil gules. A very striking contrast of color is produced by a process called "counterchanging," where a shield is divided between two colors, and a charge placed over the dividing line is also divided between the same colors transposed.

Chetwode of Chetwode: quarterly, argent and gules, four crosses patée counterchanged.
Peyto of Chesterton: barry of six party per pale dancette, argent and gules counterchanged.

A very convenient practice of representing the tinctures by certain marks and lines arose in the 16th century, and is attributed to Padre Silvestre de Petro Sancto, an Italian. It was devised to allow of the representation of armorial bearings in drawings or engravings where it was inconvenient to color them. Planché states the earliest known instance of the use of this method in England to be in an engraving of the seals of the regicides attached to the death warrant of Charles I. Sir E. Bysshe in Upton, 1654, gives a representation of these marks. Or (fig. 3) is represented

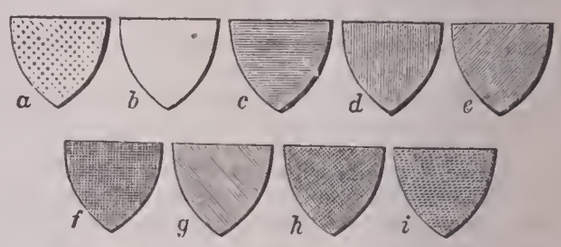


Fig. 3.—Representation of Tinctures. *a*, or; *b*, argent; *c*, azure; *d*, gules; *e*, purpure; *f*, sable; *g*, vert; *h*, sanguine; *i*, tenné.

by hatched points; silver is plain; azure is represented by horizontal lines, gules by vertical lines; those for purpure are drawn diagonally from sinister to dexter and those for vert from dexter to sinister. For sable, the lines are vertical and horizontal; for sanguine, diagonal, or in saltire, from right to left and left to right, a compound of purpure and vert; and for tenné, diagonal from sinister to dexter, and horizontal, a compound of purpure and azure.

Parts of Arms.

These are (1) the escutcheon; (2) the ordinaries; (3) partition lines; (4) charges.

The Escutcheon.

The *Escutcheon*, écu, or shield, called in blazon the field, upon which all lines are drawn and charges delineated, represents the shield borne in war upon which the arms of the knight were displayed. The figure of the shield varied in heraldry as in war. First came the long-pointed, kite-shaped shield or "pavesse," slightly convex, and used with chain armor. As late as the reign of Richard I. and John such may be seen on early effigies, commonly but by no means always without armorial bearings, which were not then generally in use (fig. 4). Varieties of this are the

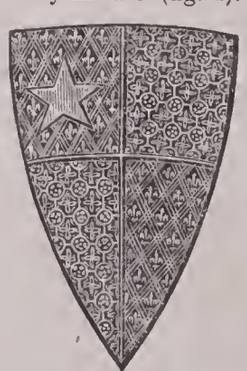


Fig. 4.

Fig. 5.—From the Bayeux tapestry.

heart-shaped or pear-shaped shields (fig. 5), and sometimes a shield representing a third part of a cylinder with square top and bottom, much used in siege operations. Early in the 13th century was introduced the small heater-shaped shield, also triangular but narrow, short, and somewhat lancet-shaped. This was in use in the reign of Henry III., and in the Early English period of architecture (fig. 6). The three water budgets of Ros appear on a shield of similar form of the date of Edward I. in the Temple Church (fig. 7). As coats of arms were then simple, this shield was large enough to contain them without crowding, and there-

fore with sufficient distinctness. When drawn or carved in architecture it is suspended by its "guiges" or shield straps, either upright or by the upper sinister angle, when it is said

Fig. 6.

Fig. 7.

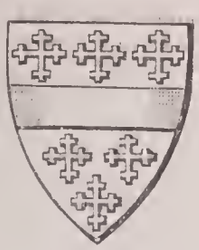


Fig. 8.

to be "couché." Fig. 8 is from the great seal of Thomas de Beauchamp, earl of Warwick, and shows the form of shield in use during most of the Edwardian period.

As tilted and fancy plate armor came into fashion, the shield also altered its figure and became four-sided, and concave in the top and side edges, with a central point below; a notch also was cut in the upper dexter corner to allow the lance to reach its rest, which projected from the breastplate, as in the shields upon the tower of the chapel of the Babingtons at Dethick, and on their tombhouse at Kingston (fig. 9). Such shields were called "chancrée," or "à la bouche." They are frequently carved as an ornament in the Perpendicular style of architecture. As the shield ceased to be used in war, and was only known as a representation upon tombs or in pedigrees, it was altered to suit the fashionable practice of introducing large numbers of quartered coats, frequently twenty or thirty, and sometimes a hundred, as in an escutcheon of the earls of Huntingdon in Burnham church.

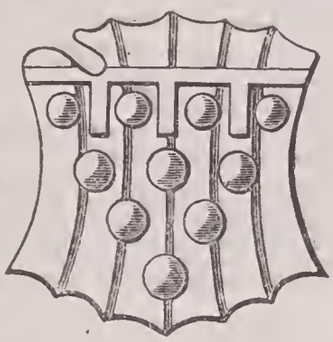


Fig. 9.

In the construction of the shield, while actually used in war, great strength had to be combined with as much lightness as possible, and this was attained by the use of cuirbouilli and plates of horn stretched upon a wooden frame. The cramps and cross pieces employed to stiffen the whole are sometimes seen upon early shields, and are supposed, with much reason, to have been painted or gilded as ornaments, and to have given rise to the bars or ordinaries which predominate in the first simple coats. Our acquaintance with the forms and fashions of the earlier shields is chiefly derived from their representations on tombs, but the actual shield of John of Gaunt was long preserved in old St. Paul's, and that of the Black Prince still hangs above his tomb at Canterbury, as do those of his father and of Henry V. at Westminster. An unmarried woman did not place her arms upon an escutcheon, but, whether maiden or widow, upon a lozenge, an early practice in allusion probably to a fusil or distaff. When married she shared the shield of her husband.[1] The lozenge is an ancient usage, being found in the seals of English ladies of the middle of the 14th century, and in Scotland a century later. In modern heraldry the shields of knights of an order are usually oval or circular, called "cartouche" shields, and encircled with a ribbon bearing the motto of the order. When married the knight's arms are blazoned alone within the ribbon, and again represented with those of his wife in a second shield encircled with a plain ribbon, and placed on the sinister side of the other. The dexter side of the escutcheon is that on the proper right of the bearer and therefore on the left of the spectator.

To secure due precision in blazoning, nine points, indicated by as many names, are taken on the surface of the shield. These (represented by the letters in fig. 10) are —at the top in a horizontal line three, the middle, dexter, and sinister chief; at the base three, also horizontal, the middle, dexter, and sinister base; and in the central or vertical axis also three, of which the upper is the honor point, the lower the nombril point, and the middle the fess point —the central point of the shield. The last three are of course in a line with the chief and base middle points.

Fig. 10.

Before passing to the ordinaries, it will be convenient here to mention a species of decoration applied to the shield, which, though not strictly heraldic, is often used in early heraldry and called "diaper." A shield "diapered," "bracteatus," is covered with a ground pattern usually in squares or lozenges with a flower or scroll work in each compartment. The idea is said to be copied and named from the linen cloths of Ypres. An often-quoted example of diaper, and a very good one, is the shield of Robert de Vere upon his tomb at Earls Colne (fig. 4). Also the shield of William de Valence upon his effigy in Westminster Abbey is a very fine example of diaper. There the ground is divided into small squares, and each contains a pattern. The row of shields in the tabernacle work of the old chapel of St. Stephen's, Westminster, exhibits some fine specimens of diapered work in squares, lozenges, and circles. The shield of Earl Warren at Castle Acre Priory

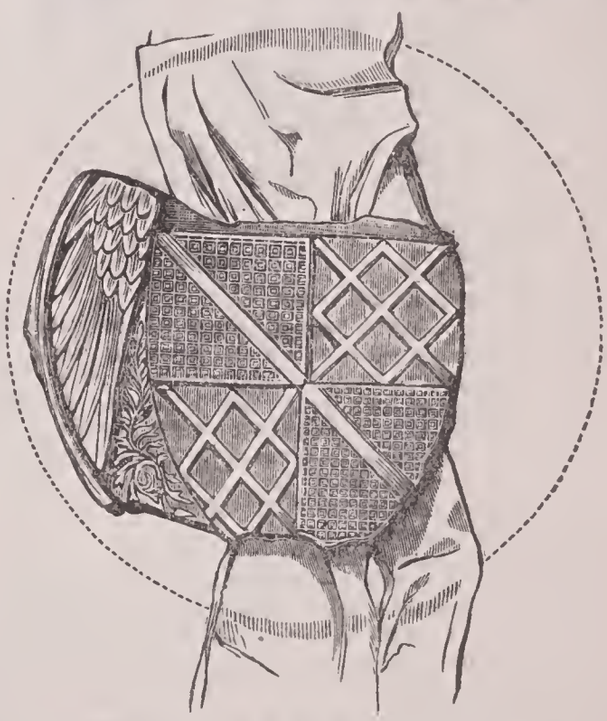


Fig. 11.—Counterseal of Thomas le Despenser.

is a good example of diaper, as is the counterseal of Thomas le Despenser affixed to a Kenfig charter in 1397 (fig. 11).

Ordinaries and Partition Lines.

The *Ordinaries*, or, as they are called in most heraldic books, "the honorable ordinaries," have been supposed to represent the clamps or fastenings of the shield, converted into ornaments by painting or gilding. They may be regarded as nine in number—the chief, the pale, the fess, the chevron, the bend, the cross, the saltire, the pile, and the quarter. When charged they are drawn somewhat broader than when blank, and each has one or more diminutives. All were more or less in use in the earliest times of heraldry, and they were then drawn more boldly and narrower than is now the custom. When such of the ordinaries as admit of it are cut short so as not to reach to the margin of the field, they are said to be humettée or coupée.

Partition Lines, closely allied to the ordinaries named from them, are the lines by which shields may be divided, and which vary both in direction and pattern. It will be convenient to notice these before proceeding to a detailed account of the ordinaries, as the partition lines will be constantly referred to in the examples. When the field is divided in the direction of an ordinary it is said to be "party per" that ordinary, as party per fess or per bend. Party per chief is rare, party per pile or per quarter unknown; party per cross is called quarterly; party per cross and per saltire is gyronny. When the partition line is

[1] When an eminent geologist and proprietor of a well-known patent lozenge left his business for the militia, and after a short time returned to civil life, it was said—

"So maidens who to Hymen yield
Exchange the lozenge for the shield,
But, when they lose the best of men,
Return to lozenges again."

mentioned without qualification, it is a straight line, but it may be broken in a variety of ways, as indented, dancette, engrailed, invected, undy, nebuly, embattled, dove-tailed, and raguly. These partition lines in some cases, if not in all, have arisen from the outline of a charge or bearing. Thus Charnels of Snareston at first bore eleven lozenges conjoined in cross, which at a later date became a cross engrailed, and fusils in the same way became converted into dancette. In English heraldry the partition lines are per pale, per fess, per chevron, per bend dexter and sinister, quarterly, per saltire, and gyronny,

The annexed shield (fig. 12) represents these partition lines. It may be blazoned—quarterly of nine coats: 1. Butler: or, a chief indented azure; 2. Fleetwood: party per pale nebuly, azure and or, six martlets, counterchanged; 3. Vavasour: or, a fess dancette sable; 4. ——— or, a chevron invected azure; 5. Boyle: party per bend embattled, argent and gules; 6. Trevor: party per bend sinister, ermine and ermines, a lion rampant or; 7. Lawrence: argent, a cross raguly gules; 8. Bottetourt: or, a saltire engrailed sable; 9. ——— party per fess dovetailed, or and sable. A good example of a cross raguly, not an armorial bearing, is found upon a 12th century tomb in the church of Llanfihangel-yn-Gwynfa in Powysland.

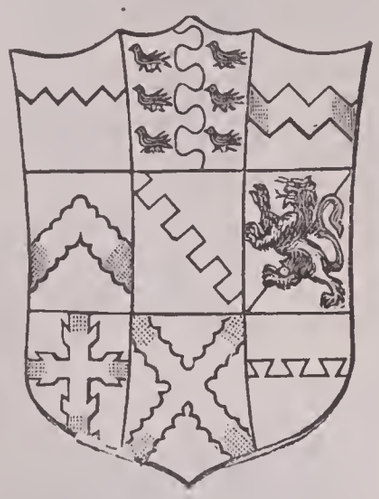


Fig. 12.

The French use parti and coupé for per pale and per fess; they do not part per chevron, but per bend and per bend sinister are tranché and taillé; quarterly is écartelé, and per saltire écartelé en sautoir; gyronny is gironé. Besides these the French have a number of other divisions, as "tierce," when the shield is divided into three parts, as "tierce en pal, tierce en fasce," etc. Tierce en pal is convenient when the coats of two wives are to be marshalled on the husband's shield.

Formerly such broken lines as were used were not mere margins, but affected the whole ordinary; a fess indented was a zigzag and called a daunce or dancette. This practice is still preserved with the line undy. A bend undy or wavy is not a mere bend with a wavy edge, but the whole bend is in waves, whereas a bend nebuly or raguly has merely a particular kind of edge.

Returning to the ordinaries, it may be remarked that very many both of these and of the subordinaries in heraldry are very frequent constituents in mouldings in the Norman style of architecture. The chevron and the billet are amongst the most common. The roundel forms the hood moulding of a door at Peterborough, and is inserted in a moulding in the intersecting arches of St. Augustins, Canterbury. The fret, the billet, and the roundel or pellet are largely used in the oldest parts of Malmesbury, and on Lincoln tower is a good example of undy,—and this before the regular employment of heraldic bearings.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

1. The *Chief*, chef, caput, is the upper part or head of the shield, covering one-third of it, and parted off by a horizontal line. It is found in the earliest examples of arms. In the roll of Henry III. it occurs fourteen times, in that of Edward II. twenty-one times.

De Vivonne: ermine, a chief gules (fig. 13).
Butler (see fig. 12).
Astou: argent, a chief undy (fig. 14).
St. John of Melchbourne: argent, on a chief gules, two mullets pierced or (fig. 15)
Cromwell of Tattershall: party per chief, gules and argent, a bend azure; which might also be blazoned as gules, a chief argent, and a bend azure (fig. 16).

Heraldic writers give the *fillet* as a diminutive of the chief. It was a narrow strip laid upon the chief, a little above its lower margin. Guillim mentions, but gives no examples of it.

2. The *Pale*, pal, palus, is a vertical strip set upright in the middle line of the shield, and one-third of its breadth. One of its earliest examples, if indeed it be not a mere gilt ornament, is ascribed to Graintmaisnel, baron of Hinkley, who is reported to have borne gules, a pale or; but the banner of the barons of Hinkley carried by Simon de Montfort was per pale indented, gules and or. The "sable pale of Mar" is the well-known bearing of Erskine, argent, a pale sable (fig. 17), but when it was introduced into Scotland is not clear. In the roll of Henry III. there occurs no pale, but there are three examples of paly. Party per pale is also there found. In the roll of Edward II. there is also no pale, but paly or party per pale occurs thirteen times. The latter is called simply "party:"—Pluys, "party d'or et goules."

Fig. 17.

Fig. 18.

Fig. 19.

Fig. 20.

The diminutives of the pale are the *pallet*, one-fourth, and the *endorse*, one-eighth, of the breadth of the pale, both unknown anciently. The pallet may be used singly, the endorse only in pairs, one on each side of the pale.

Waldgrave: per pale or and gules.
Marshall, Earl Marshal and of Pembroke: party per pale or and vert, a lion rampant gules.
Fleetwood (see fig. 12).

When the pale is repeated, it is blazoned as "paly," and the number of pieces specified.

Kingdom of Aragon. paly of ten argent and gules (fig. 18).
Gurney: or, two pallets azure.
Wykes of Dursley: argent, on a pale endorsed sable three greyhounds' heads erased or, collared gules (fig. 19).
Daniel of Cheshire: argent, a pale fusilly sable.
Lightford: azure, a pale rayonée or (fig. 20).

Fig. 21.

Fig. 22.

Fig. 23.

3. The *Fess*, fesso, fascia, is a strip placed horizontally across the middle of the field. It occurs about twenty-five times in the roll of Henry III., and its diminutives about twenty-three times, or forty-eight times in all, against ninety in the roll of Edward II.

Hapsburg: gules, a fess argent (fig. 21).
Charlotte, queen of George III., on her shield of Mecklenburg-Strelitz placed a scutcheon of pretence party per fess, gules and or, for Stargard.
Vavasour (see fig. 12).
Henry de Percy, ancient blazon: azure, a fess engrailed or (fig. 22). This is a way of describing what is better known as azure, five fusils conjoined in fess or.
The seal of Walter son of Alan, steward of Scotland, 1190, gives a fee checquy, probably the earliest trace of the Stewart coat.
Weld of Lulworth: azure, a fess nebuly between three crescents ermine (fig. 23).
De le Plaunch: argent, a fess embattled gules.
Paramour: azure, a fess embattled counter-embattled, between three estoiles or.
The Temple banner "Beauseant" was party per fess sable and argent.
Nicholas de Criol: per fess or and gules.
Swinburne (modern): party per fess gules and argent, three cinquefoils counterchanged.
Pearston: argent, a fess quarterly, sable and or (fig. 24).

The diminutives of the fess are the *bar*, covering one-fifth of the field; the *barrulet*, one half, and the *closet*, one-quarter of the bar. The closet is used in pairs only, usually called *gemelles*, and these are sometimes quadrupled, two pairs on each side, and sometimes are used without the bend between them. The bar is rarely used singly, the number must be specified if above four, when the coat is "barry" of the given number. The term fessy is not used.

Harcourt of Ankerwyke: gules, two bars or.
Basset of Tehidy: or, three bars wavy gules.
Blount: barry nebuly of eight pieces, or and sable.
Fitz Alan of Bedale: barry of six, argent and azure.
Dabridgecourt: ermine, three bars humetty gules, fesswise in pale.
Badlesmere: argent, a fess gemelled gules (fig. 25). This is from the roll of Caerlavrock, but the more used blazon is—argent, a fess and two bars gemelles gules, which might be given—a fess closeted.
Fairfax of Denton: argent, three bars gemelles gules, surmounted by a lion rampant sable, crowned or.
Huntercombe: ermine, two pair of gemelles gules.

Edmondson and some other writers describe the gemelles as cotises.

4. The *Chevron*, cheveron, canterius, from whatever source derived, seems to have been named from its resemblance to the main rafters or principals of a roof, a familiar sight in early buildings. It is common to find orders on the royal foresters for so many pairs of chevrons. Mr. Planché points out that in the earliest English examples of this ordinary, in the seal of Gilbert, earl of Pembroke, in the reign of Stephen, the upper edge of the shield is pointed like a ridged roof, and the chevrons are parallel to it, and divide the shield into thirteen spaces. He regards as a part of the structure of the shield those chevrons, afterwards reduced to three and used as a regular heraldic bearing by the house of Clare. The chevron occurs six times in the roll of Henry III., and the chevronel, its diminutive, nine times. The two occur ninety-two times in the roll of Edward II. In breadth it is one-fifth of the shield. Its diminutives are the *chevronel* or étage, of half, and the *couple-close*, of a quarter its breadth. The latter is borne in pairs above and below the chevron. When the chevron is repeated up to three they may be chevrons or chevronels. If exceeding that number the bearing is chevronny, unless the number be specified. The chevron is still used to denote the rank of the non-commissioned officers of the British army, but of late years has been borne by them inverted.

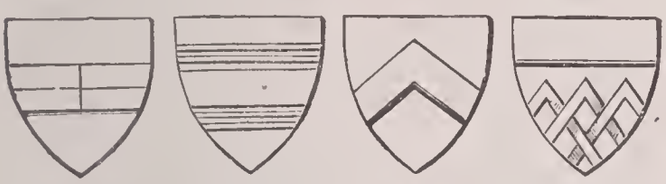


Fig. 24. Fig. 25. Fig. 26. Fig. 27.

Stafford: or, a chevron gules (fig. 26).
Marler: argent, a chevron purpure, in dexter canton an escallop sable.
Fettiplace: gules, two chevrons argent.
Clare: or, three chevrons gules (fig. 6).
Wyvill of Constable-Burton, derived from Fitz Hugh: gules, three chevronels brazed vair, and a chief or (fig. 27). [Brazed is interlaced.]
Kniveton: gules, a chevron party per chevron nebuly, argent and sable (fig. 28).
Fitz Walter: or, a fess between two chevrons gules (fig. 29).
Hungerford: per pale indented gules and vert, a chevron or (fig. 30).
Hotot: azure, a chevron couple-closed or, between three crescents argent (fig. 31).
Newport on Usk commemorates the Staffords, its ancient lords, by bearing a chevron reversed (fig. 32).

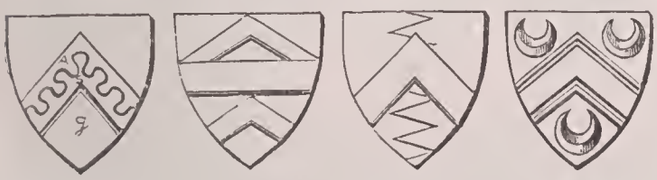


Fig. 28. Fig. 29. Fig. 30. Fig. 31.

5. The *Bend*, bande, balteum, is a strip extended upon the shield from the dexter chief to sinister base, and in breadth one-fifth of the field. The diminutives are the *bendlet*, half the bend, and the *cotise*, or cost, a fourth part, borne in pairs, flanking the bend; and the *ribbon*, one-eighth of the bend. The ribbon is used as a difference, and is sometimes couped or cut short, when it becomes a *bâton*, and is the French barre. The bâton often marks illegitimacy. The term bâton, however, is also applied to the ribbon.

Fig. 32. Fig. 33. Fig. 34.

Scrope of Danby: azure, a bend or; a very celebrated example of the bend (fig. 33).
Culpepper: argent, a bend engrailed gules.
Wallop of Farleigh-Wallop: argent, a bend wavy sable (fig. 34).
Fortescue of Castle-Hill: azure, a bend engrailed argent, cotised or.
Clopton: sable, a bend between two cotises dauncette or (fig. 35).
Boyle: party per bend embattled,[1] argent and gules (see fig. 12).
Byron of Rochdale: argent, three bendlets enhanced gules (fig. 36).
Montford: bendy of ten, or and azure.

[1] This is called also crenellated, and in French bretassé, from the bretasche or wooden gallery attached to the battlements of castle walls. When embattled on both faces the piece is said to be "embattled counter-embattled." The notch in a parapet is an embrasure, the intermediate piece of masonry a merlon. When a second and a smaller merlon is placed on the first, the battlement is said to be stopped.

Chaucer: per pale argent and gules, a bend counterchanged (fig. 37).
Fitz Herbert of Norbury: argent, a chief vair, or and gules, over all a bend sable.
Widdrington: quarterly, argent and gules, a ribbon sable (fig. 38).
Sir Hugh Baden: argent, on a bend double cotised sable three eagles displayed palewise or.
Keck of Stoughton: sable, a bend ermine between two cotises, flory counterflory, or.

Fig. 35. Fig. 36. Fig. 37. Fig. 38.

The *Bend Sinister* is a variety of the bend drawn from the sinister chief to the dexter base. Its diminutives are the *scrape* or scarp, half the breadth, and the *ribbon* or bâton sinister. A bend sinister is a rare bearing, and, with its diminutives, is frequently used to express illegitimacy, especially the bâton, though sometimes as a difference only.

Richard de Bury, bishop of Durham: party per bend sinister, or and azure, a bend counterchanged (fig. 39).
Trevor (see fig. 12).
The dukes of Orleans: azure, three fleurs-de-lys or, a bâton argent (fig. 40).

6. The *Cross*, croix, crux, needs no description save that in heraldry it is usually the Greek cross, or that of equal arms. The breadth is one-third of the shield. It is an early and very common bearing, and whatever its origin it speedily became identified with the emblem of Christianity, and was popular throughout Christendom—

> "Crux mihi certa salus, crux est quam semper adoro,
> Crux domini mecum, crux mihi refugium.
> Per crucis hoc signum fugiat procul omne malignum."

When plain it is blazoned only as "a cross." Thus the cross of St. George is "argent, a cross gules," and the statutes of the Temple direct each knight to wear a red cross upon his "cotte d'armes," on breast and back. As a plain cross it occurs six times in the roll of Henry III., and in its varieties eleven times, and in the roll of Edward II. these numbers have risen from 17 to 102, when it was the most popular of the ordinaries.

De Burgh of Ireland: or, a cross gules (fig. 41).
Duckenfield of Duckenfield: argent, a cross pointed wavy sable, voided.
Ufford: sable, a cross engrailed or (fig. 42).

Fig. 39. Fig. 40. Fig. 41. Fig. 42.

A seal of John de Ufford, probably about 1360, bears on a heater shield what would now be described as eight fusils conjoined in cross, and which is an early form of the Ufford coat. There is also a mullet in dexter canton, possibly to mark a younger branch.

Colley: argent, a cross wavy, voided, sable (fig. 43).
Skirlaw, bishop of Durham: argent, six willow wands interlaced in cross sable, in allusion to his father, who was a basket-maker (fig. 44).
Lawrence (see fig. 12).

Party per cross or quarterly is an early and popular bearing.

Say: quarterly, or and gules (fig. 45).
Lacy: quarterly, or and gules, a bend sable.
Fitz Warin: quarterly, per fess indented, argent and gules.
Atkins of Saperton: argent, a cross sable, bordered with half fleurs-de-lys, between four mullets, sable.
Loraine of Kirkharle: quarterly, sable and argent, a cross counter-quartered of the field.

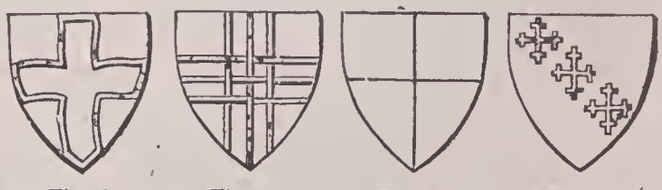


Fig. 43. Fig. 44. Fig. 45. Fig. 46.

When the central square of the cross is removed, it is said to be quarter-pierced, a cross quarter-pierced.

The varieties of the cross are almost innumerable. Edmondson gives 107 of them, and there are many more. Of these it will be sufficient to notice those comparatively few that are older and in general use; as the cross botonny, the cross crosslet, the cross flory, moline, patée, patonce, potent, recercelée, and void-

ed. None of these varieties extended to the margin of the field. When a plain cross does not so extend it is blazoned as couped or humetty.

The cross botonny, trefléé, or modulata has each limb capped by a trefoil, or sort of button.

Northcote of Pynes: argent, three crosses botonny sable, palewise in bend (fig. 46).

The cross crosslet has its extremities crossed. It is usually borne as a charge in numbers, but not always.

Wasterley: argent, a cross crosslet sable.
Beauchamp, earl of Warwick: gules, a fess between six cross crosslets or (fig. 8).

When the lower limb is uncrossed and pointed it is "fitchy."

Belgrave: argent, a cross patée fitchy sable (fig. 47).

Fig. 47.

Fig. 48.

Fig. 49.

The cross patée was the emblem of the Knights of St. John, and is known as the "Croix de Maltbe." The cross patonce has expanded ends like the cross patée, but each terminates in three points. Patée and patonce were not always distinguished. At Caerlavrock Latimer is described as bearing a cross patée, whereas the regular coat of the family was gules, a cross patonce or.

Wm. de Fortibus, before 1241: gules, a cross patonce vair (fig. 48).

The cross flory or fleurettée is capped in a similar way by fleurs-de-lys.

Lamplugh of Lamplugh: argent, a cross flory sable (fig. 49).
Richard Suwart or Siward at Caerlavrock bore sable, a cross flory argent.

The cross moline is so called from the fer de moline, or mill-rind, the iron clamp of the upper millstone. When the mill-rind itself is borne it is pierced, but the cross moline is not necessarily so. Its extremities are split, curved outwards, and cut off square. It is an early bearing. When pierced this must be specified.

Bec of Eresby: gules, a cross moline argent.
Molyneux of Sefton: azure, a cross moline quarter-piereed or (fig. 50).

The cross potent, potence, or crutch or gibbet headed, has its extremities T-shaped.

An early example is seen in the arms of Jerusalem, argent, a cross potent between four crosslets or (fig. 51). Originally, however, the arms of the cross ended in knobs like the handles of a pilgrim's staff, thence called "bourdonnée."

The cross recreelée has the ends split and curled outwards, but differs from the cross moline in having them pointed. The two bearings were occasionally confounded, and while the Baron Bec bore a cross moline, Bishop Antony Bec, his brother, is described as bearing a cross recercelée.

The cross voided is the outline only, called by the French "un croix faux;" the field is seen through it. The cross recercelée is usually also voided.

The lords of Crevecœur bore "d'or, ung faux crois de goules, recercelée" (fig. 52).
Basing, *temp.* Edward III.: azure, a cross recercelée and voided or.

Fig. 50.

Fig. 51.

Fig .52.

Fig. 53.

The cross formée is peculiar among these varieties, inasmuch as its extremities reach the edge of the field. In other respects it resembles the cross patée.

Lawley of Spoonhill: argent, a cross formée checquy, or and sable.

Among the other, later, and but little used varieties of the cross may be mentioned the avellane, ending in filbert husks; the cross anchored, of which the limbs terminate in anchors; the cross of the crucifixion or of Calvary, mounted on steps. A cross with a narrow border of another color is "fimbriated;" a cross pointed is where the ends are so cut.

7. The *Saltire*, saltier, or sautoir, is known as the cross of St. Andrew, and is a common constituent in Scottish coats of arms. The origin is said to be a sort of stirrup or crossed loop suspended from the saddle by the aid of which the knight leaped into his seat. Such a stirrup certainly appears on the steed of Patrick, earl of March, on his seal, and on the seal of an early Despenser, and this is the only suggestion that accounts for the name. The saltire is in breadth one-third of the field.

The Scottish emblem is azure, a saltire argent; that of St. Patrick, argent, a saltire gules. Neville bore

"A silver saltire upon martial red,"

that is, gules, a saltire argent (fig. 53).
Bottetourt: or, a saltire engrailed sable (fig. 12).
Gage: party per saltire, argent and azure, a saltire gules (fig. 54).
Glanville of Catchfrench: azure, three saltires humetty or (fig. 55).
Bruce: or, a saltire and chief gules.

Fig. 54.

Fig. 55.

Fig. 56.

Fig. 57.

Common charges placed upon a horizontal or vertical ordinary, as a fess or chief or cross, are placed upright; if on an inclined ordinary, as a bend or saltire, their position should be specified; if upright, they are palewise; if inclined, bendwise or saltirewise. On the chevron they are upright unless otherwise specified.

Dalrymple: or, on a saltire azure nine lozenges of the first (fig. 56).

Here the charges slope with the limbs of the saltire, that in the centre being upright. The deanery of Hengham, dedicated to St. Andrew, bore on its seal a saltire raguly. The saltire has no regular diminutives, but when several are borne they are couped.

8. The *Pile*, pieu, pila, is a triangular strip, its base one-third of the breadth of the shield, and usually applied to its upper margin, the point coinciding with the lower point of the shield. It has been derived from the Roman *pilum*, a military weapon, and from the *pile* of the engineer. The origin is obscure, but it is a very early bearing. It has no diminutive.

Sir John Chandos, as Froissart often tells us, bore "d'argent, a ung peel de goules, e un label d'azure" (fig. 57), and his ancestor Robert, *temp.* Henry III., bore or, on a pile gules three estoiles, between six of the same, counterchanged, an unusually complicated bearing for that age.

Waterhouse: or, a pile engrailed sable.

Frequently more piles than one were used, generally three, when they are to be blazoned as meeting in base.

Holles: ermine, three piles sable meeting in base (fig. 58).
Hulse: argent, three piles sable, one issuant from the chief between two from the base.

When the base of the pile is applied to any other part of the shield than the chief it must be specified. The pile was used by Henry VIII. as a vehicle for some of his grants of augmentation.

9. The *Quarter* or franc-quartier covers the upper dexter quarter of the shield. If placed in the sinister quarter, this must be specified. Its diminutive is the *canton*, of two-thirds its area. Both are early bearings, but in the roll of Henry III. the quarter appears in several coats which in later rolls are blazoned with the canton. Both are frequently charged. When either occurs in conjunction with another ordinary or sub-ordinary, they are placed above it, and therefore blazoned after it, as further from the field. Both are used as early differences, as in the families of Zouch and Basset, and both are always borne with straight edges. A canton is also called a corner, and a cross between 4 crosses is said to be cantoned of them.

De Clare (old): or, a quarter gules (fig. 59).
Shirley of Eatington: paly of six or and azure, a quarter ermine.
Sutton of Norwood: argent, a canton sable.
Samuel Clark, the martyrologist: gules, a fleur-de-lys or, a canton ermine (fig. 60).

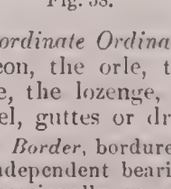


Fig. 58.

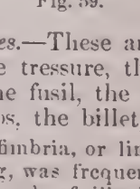


Fig. 59.

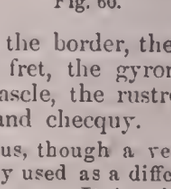


Fig. 60.

Subordinate Ordinaries.—These are the border, the inescutcheon, the orle, the tressure, the fret, the gyron, the flasque, the lozenge, the fusil, the mascle, the rustre, the roundel, guttes or drops, the billet, and checquy.

The *Border*, bordure, fimbria, or limbus, though a very old and independent bearing, was frequently used as a difference, and occasionally as a mark of illegitimacy. It is what its name expresses, and its breadth is one-fifth of the field. When used in an impaled coat the border is not continued round the inner side; in fact it is dimidiated. In old exam

ples this was not always attended to. In a quartered coat the border is borne complete.

Sir Perdicas d'Albret, *temp.* Edward III.,

"Who gaily shield about his neck did fling,
Wrought with dent bordure, silver shining,"

bore "gules a border indented argent."

Rondell: ermine, a border compony, or and sable (fig. 61).

Hamelin, illegitimate brother of Henry II., seems to have borne around his arms, on a border gules, eight lioncels passant or. This was before quartering came into use. The augmentation granted by Henry VIII. to Courtenay, marquis of Exeter, was a border quarterly of England and France, the fleurs-de-lys and lions enurmy, or in orle (fig. 62).

Fig. 61.

Fig. 62.

Fig. 63.

The *Inescutcheon*, or écusson, is a small shield borne within and upon the greater one. It occurs in the earliest coats, and when voided becomes an orle.

Mortimer: barry of 6 or and azure, an inescutcheon argent, a chief of the first paly of the second between two gyrons of the same (fig. 63).

Rokeley: ermine, an inescutcheon azure.

Allestree of Allestreo: argent, a chief azure, on a bend gules three inescutcheons party per chief, vert and argent (fig. 64).

The arms of Maxwell, Lord Herries and earl of Nithsdale, afford a good example of this subordinary. They are, argent, an eagle displayed sable, beaked and membered gules, surmounted with an inescutcheon of the first, charged with a saltire of the second, surcharged with a hedgehog or, for Herries.

The *Orle* is the edge or hem, ourlet, of the inescutcheon, voided, and is therefore blazoned by the French as a false escutcheon.

John de Baliol: "De goules, ove ung faux escochon d'argent," that is, "gules, an orlo argent" (fig. 65).

Winnington of Stanford: argent, an inescutcheon voided, within an orle of martlets sable (fig. 66).

Fig. 64.

Fig. 65.

Fig. 66.

Fig. 67.

The *Tressure* is in fact a narrow orle, almost always borne double, and usually flowered. It is a favorite Scottish bearing, and is set with fleurs-de-lys placed alternately, the upper and the lower half on each face of the tressure, when it is blazoned "flory-counterflory." This, in the Scottish royal arms, is said to denote the early alliance between that country and France. The bearing is, or, a lion rampant within a double tressure, flory-counterflory, gules (fig. 67). The tressure was a common grant of augmentation from the crown for services or in memory of an alliance. Scott of Thirlstane had it from James V. and bore, or, a bend azure, charged with a mullet pierced, between two crescents of the first, the whole within a double tressure flory-counterflory of the second—

"The tressured fleurs-de-lys he claims
To wreath his shield."

The *Fret* was originally borne fretty, representing a trellis. The single fret is very rare in ancient arms, but many of those families who at first bore fretty afterwards bore a fret. Fretty is usually composed of eight pieces.

Maltravers: sable, fretty or, which soon became and continued sable, a fret or (fig. 68).

When nailed at the joints it is said to be clouée.

Trussel: gules, a trellis (fretty) clouée or.

Harrington: sable, a fret argent, called also a Harrington knot (fig. 69).

Vernon of Sudbury: argent, a fret sable.

The *Gyron*, also an old bearing, is the lower half of a quarter divided diagonally. It is a Spanish ordinary, and said to come from "giron," a gusset. It is seldom borne singly, and usually is gyronny, when the shield is divided per pale, per fess, per bend dexter, and per bend sinister into eight sections. If more, the number must be specified. In the earliest examples the divisions are twelve.

Bassingbourne: gyronny of twelve, or and azure.

Campbell: gyronny, or and sable (fig. 70).

The *Flasque*, or flaunch, is the segment of a circle taken out of the two sides or flanks of the shield, the margin of which forms the chord. They are always used in pairs, one on each side. This bearing is not of great antiquity.

Fig. 68.

Fig. 69.

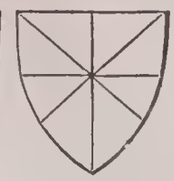


Fig. 70.

Fig. 71.

The *Voider*, the diminutive of the flasque, has a flatter curve. The voider in defensive armor was a gusset-piece either of plate or of mail, used to cover a void or unprotected space at the elbow or knee joints.

Frere: gules, two pards' faces between as many flasques or (fig. 71), alluded to in *Whistlecraft* by Mr. Hookham Frere—

"Two leopards' faces were the arms he bore."

When the bearer was asked to give some verses descriptive of his arms to be placed at the head of a history of the family, his answer was—

"The flanches, on our field of gules,
Denote, by known heraldic rules,
A race contented and obscure,
In mediocrity secure,
By sober parsimony thriving,
For their retired existence striving,
By well-judged purchases and matches,
Far from ambition and debauches.
Such was the life our fathers led;
Their homely lesson, deep inbred
In our whole moral composition,
Confines us to a like condition."

The lozenge, the masele, and the rustro are all derived from the fret or fretty, and do not appear originally to have been used singly.

The *Lozenge* is a square, set up diagonally like the diamond in playing cards. It is seldom used alone, and when the shield is covered with it, it is called lozengy.

Fitzwilliam: lozengy, argent and gules (fig. 72).

De Burgh: gules, seven lozenges vair conjoined 3, 3, 1.

The *Mascle*, or rather masculy, for originally it was so used, is said to represent a net.

Rokele of Suffolk: masculy, gules and ermine.

Poges of Stoke-Poges: masculy, argent and gules.

De Quincy, earl of Winchester: "gueles, six mascles d'or, voydés du champ;" and afterwards, gules, seven mascles or, conjoined 3, 3, 1 (fig. 74).

The *Rustre* is of later introduction, and is not a common bearing. It is a lozenge pierced in its centre by a round hole.

Custance: or, a rustre sable (fig. 73).

Fig. 72.

Fig. 73.

Fig. 74.

The *Fusil* is an elongated lozenge, from the French fuseau, a spindle, and is supposed to represent a distaff charged with yarn. A very early example of its use is

Montacute: "d'argent avec ung fess engralé de geules d. trois plèces," which speedily became "argent, three fusils conjoined in fess gules" (fig. 75).

William of Waynflete and Wilson-Patten: fusilly, ermine and sable, a canton or (fig. 76).

It has been suggested that the Percys derived their fusils from their lordship of Spindleton.

Trefusis of Trefusis: argent, a chevron between three spindles sable.

Fig. 75.

Fig. 76.

Fig. 77.

Fig. 78.

The *Roundel*, if of metal, is a simple disk; if of color, it is convex, half a globe. It is seldom borne singly, and is named specially from its color.

If Or, a Bezant.
" Argent, a Plate.
" Azure, a Hurt.
" Gules, a Torteau.
" Sable, a Pellet, Gunstone, or Ogress.
If Vert, a Pompey.
" Tenny, an Orange.
" Sanguine, a Guze.
" Purpure, a Golpe.

The last four are almost unknown in English heraldry. Akin to these is the *fountain*, a disk barred wavy, argent and azure,

to represent water. Although bezants, plates, hurts, and torteaux are given in early rolls of arms, their names do not always carry their colors. They are blazoned as roundels d'or, pelottes d'argent, torteaux de goules. The torteau is sometimes called a séruse. The pellet often stands for the roundel, and the bezant is called a talent, from a coin of that name current with the bezant in the East.

Alan La Zouch: Gules, bezanty. This was afterwards reduced to ten bezants, 4, 3, 2, 1, with a quarter and sometimes a canton of Britanny, that is, "ermine" (fig. 77).
Camoys: or, on a chief gules three plates (fig. 78).
Wellesley: gules, a cross argent between twenty plates, 5, 5, 5, 5.
Baskerville of Old Withringtou: argent, a chevron between three hurts (fig. 79).
Hurting: argent, ten hurts, 4, 3, 2, 1.
Courtenay: or, three torteaux (fig. 62).
Babington: argent, ten torteaux, 4, 3, 2, 1, a label azure (fig. 9).
Fulkyn: sable, on a cross between twelve billets argent three golpes.
Greville: sable, on a cross engrailed or five pellets.
Bridgeman: argent, ten ogresses, on a chief a lion rampant of the second.
Stourton of Stourhead: sable, a bend or between three fountains (fig. 81).

In early lists the annulet is blazoned as a false roundel; thus Vipont is said to bear gules, six false roundels or.

Guttes or drops are represented pear-shaped with a tail like a Rupert's drop, or the tears on funeral draperies. They are not found in the earliest coats. They, like roundels, are named from their color, thus: or—gutté d'or; gules—gutté de sang; argent—gutté d'eau; sable—gutté de poix; azure—gutté de larmes; vert—gutté d'huile.

Malory: argent, a cross sable, gutté d'or.
Winterbottom: azure, gutté d'eau.
Kington: argent, gutté de larmes; on a chief azure three barons' coronets or (fig. 80).
Fitz of Fitzford: argent, gutté de sang, a cross of the same.
Chichester city: argent, gutté de poix, on a chief indented gules a lion of England.
Marshal: argent, on a fess gules three drops ermine.

The *Billet* or delve is a small parallelogram usually borne in numbers and set up on one end.

Coudray: gules, billetty or.
Delves: argent, a chevron gules, fretty or, between three delves sable (fig. 82).

Somewhat akin to these subordinaries is a division of the field known as *checquy*, where the field is divided into small squares like a chess-board. Their number is not specified, but usually is made up of seven squares in a line, and in depth according to the length of the shield. Hugh, earl of Vermandois, is said to have borne checquy, or and azure, and as his daughter married Warren, it is possible that the earls of Surrey thence derived their well-known coat.

Fig. 79.

Fig. 80.

Fig. 81.

Warren: checquy, or and azure (fig. 83).
Tateshal: checquy, or and gules, a chief ermine.

Fig. 82.

Fig. 83.

Fig. 84.

Checquy was not confined to the field, but was also applied to the charges upon it.

Stuart: or, a fess checquy, argent and azure.

Where there is but one row of squares, the bearing is called *gobonny* or *compony*, if of two rows, *counter-compony*.

Gray: barry of six, argent and azure, a bend compony of the first and gules (fig. 84).
Fitz Roy: gules, a border quarterly, ermine and counter-compony, or and azure.

Common Charges.

Next to the purely heraldic figures connected with the shield and their diminutives and subordinaries, come those imported into heraldry as charges from all quarters, including an immense variety of objects, natural and artificial, beasts, birds, fishes, reptiles and insects, flowers, and the fruits of the field, chimæras, astronomical and celestial figures, man and his parts, arms and armor, implements of war and the chase, ships, articles of dress, and a miscellaneous budget far too heavy to enumerate.

The rules for the placing of these charges are simple. If single they stand in the centre of the shield; if two, in pale, or one over the other; if three, 2 and 1; if the number is longer the order must be specified (see fig. 85). The French carry the unexpressed understanding much further. With them four pieces are placed 2 and 2; five pieces, in saltire; six are 3,2,1; seven are 3,3,1; eight are in orle; and nine are 3,3,3.

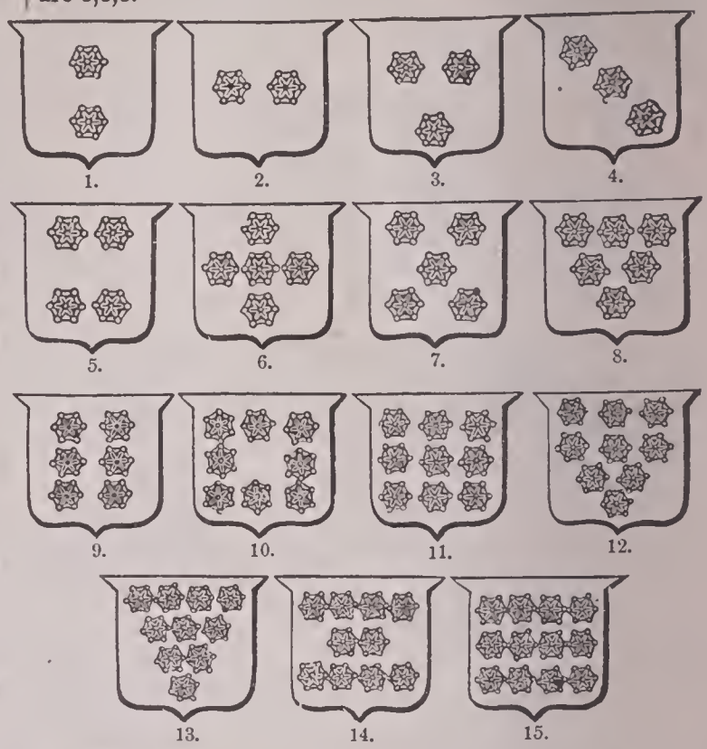


Fig. 85.—Different arrangements of charges upon a shield:- (1) 2 roses; (2) 2 roses in fess; (3) 3 roses; (4) 3 roses in bend; (5) 4 roses, 2 and 2; (6) 5 roses in cross; (7) 5 roses in saltire; (8) 6 roses, 3,2,1; (9) 6 roses, 2,2,2; (10) 8 roses in orle; (11) 9 roses, 3,3,3; (12) 9 roses, 3,3,2,1; (13) 10 roses, 4,3,2,1; (14) 10 roses, 4,2,4; (15) 12 roses, 4,4,4.

Animals.

The following rules are applicable to the blazoning of animals. Generally, unless otherwise specified, they are shown in profile, looking towards the dexter side; when to the sinister, the word counter is prefixed, "a lion counter-passant." Animals back to back are "addorsed;" face to face, "confrontée;" facing the spectator, "gardant," or "affrontée;" looking back, "regardant;" when rising out of the edge of an ordinary, "issuant;" when out of the middle of it, "naissant." When the claws, horns, tongues, hoofs, or mane are shown of a special color, the animal is "armed," "corned," "langued" or "lampassé," "ungued," or "crined." Sometimes he is crowned royally or ducally, sometimes "collared," "gorged," or "accollée." When wounded he is "vulned."

When of its natural color an animal is "proper," but it may be of any metal, color, or fur, and divided by any partition lines. When a head or member is torn off it is "erased." When cut off "couped." When men are clothed, they are "habited;" when nude, they are "salvage."

Quadrupeds.—Of these the *Lion* is by far the most popular, nor is his popularity confined to England. He appears not only in the British arms, but in those of Spain, Holland, Denmark, Bohemia, and Saxony, and many lesser states. Of Edward II.'s 918 bannerets, 225 bear lions in some form or other. The favorite attitude is rampant, but he may be passant, saliant, statant, sejant, couchant, or dormant. About thirty varieties of attitude are enumerated by writers; but most are rarely if ever used, and indeed it is seldom the lion is other than rampant or passant. Sometimes he is borne "demi," especially as a crest. His paws or jambs are also borne, and his tail. In one or two well-known instances on the Continent he is "déchaché," that is, his head and paws and the tuft of his tail are cut off. When a member is borne upright, it is "erected." As a set off to this dismemberment, in early rolls the lion is sometimes represented as two-tailed, or "queue furchée," and there are examples of bicorporate and tricorporate lions, though not many. When above three lions are shown, they become lioncels or lions' whelps, unless otherwise specified.

It has been shown that as early as 1127 Henry I. used the lion as an ornament upon the shield he gave to his son-in-law, who bore those animals upon his brodekins, as did the early French kings the flour-de-lys. Mr. Planché has investigated

this early use of the lion by Henry with great acuteness. A prophecy of Merlin, held to apply to that king, designated him as the Lion of Justice; his favorite residence and death-place was in the forest of Leon or Lyons in Normandy; his wife Adeliza was a daughter of Godfrey, duke of Louvain or Löwen, a name which certainly gave rise to the lion as the arms of that family.

William, earl of Gloucester, Henry's grandson, sealed with a lion. Richard de Redvers, earl of Devon, who married a granddaughter of Henry, also bore a lion, as did Ranulph, earl of Chester, who married another grandchild. William d'Albini who married Henry's widow, used the same animal. All this occurred at a period when armorial bearings were by no means an established institution, and when every great noble was taking it up, and quite open to assume a bearing. On the whole, therefore, it seems probable that to Henry I. was due the introduction of the lion into English heraldry. It has been seen that under Richard and John the lions became the settled arms of England, and this will account for the general adoption of the royal beast in English coats of arms. In heraldry a "lion passant gardant or" is always blazoned as "a lion of England."

The identity of the lion of England with the leopard has been the subject of much controversy, and when Napoleon talked of driving the leopards into the sea he evidently used the word in disparagement of our national bearing. The early heralds, who probably were not zoologists, seemed to have confounded the lion with the leopard, and to have used the names according to the attitude of the animal. When rampant he was a lion, when in any other attitude, as passant, he was leo-pardé or a lion-as-a-leopard, but never drawn spotted like a real leopard. As the lion came more generally into use, and was borne in various attitudes, the allusion to the leopard was gradually dropped, though as late as the reign of Edward III. and Richard II. the royal crest was described as a leopard, and Henry V. had a Leopard herald. Among the greater barons of the 13th and 14th century, the lion was borne by the earls of Arundel, Cornwall, Devon, Hereford, Leicester, Lincoln, the Earl Marshal and the earl of Salisbury, as well as by scores of the lesser barons or knights. Sir Tristem, the knight of lionesse, bore a lion when

"Mordant with his might,
With a lance un-light,
He smote him in the lion."

Fig. 86.

Fig. 87.

Fig. 88.

Fig. 89.

Lewis of Llanishen and Cromwell their cadet bore and bear sable, a lion rampant argent, a bearing still used by their cadets, the Lewises of Pennsylvania, who migrated above two centuries ago (fig. 86).
Mathew of Castell-y-Mynach: argent, a lion rampant regardant sable (fig. 87).
Evoringham: gules, a lion rampant vair, crowned or.
Haverlug: argent, a lion rampant queue furchée gules, gorged azure (fig. 88).
Capel: gules, a lion rampant betweeu three cross crosslets, fitchy, or. In allusion to which Lord Capel is described at the siege of Colchester:—

"There lion-like undaunted Capel stood,
Beset with crosses in a field of blood."

Sir Simon de Felbrigge, K.G.: or, a lion saliant gules (fig. 89).
Fitz Payne: gules, three lions passant in pale argent, debruised by a bendlet azure (fig. 90).
The lion statant is more usually seen on a crest, and is that of Percy and Talbot.

Fig. 90.

Fig. 91.

Fig. 92.

Tynte of Cefn Mably: gules, a lion couchant between six cross crosslets, argent, 3 and 3.
Ayleworth of Essex: gules, a lion dormant, or.
Longspee, earl of Salisbury: azure, six lioncels rampant or, 3, 2, 1 (fig. 91).
Edmond, earl of Lancaster: a tricorporate lion issuing from three parts of the escutcheon, united at the head, gardant in the fess point, or, armed and langued azure (fig. 92).
A Scottish seal of Chalmers, 1449, bears a demi-lion issuant from a fess, in base a fleur-de-lys.
Markham: azure, on a chief or a demi-lion rampant issuant gules (fig. 93).
Sir Henry Eame, K.G.: or, out of the middle of a fess a lion rampant naissant gules, armed azure (fig. 94).
Wyndham: argent, a chevron between three lions' heads erased or (fig. 95).
Newdigate: gules, three lions' jambs erased argent (fig. 96).
Pinchbeke: sable, three lions' tails erased erect argent (fig. 97).

Fig. 93.

Fig. 94.

Fig. 95.

Fig. 96.

The *Leopard*, that is, the real spotted animal, is seen now and then in coats of arms, but is of much later introduction than the lion, which is often called by that name. Thus Sir Reginald de Dunstanville is blazoned as bearing "gules, two leopards passant debruised of a bâton;" these most certainly were lions. A coat of Astley was, however, gules, a leopard rampant argent, in that case a real leopard. He is often called a pard.

Cantelupe: azure, three pards' heads jessant fleurs-de-lys or (fig. 98).
Wentworth: sable, a chevron between three pards' faces or.
Hubard of Ipsley, who held under Cantelupe: sable, three pards' heads jessant fleurs-de-lys argent.

The heraldic *Tiger* is neither a common nor an early bearing. To the body of the wolf he adds the tail of a lion, and he is studded with tufts of hair.

The supporters of Hastings, earls of Huntingdon, are two man-tigers affrontés.
Lone of Ellow bears azure, a tiger passant or.
Hunloke of Wingerworth: azure, a fess between three heraldic tigers' heads erased or.

The *Wolf*, when saliant, is said to be "ravissant."

Lovett of Astwell: gules, three wolves passant sable, in pale.

The wolf, the boar, the hart, and the hare were the four heraldic beasts of venery. Dame Juliana Berners says—

"Four maner beastys of venery there are:
The first of them is the hert, the second the hare,
The boar is one of them, the wolf, and not one moe."

The *Boar* is the only beast besides the lion borne in the roll of Henry III., where Adam de Swyneburne bears "de goules, a trois testes de sanglier d'argent" (fig. 99), a bearing which, however, the family have long laid aside for "por fess gules and argent, two cinquefoils counterchanged," a coat derived from Umfraville. The hure or teste de sanglier is a common crest. The "glory of the tusky boar" is in his tusks, "dente timetur aper." He is also borne whole.

Gilpin: or, a boar sable.
The boar was the cognizance of Richard III., with a thorn bush—

"The bristly boar
In infant gore
Wallows beneath the thorny shade."

It is the crest of most of the clan Campbell.

The *Bear* is also a beast of heraldry.

Beresford: argent, a bear rampant sable, muzzled, collared, and chained or.
Fitz Urse: or, a bear passant sable.

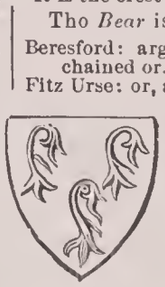


Fig. 97.

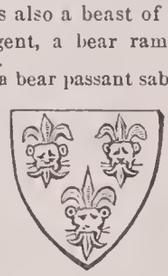


Fig. 98.

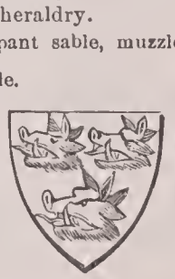


Fig. 99.

Fig. 100.

The *Fox*.

Williams: argent, two foxes sallant counter-saliant in saltire, gules, the dexter surmounting the sinister (fig. 100).

The *Cat-a-Mountain*, musion, or wild cat, was long preserved in Rockingham forest, the country of Catesby, the first of the well-known trio—

"The cat, the rat, and Lovel our dog."

Catesby, however, bore argent, two lions passant gardant sable, crowned or.
Keate: argent, three mountain cats passant in pale sable.

The musion was the emblem of Burgundy, and the arms of an imprisoned cat were fabled to have been granted by Childebert to a knight who made prisoner Gundemar of Burgundy.

In the following dialogue from Ferne's *Glory of Generositie* the reader will recognize an amusing passage in Quentin Durward.

"*Paradis*, the herald.—Therefore, I pray you, begin and tell your soverelgn what coat armour this knight beareth?

"*Torquatus*, a knight.—Methinks he beareth sable, a muslon passant gardant or, oppressed with a fret gules of eight parts, uayles argent (fig. 101).

"*Columel*, a ploughman.—Jezu, Zir! call you this arms? now by my vaye, e'had thought arms should not have been of such trifling things. Why, this is even the cat in the milk-house window. Full

ill will her dayri thrive giffe she put zutche a vermin beast in trust to keep it."

The *Dog*.—The mastiff or talbot supports the shield of the earls of Shrewsbury. "The talbot ever true and faithful to the crown." In the fine brass of Sir Brian Stapleton at Ingham, 1432, the knight rests his foot upon a dog whose collar is marked "Jakke."

Burton of Falde: azure, a fess betweeu three talbots' heads erased or.
Mauleverer of Allerton Mauleverer: gules, three greyhounds or leviers curraut iu pale argent.

The alauud or hunting dog was in great request. Those of Henry VIII. bore his arms and badges on their collars. Fienes, Lord Dacre, used it as a supporter.

The *Stag* and *Hart* were old, though not of the earliest bearings. The stag appears in the roll of Edward II. When in motion he is trippant; when lying down he is lodged. His antlers are his "attires;" a pair of attires attached to a fragment of the skull bone forms "a massacre." The head is usually borne full-faced, when it is said to be cabossed or cabaged.

Green of Green's Norton: azure, three bucks trippant or.
Bullstrode of Bullstrode: sable, a stag's head cabossed argent, attired or, and between the attires a cross patée fitchy of the third, transfixed through the nostrils by an arrow of the last, barbed and feathered of the second. This is called a stag of St. Hubert (fig. 102).
The kingdom of Würtemberg: or, three attires of a stag barwise in pale sable.
Cocks: sable, a chevron between three massacres argent.
Roper: per fess, azure and or, a pale and three roebucks' heads counterchanged.
John Trie who, *temp.* Edward II., was son and heir of Alicia de Hertley, bore "a hart's head cabossed."

Fig. 101.

Fig. 102.

Fig. 103.

The stag's head was the emblem and armorial bearing of the M'Kenzies, whose chief, the lord of Kintail, was called by the Highlanders "Caberfaigh"—

"Proud chief of Kintail,
Let the stag in thy standard bound wild iu the gale.

The heraldic *Antelope*, or agacella, somewhat resembles a tiger, but has horns and hoofs. Brooke, Lord Cobham, had for a dexter supporter an agacella, horned, tusked, and armed or.

The *Elephant*.

Elphinston: gules, an elephant passant argent, tusked or.
Saunders of Welford: per chevron, sable and argent, three elephants' heads erased counterchanged.

The *Bull*, or buffler, in his wild state was a formidable animal, and is used heraldically, though more frequently as a crest, supporter, or cognizance, than in arms—

"Mightiest of all the beasts of chase
That roamed in woody Caledon."

Front de Bœuf, a real Norman name, probably bore no arms, though Scott appropriately gives him the bull's head. The head cabaged was a Welsh bearing; and when the horns and hoofs are noticed, he is said to be armed or corned and ungued. The bull's head is the crest of Hastiugs and Nevill, and the pied bull a well-known cognizance.

Skeffington: argent, three bulls' heads erased sable, armed or (fig. 103).

The *Calf*.

Le Vele of Tortworth and St. Fagans in Glamorganshire: argent, on a bend sable three calves or.
Calverley: argent, on a fess gules three calves or.

The *Horse*, the support of the equestrian order, does not appear in early coats of arms, although the winged horse was a cognizance of the order of the Temple. A gray horse is a liard, a bay a bayard. When in the field he is free, when in harness barded and caparisoned.

Trevelyan of Nettlecomb, whose ancestor is supposed, in Cornwall, to have come out of the sea at the Land's End ready mounted, incongruously enough, upou a laud horse, bears gules, a demi land horse issuaut from the water, all proper.
Horsey of Melcombe-Horsey: azure, three horses' heads couped, bitted, and reined or.

The *Ass*, probably the wild ass endued with sublimity in the book of Job, found a place on the shield of the old Cheshire family of Hockenhull, argent, an ass's head erased sable.

The *Ram*.—Recently a valuable silver dish was fished up from Whittlesea Mere, having rams' heads at each end, evidently once the property of the Abbey.

Ramsey Abbey, "Ramsey the rich," bore or, on a bend azure three rams' heads couped argent, armed of the field.

The *Sheep* is occasionally seen, but the *Lamb* from its religious association was in general use. The Pascal Lamb was one of the cognizances of the Templars, and is adopted with equal propriety by the gentlemen of the long robe. As the "Lamb and Flag" it is known extensively in South Wales. Price of Park aud other descendants of Jestyn ap Gwrgant bore it as a crest.

Lambton of Lambton: sable, a fess between three lambs trippant argent.

The fleece of the sheep gave name to the great Burgundian order, and the toison d'or was its jewel. It probably refers to the pastoral wealth of Burgundy, but is said to have been founded by Philip the Good, in allusion, not to the bad faith of Jason, but to the prowess of Gideon.

The *Goat*.—William de Capraville bore a goat "exsiliens."

Thorwold of Marston: sable, three goats saliant argent.

The *Coney*.

Coningsby of Hampton Court: gules, three coueys argent.

The *Otter*.—L'outre was used as a supporter by Luttrel of Dunster.

The *Squirrel*.

Nutshaw: argent, a squirrel sejaut nibbling a nut, all proper, from a hatchmeut iu Claybrook Church.

The *Hedgehog*, herison, ericius.—In the church of Gamelston, Notts, is a fine effigy in chain mail of the end of the 13th century, of one of the family of Heriz, and on the shield are three hedgehogs. They bore azure, three hedgehogs or. The hedgehog is also borne by the Maxwells for the lordship of Herries.

The *Mole*.

Mitford of Mitford: argent, a fess sable between three moles proper.

The *Ermine*, the fur of which is borne widely, is scarcely known in heraldry as an animal. The reader will, however, remember the three ermines in the windows of Waverley House.

Birds.—The bird of heraldry before all others is the *Eagle*, the symbol of the fourth evangelist. Its earliest and chief popularity was in Germany, where it was adopted by the empire and by many of the principal sovereign princes.

It appears but twice in the roll of Henry III., but after his brother Richard, earl of Cornwall, became king of the Romans, he adopted the eagle, which on that account was to be seen in all the armorial glass of the midland churches, and was widely copied in private coats of arms. His son Edmund, while bearing "Cornwall" for his arms, suspended his shield from the beak, and placed it on the breast of an eagle in reference to his father's rank. In the roll of Edward II. there are forty-three examples of eagles.

The nobles of the old Holy Roman empire place their shields upon the breast of an eagle, as may be seen in England in the insignia of the duke of Marlborough as a prince, and of the earl of Denbigh and Lord Arundel of Wardour as counts, of that empire.

The imperial eagle is always represented with two heads, the origin of which is obscure. The emperor Frederick II. on his contemporary shield in Westminster Abbey has a single-headed eagle. The second head is supposed to have been produced by the dimidiation of two coats, each an eagle, but this is scarcely probable. The eagle of the house of Brandenburg has but one head. Some of the North Wales gentry, headed by Sir Watkin Williams Wynn, place their shields upon the breast of an eagle, single-headed, and the practice is not unknown in Scotland. The seal of the widow of one of the Warwickshire Harpurs in the time of Edward II. gives an eagle, and in his two claws shields of her husband's arms and her own.

Besides the eagles of Austria, Brandenburg, Russia, imperial France, and the United States, the bird was the emblem of Este, Bohemia, and Moravia, of many of the German, Italian, and French nobles, and of many very ancient English and Scottish names, as Monthermer, Bedingfield, Biddulph, Glyn, Weston, in England, and Ramsay, Maxwell, and Carnegie, in Scotland. The great financiers Rothschild use an eagle for their arms.

The eagle is always shown "displayed," that is, upright, with his breast to the front, and his legs, tail, and wings expanded,—what is commonly known as a spread eagle.

When the beaks and talons of birds of prey are specified, they are said to be beaked and armed. In the roll of Henry III., Sir Dru de Barenton bore sable, three eagles or, and his descendants in the reign of Edward II. had increased the number to six and gave them argent. Piers Gaveston bore six eagles upon his shield and horse furniture.

Peter, earl of Richmond and Savoy, who built the Savoy Palace in 1250, and was uncle of Eleanor, queen of Henry III., on the shield of his monumental effigy at Aqua Bella bears an eagle for Savoy. The cross, the later arms of that house, appears on the pommel of his sword. Long before this, about 1142, when Mathieu de Montmorenci married Adela of Savoy, he added four alerions or eaglets to his arms, probably in compliment to his wife, who bore an eagle displayed; and certainly in 1206 the acknowledged arms of the house of Savoy were an eagle.

Parts of birds, especially of eagles, are borne, as the head,

wings, legs, and feathers. When feathers are used, and the quill is of a special color, they are said to be quilled. When a bird is leaving the ground it is "rising," when on the wing it is "au vol," when the wings are down it is "closed," when open "disclosed."

Bedingfeld of Oxburgh: ermine, an eagle displayed barry argent and gules (fig. 104).
Glynne of Hawarden: argent, a two-headed eagle sable (fig. 105).
Culcheth of Culcheth: argent, an eagle disclosed, preyant on a child in a mantle gules, wattled or. This is the crest of Stanley, well known in Lancashire as the bird and bantling.
Aubrey of Llantrithyd: azure, a chevron between three eagles' heads erased or.
Seymour: gules, two eagles' wings conjoined in lure or (fig. 106).[1]
Bray of Shere: argent, a chevron between three eagles' legs erased à la quise ("cuisse," that is, removed at the thigh) sable, armed gules (fig. 107).

Fig. 104.

Fig. 105.

Fig. 106.

Fig. 107.

The *Falcon*, as an accessory to field sports, was much esteemed, and is often borne in heraldry. It is also called a gerfalcon, peregrine falcon, and tiercelet. The falcon is usually borne with the jesses or leather thongs about its legs, sometimes with a hood and bells. It is then jessed, hooded, and belled. When feeding it is "at prey." The lure was a bunch of feathers towards which the bird was taught to return. On the seal of Alice, countess of Eu (1234–42), she bears on her hand a falcon with its jesses pendant. It was the custom to slip over the claws of the young birds a silver ring, which could not afterwards be removed. Two such rings were found at Castle Hedingham, the seat of the De Veres, engraved "Ox-en-forde." One of gold found at Biggleswade bore "Sum regis Angliæ," and within the ring "et comitis Herfordiæ." However well trained, these birds were always liable to prove rifflers, that is, not to return to the lure.

"For though thou night and day take of him hede,
And strew his cage faire and soft as silk,
And give him sugre, hony, bred, and milke,
Yet right anon so that his door is up
He with his feet will spurren down his cup,
And to the wood he will, and wormes," etc.

Falconer of Halkerton bore originally gules, three hawks' lures or. After a marriage with Douglas they bore or, a falcon's head proper, issuant out of a man's heart gules between three stars azure. The English Falconers bore argent, three falcons gules, jessed, belled, and hooded or (fig. 108).

Fig. 108.

Fig. 109.

Fig. 110.

Degge: or, on a bend azure, three falcons rising argent, jessed and belled of the field.
Baker: argent, on a fess gules three falcons' heads erased of the field.
Ridley of Blaydon: gules, a chevron between three gos-hawks argent.
Aldringtou: sable, three hawks' lures penned, stringed, and ringed argeut.

The *Swan* was the cognizance of the Bohuns. Humphrey, earl of Hereford, in 1319, bequeathed to his son "un lit entier de vert poudré de cynes blanches." When gorged with a ducal coronet having a gold chain attached to it, it is called a cygnet royal. The swan was marked or nicked according to the rank of its owner. By a statute of 22 Edward IV. no man having less than five marks per annum could lawfully keep a "game" of swans. The keeper who looked after them was the "gamester."

Pitfield of Dorset: azure, a bend engrailed between two cygnets royal.
Guest: azure, a chevron or between three swans' heads erased proper.

The *Peacock*, paon, is more common as a crest than in the shield. He is usually represented with his tail spread, and is then blazoned as a "peacock in his pride," as seen in the crest of Manners.

Pawne: argent, three peacocks in their pride proper.

Yeo of Devon bore argent, a chevron sable between three *Turkey Cocks*, tails expanded, proper.

[1] Heralds differ about the blazoning of this coat. The old terms, gules, a pair of wings displayed or, were thought scarcely clear. York described it as gules, two wings conjoined in fess or. Ralph Brooke takes refuge in French with "Deux vols de l'aigle eu cœur;" but "vol," says Camden, "is a complete pair of wings." Guillim gives "a pair of wings inverted and conjoined." Who shall decide amidst so many wearers of the tabard?

The *Pelican* is also more common as a crest than in arms. When in profile she is usually vulning herself, and when full-faced on her nest feeding her young she is "a pelican in her piety."

Carne of Nash: gules, a pelican in her piety or (fig. 109).
Pelham: azure, three pelicans vulning themselves proper.

The *Ostrich* is also better known as a crest as borne by Digby, or as a supporter by the earls of Buchan. The plume of ostrich feathers, the well-known cognizance of the Black Prince, gave rise to the arms of his natural son, Sir Roger Clarendon, who bore or, on a bend sable three ostriches' feathers argent, passing through as many scrolls of the field.

Jervis of Devon: argent, six ostriches' feathers, 3,2,1, sable.

The *Stork*.

Starkie of Huntroyde: argent, a bend between six storks sable.

The *Heron* is one of the few birds found in early coats of arms.

Heron of Chipchase and Ford occurs in the roll of Henry III. One of the family was the husband of her of whom

"Fame
Whispered light tales" . . .

at the court of James IV. They bore gules, three herons argent.

The *Cormorant*, or liver, appears with a double pun in the arms of Liverpool: argent, a liver sable, billed and legged gules, holding in his bill a bunch of laver vert.

The *Sheldrake*, also a water-fowl, was introduced into heraldry to suit Sheldon, mayor of London in 1676, who bore sable, a fess between three sheldrakes argent.

The *Raven*, corbeau, has been the bearing of Corbet from the beginning of armorial bearings.

Corbet of Moreton Corbet: or, a raven sable—
"A raven sat on Corbet's armed crest."

Ravenhill: argent, three mounts vert, on each a raven sable.

The *Rook* is occasionally borne, and sometimes conjointly with the piece known as the rook in chess.

Rook of Kent: argent, on a chevron engrailed between three rooks sable, as many chess rooks of the first.

The *Owl*, the bird of Minerva, but seldom condescends to figure in a coat of arms. The learned Sir Henry Savile however bore—

Argent, on a bend sable three owls of the field.
Sir Francis Theobald of Barking, Castello's "harum linguarum callentissimus," bore sable, a fess embattled between three owls argent.

The *Cock*, more usual as a crest, is sometimes borne in arms. When his beak, comb, wattles or gills, and spurs are given, he is beaked, crested, wattled or jewlapped, and armed.

Cockaigne: azure three cocks argent, armed, crested, and jewlapped proper.

The *Popinjay*, papagay, or pye, is one of the earliest beraldic birds.

Curzon: argent, on a bend sable three popinjays or, collared gules.
Thwenge or Fitz Marmaduke: argent, a fess gules between three popinjays vert, beaked, legged, and collared of the second.

The *Chough* is in repute in Cornish heraldry; he is black, with red legs and beak.

Peniston: argent, three Cornish choughs sable, beaked and legged gules.
Onslow: argent, a fess between six Cornish choughs proper.

The *Shoveller*, said to be a Cornish bird, is borne by the family of Herle, who came to Cornwall from West Herle in Northumberland, and probably therefore assumed their arms, argent, a fess gules between three shovellers proper, after their migration. The heiress married Hastings.

Tyrwhit: gules, three *tyrwhits* or.

The *Swallow*, or hirondelle, forms the very early coat of the Arundells, of whom William le Brito (1170) says—

"Hirundelæ velocior allte, quæ dat
Hoc agnomen ei."

"More swift than bird hight Arundel,
That gives him name and in his shield of arms is blazoned well,
He rides amid the armed troops, and with his spear in rest
(The staff was strong, the point right sharp) runs full upon the breast
Of Sir Guillaume."

Sir Thomas Arundell was by Rudolph II. (1595) created a count of the empire for military service against the Turks. The Arundells of Wardour bear sable, six swallows argent, 3,2,1.

FISHES.—The inhabitants of the water do not play a very important part in heraldry, and are scarcely known among the more ancient coats, although a special and interesting volume has been written by Mr. Moule on the heraldry of fishes. When borne horizontally they are "naiant;" when vertically, "hauriant," though this is not always expressed; when bent they are "embowed" as the dolphin in the crest of Courtenay.

The *Pike*, or luce, is the oldest example of a fish in heraldry.

Lucy of Charlecote, Shakspeare's "Justice Shallow:" gules, semée of cross crosslets, three luces hauriant argent (fig. 110).

The *Dolphin*, whatever his zoological position may be, is heraldically a fish, as is also the *Whale*. As the emblem of Dauphiné the dolphin was adopted with the name by the heirs-

apparent of the old French monarchy, who quartered with the fleur-de-lys azure a dolphin haurlant or.

Fishacre of Fishacre: gules, a dolphiu naiant argeut.
Kendal of Pelyn: argent, a chevron between three dolphins naiant embowed sable.

Dean Swift says that his cousin Thomas Swift gave for his device a swift or dolphin twisted about an anchor with the motto "Festina lente." This, however, was the device of the printer Aldus.

Whalley of Whalley: argent, three whales' heads erased nalant sable.

The *Barbel* was also an early bearing, used by the counts of Bar, who bore azure, crusuly fitchy, two barbels erect embowed or, within a border engrailed gules,—a bearing found in the quartorings of many German princes.

The *Herring* occurs in the roll of Edward II.

Herlngaud: gules, three herrings haurlant argeut.

Tho manor of Earlton, Norfolk, was held by the service of presenting annually at the exchequer certain herring pies.

Roach.—Peter de Rupibus or Des Roches, bishop of Winchester, bore three roaches.

Conger.—Chief-Justice Gascoyne bore argent, on a pale sable a conger's head erased or.

Trout.

Troutbeck: azure, three trouts fretted In triangle argent.

The *Chabot*, a sort of gurnet, was used as a badge by the family of Rohan-Chabot.

The *Scallop*, or escallop shell, is an old and popular charge, especially in Spain, as the emblem of St. James of Compostella, which led to its being the sign of a pilgrim. The seal of the fraternity of St. James at Wisby (about 1200) represents St. James as a pilgrim with a scallop upon his scrip. Sir Walter Raleigh says—

"Give me my scallop shell of quiet,
My staff of faith to walk upon."

Scales: gules, six escallops argent, 3,2,1 (fig. 111).
Shelley: sable, a fess engrailed between three whelks or.

Fig. 111.

Fig. 112.

Fig. 113.

Fig. 114.

Reptiles, Insects, and Monsters.—Reptiles and Insects are charges rarely seen in early coats.

The *Serpent* is the bearing of the Visconti, dukes of Milan: argent, a serpent gliding in pale azure, crowned or, vorant an infant issuant gules.

The *Snake* or bisse, anguis.

Sir Wm. de Malbisse: three testes de bysses.
The usual bearing of the name of Vaughan in S. Wales is azure, three boys' heads couped at the bust argeut, wreathed about the neck with a snake proper.
Bottreaux: argent, three toads (botraces) erect sable.

The *Fly*, musca.—Muschamp of Wooler bore argent, a chevron vert between three flies. This bearing is seen on a boss of the cloister at Canterbury, but the muscæ are represented as butterflies, which loses sight of the allusion.

The *Bee.*—Both Sir Robert Peel and Sir Richard Arkwright appropriately placed a bee in their arms.

Chimæras.—A chimæra is a modification of some existing animal, though often much more than "parce detorta" from its type. Of them the most celebrated is the winged lion of St. Mark, the proud emblem of ancient Venice. Technically the bearing is "azure, a winged lion sejant gardant, with a glory, or; in his fore paws an open book, thereon 'Pax tibi, Marce, Evangelista meus,' over the dexter page a sword erect,—all proper."

The *Dragon*, though not very much used in heraldry, is a chimæra of ancient date and much employed in early romance. He is thus described—

"There was a dragon great and grymme,
Full of fire and also of venym;
And as a lion then was his fete,
His tayle was long and full unmete;
Betweeu his head and his tayle
Was twenty-two foote withouten fail;
His body was like a wine ton,
He shone full bright against the sun;
His eyes were bright as any glass,
His scales were hard as any brass."

The dragon was a favorite standard with the Welsh princes, and used also by the Anglo-Norman sovereigns. He is drawn with four legs and wings, a long barbed tail usually knotted, and a body protected by scales. In English heraldry he is used chiefly as a crest. In Wales, Rhys Ap Tudor Mawr is said to have borne "argent, a dragon segreant sable."

The *Gryphon* is popular both in romance and heraldry. He is an emblem of vigilance, and inhabited a mountain in Bactria and guarded much gold there. It was in defence of this that he

"Through the wilderness
Pursued the Arimaspian."

He is drawn with the body and tail of a lion, the head of a cock, a pair of wings, and very long sharp claws. When on his hind legs he is segreant.

Morgan of Tredegar: or, a gryphon segreant sable (fig. 112).
Evelyn of Wotton; azure, a gryphon passant and a chief or.
Cotton of Landwade: sable, a chevron between three gryphons' heads erased argent.

The gryphon was an early cognizance of Redvers, earl of Devon, and was used statant by some branches of the Montacutes in the time of Henry III.

The *Wyvern* is a two-legged dragon with the body passing off into a long tail barbed at the end and usually borne nowed or knotted.

Drake: argent, a wyvern statant, tail depressed and nowed, gules (fig. 113).

Cockatrice.

Langley, argent, a cockatrice sable, combed gules.

The *Unicorn* or licorne abounds in Scottish heraldry, and was made the sinister supporter of the arms of Great Britain by James I.

"Ceste merveillose beste,
Qui une corne a en ta teste
Senefie nostre seigneur,
Ihesu Crist nostre sauveur.
C'est l'unicorne spirituel,
Qui entre la vierge prist ostel."

Harting: argent, a unicorn sejant sable, armed and ungued or.

The *Mermaid.*

Ellis: argent, a mermaid gules, crined or, in her right hand a comb, in her left a mirror. argent.

The *Martlet*, or merlotte, a small bird without legs, and always represented close. It is one of the oldest and commonest of charges, but seldom if ever borne singly (see Fleetwood, fig. 12).

Furnival of Farnham Royal: argent, a bend between six martlets gules.
Roger de Merley, roll of Henry III.: barry of ten, argent and gules, on a border azure eight martlets or.

Flowers and Fruits of the Earth.—Of these the palm was an emblem of victory; the laurel, of triumph; the oak, of strength; the olive, of peace, the cypress, of woe; the vine, of fecundity and joy; the lily, of purity; the daisy, of humility; while the holy

"Trefoil, St. John's wort, and dill
Hinder witches of their will."

Fleur-de-lys.—At the head of heraldic flowers, if flower indeed it be, is the *fleur-de-lys* (fig. 60), the *Flos gladioli* of Upton, said to have been brought down by an angel for the arms of France, and which was certainly used by Louis VII. and borne singly and in numbers by Philip Augustus. It may be allied to the lily—

"The lily, lady of the flowery field,
Or fleur-de-luce, her lovely paramour;"

or its original designation may have been "Fleur de Louis." It was not at first popular either in Normandy or in England, occurring but twice in the roll of Henry III., and only twenty times in that of Edward II., nor was it until its assumption by Edward III. that it came into general use in England. The Cantilupes bore three fleurs-de-lys before they added the pards' heads (fig. 98).

Digby of Coleshill; azure, a fleur-de-lys argent.
Portman of Orchard-Portman: or, a fleur-de-lys azure.
Beaumont, to show his claim to descend from the blood-royal of France, bears azure, semée of fleurs-de-lys, a lion rampant or.
Hawkins: argent, on a saltire sable a fleur-de-lys or.
New College, Oxford: sable, three lilies slipped argent.

The *Rose* (*Flos florum*) is a very popular charge in English heraldry, though in the roll of Henry III. it occurs but once, and in that of Edward II. only twelve times. Usually the flower is borne alone and full-faced, with five petals, and barbs and seeds between them. If a stalk is shown, it is usually "slipped," that is, cut off obliquely.

Boscawen of Boscawen-Rose: ermine, a rose gules, barbed and seeded proper (fig. 114).
Bilson, bishop of Winchester: azure, a rose and pomegranate impaled dimidiated, gules and or, barbed, seeded, stalked, and slipped counterchanged.

The rose is also used in the chaplet, a favorite head ornament, of which a good example may be seen upon the conical helmet of Humphrey de Bohun (1267), in Gloucester cathedral. After the gallant defence of Calais in 1348, in which Edward and the Black Prince served under Sir Walter Manny, the king was so pleased with the valor shown by his prisoner Eustace de Riheaumont that he took a chaplet from his own head and gave it to Sir Eustace with his liberty, bidding him "wear it for a year for the love of me."

Greystoke: barry of six, argent and azure, three chaplets gules

The *Trefoil, Quatrefoil, Cinquefoil,* and *Sixfoil* are all common charges, usually but not always borne, like the rose, without a stalk.

Harvey of Ickworth: gules, on a bend argent three trefoils slipped vert.
Vincent of Stoke D'Abernon: azure, three quatrefoils argent (fig. 115).
Robert de Bellomont, earl of Leicester (1191–1220), sealed with a cinquefoil, bearing on each foil an ermine spot; and Robert de Quincy, the son of one of Earl Robert's sisters, bore "de goules ung quintefoil de hermyn."
Umfravile of Penmark: gules, a sixfoil or.

Fig. 115.

Fig. 116.

Fig. 117.

The *Thistle,* which gives name to the Scottish order, is also an heraldic bearing in that country.

Leaves, feuilles, are borne by Leveson and Foulis; hazel leaves by Hazlerigge of Noseley; strawberry leaves, or fraises, by Frazer of Lovat; walnut leaves by Waller; oak leaves by Oakes; by Elmes of Lifford, elm leaves; rye and barley or orge by Rye and Grandorge. Bigland bears three ears of big.

Wood and Borough bear trees rooted up or eradicated.
Borough of Chetwynd: gules, the stem and trunk of a tree eradicated and couped, sprouting in two branches argent.

When Queen Elizabeth visited Worcester the citizens transplanted a pear tree laden with fruit into the market-place, for which attention she added pears to the city arms. Warden abbey, Beds, was famous for a pear that bore its name and constituted its arms—azure, three Warden pears or. The kingdom of Granada bore argent, a pomegranate slipped proper. Serjeaux bore argent, a saltire sable between twelve cherries slipped gules.

The *Garb,* gerbe, or wheatsheaf, was a common bearing, especially in Cheshire. Sometimes the garb is banded of a different color.

Grosvenor: azure, a garb or.
Vernon of Shipbrook: or, on a fess three garbs of the field.

Celestial Figures.—The *Sun* was the cognizance of Louis XIV., with the overbearing motto, "Nec pluribus impar." In heraldry this was blazoned as "the sun in his splendor."

Jean de la Hay bore argent, the sun in his splendor gules.
Ralph de la Hay, *temp.* Henry III., differenced this coat by bearing only a ray of the sun, "blanc, ung rey de soleil de goules."
Sir John Aldam, *temp.* Edward II.: azure, a ray of the sun or. In both examples the ray issues from the dexter chief, and is borne bendwise. It resembles a pile wavy.
John de Fontibus, bishop of Ely, 1220-25, bore the sun, moon, and seven stars, 2,1,2,1,2,1.

The *Moon* is always borne as a crescent, and usually with the concavity upwards. If this be to the dexter it is increscent, if to the sinister, decrescent. It is an early and general charge, though seldom borne singly.

Chapman: per chevron argent and gules, a crescent counterchanged.
Weld: azure, a fess nebulé between three crescents ermine.
Baron of co. Lincoln: azure, in chief two moons increscent and decrescent argent, in base an estoile or.
The seal of Sir Lawrence de Berkerolles, 1392, gives a chevron between three crescents (fig. 118).

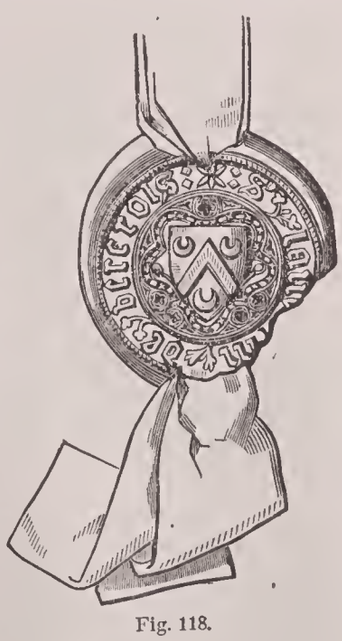


Fig. 118.

The *Star,* or estoile, is usually shown with six rays, wavy, and is thus, and by not being pierced, distinguished from the mullet. If there be more rays the number must be given.

Ingilby of Ripley: sable, an estoile argent.
One of the branches of De la Hay bore argent, an estoile of sixteen rays gules.
Sir Francis Drake, in memory of his voyages, bore sable, a fess wavy between the arctic and antarctic pole stars argent.

Man and his Parts.—The full human figure is very rarely borne in coats of arms. In Scotland the Dalzells bear sable, a naked man with arms extended, proper; formerly he was borne suspended from a gibbet.

Wood: azure, three salvage men ambulant in fess, proper; in their dexter hands a shield argent charged with a cross gules, in their sinister a club resting on their shoulders, also proper.

Mr. Way mentions an MS. at Melton, in which two knights are represented tilting before a French princess, one of whom bears for a coat three demoiselles caged in a basket.

Canning of Foxcote: argent, three blackamoors' heads couped sable, capped or, fretty gules.
Tremaine of Colacombe: gules, three dexter arms conjoined at the shoulder, flexed in triangle, or, fisted argent.
Maynard: argent, three sinister hands couped at the wrist gules.
Foljambe of Walton bears a man's leg for a crest.
The Isle of Man: gules, three legs armed in mail proper, garnished and spurred or, conjoined at the thighs and flexed in triangle, a bearing certainly in use as early as the reign of Edward I., and possibly earlier (fig. 116).
A very extraordinary bearing is that granted to Peter Dodge of Stopworth, Cheshire, by Guyenne king-at-arms, 8th April, 34 Edward I., for services in battle, "Porter a son escu d'or et sables, barré de six pièces et ung pal gules, avec une mamelle de femme dégoutante." It is said to be the earliest example of a grant of arms by a herald. Happily for heraldry there are not many such.
Newton: sable, two shin bones saltire-wise, the sinister surmounted by the dexter, argent.
Douglas: argent, a man's heart gules, ensigned by a royal crown proper, on a chief azure two stars of the first.

The "*quinque vulnera,*" or five wounds of the crucifixion, are a common ecclesiastical bearing on architectural shields, and several bishopries bear figures of saints on their shields, but these are scarcely within the limits of proper heraldry. Thus the arms of the see of Chichester are—

Azure, Presbyter John mitred, seated on a tombstone, in his sinister hand a mound, his dexter extended, all or. In his mouth a sword fesswise argent, hilted and pomelled or, the point to the sinister.

Miscellaneous Objects.—*Helmet.*—The helmet completed the knight's equipment. He wore "l'ecu au cou, son heaulme sur la tête, et son glaive au poing," or,

"His helm of latoun bright,
His saddel was of revell bone,
His bridle as the sun shone,
His spere was of fine cypress."

Halliday of Hungerford. sable, three helmets argent, garnished or, with a border engrailed of the second. The motto referring to the omitted fourth helmet is exceedingly happy, "Quarta salutis."

Morion. or steel cap.

Brudenel of Dene. argent, a chevron between three morions sable.

Gauntlet.

Gunter of Tregunter· sable. three dexter gauntlets or.

The *Sword* is much used in heraldry; it was the oldest weapon and that most thought of. The soldier in all time was the man of the sword. Damascus, Cologne, Bilbao were in turn famous for the manufacture, as was among smiths Andrea di Ferrara. The swords of great soldiers have been celebrated: Bhowanee as the sword of Sivajee, Excalibar of Arthur, Taillefer of Cœur de Lion—

"Schwafurlama's magic blade,
Was by dwarfs at midnight made."

There was also the weapon by which Roland, with "huge two-handed sway," cleft the pass of Roncesvalles,

"And to the enormous labor left his name."

The sword of Talbot bore "Sum Talboti pro vincere inimicos suos,"—"Bad Latin," says Fuller, "on it, but good steel in it." King John gave his own sword to the town of Lynn Regis with the inscription, "Ensis hic donum fuit regis Joannis, a suo ipsius latere datum." The sword of heraldry is two-handed.

Kilpec of Kilpec: argent, a sword bendwise sable.

The *Axe* was reckoned a manly weapon—

"King Richard, as I understond,
Yet he went out of Engloude,
Let make an axe for the nones,
Therwith to crush the Saracens bones.
. . . . . .
Thereon were twenty pound of steele."

The Danish battle-axe was famous. Walter de Plumpton held Plumpton by the tenure of a Danish axe that hung up in his hall there.

Hackluyt: gules, three Danish axes or.

Lance.—The arms granted to Shakespeare's father were, or, on a bend sable a lance of the field.

Spear Head.—This is a common bearing among the Welsh of Glamorgan and Brecknock, and used by Jones of Fonmon; sable, a chevron between three spear heads argent, points embrued gules. It is quartered by Lewis of Greenmeadow, a cadet of Vau, and by others.

The *Arblast,* or cross-bow, was the most unpopular weapon, as requiring no strength or manliness for its use. Richard I. is generally said to have met his death from a cross-bow; but the earls of Aberdeen, who claimed to represent Bertrand de Gourdon, bear as their crest two arms drawing a long bow. The cross-bow was forbidden by Innocent II. and the emperor Conrad at a council in 1139. Guillaume de Dôle, who wrote before 1200, says of this weapon—

"Par effort de lance et d'escu,
Conqueront toy ses ennemies

Ja arbalêtrices nu fu mis,
Por sa guerre li autoritez."

Nevertheless as early as 1270 the master of the cross-bows was a great officer of the French crown.

Arblaster: ermine, a cross-bow in pale gules.

The *Bow*, though formed of Spanish yew, was essentially an English weapon. It occurs in heraldry, though scarcely so frequently as might have been expected, and chiefly in allusion to a name. The belt or baldrick, sheaf of arrows, buckler, and sword completed the equipment of an archer—

"Their baudrieks set with studs, athwart their shoulders cast,
To which, under their arms, their sheaves were buckled fast;
A short sword at their belt, a buckler scarce a span,
Who struck below the knee, not counted then a man.
All made of Spanish yew, their bows were wondrous strong,
They not an arrow drew but was a clothyard long.
Of archery they had the very perfect craft."

The bow was used by the English in the attack on the isle of Rhé in 1627.

Bowes of Streatlam: ermine, three bows palewise strung gules (fig. 117).

The *Arrow*.—Drayton describes

"Their arrows finely paired for timber and for feather,
With birch and Brazil piereed, to fly in any weather;
And shot they with the round, the square, or forked pile,
The loose gave such a twang as might be heard a mile."

The burgesses of Sheffield seal with a sheaf of arrows.

Birdbolt, or bozon.

William de Gresley held a manor "per unum arcum . . . et unam bozonem."

Bozon of Barrowby: argent, three birdbolts gules, feathered or.

The *Pheon*, or broad arrow.

Sydney of Penshurst: or, a pheon azure (fig. 119).

Floyer of Floyer's-Hayes: sable, a chevron between three broad arrows argent.

In heraldry arrows are usually drawn as clothyard shafts. The pheon is always drawn with the head only.

Besides these, and also more or less connected with war and the chase, are the buckle, barnacle, calthrop, castle, fireball, hammer, horse-shoe, hunting horn, maul, pick, spur, stirrup, and some hundreds of miscellaneous objects, travelling so far out of the legitimate charges of heraldry as to include apples and acorns, beehives, and a turnstyle. A very few of the most ancient have been selected.

Walter Agard held Tutbury under Henry III. by a white hunters' horn, and bore for arms, argent, three hunters' horns sable.

The *Chain* borne by the kings of Navarre, the puzzle and delight of French heralds, "gules, a trellis of chains or, in cross and saltire," also blazoned "gules, a carbuncle closed and pomelled or," or by the Spanish heralds—"cadenas d'oro atronesados en campo de sangre."

The *Annulet*, said to be a link of mail.

Musgrave of Edenhall, derived from Vipont: azure, six annulets or, 3,2,1.

Lowther also derived his arms, or, six annulets sable, 3,2,1 from the same source.

Calthrop—a four spiked implement, so arranged that when thrown on the ground one spike always stood upright. Calthrops were used to keep off cavalry. Bruce used them at Bannockburn, and among the stores at Dover castle, 16 Edward III., was a barrel containing 2900 calketrappes. Froissart says the English on one occasion supplied their place by sticking their spurs into the ground.

Horseman: or, three calthrops gules (fig. 120).

Fig. 119.

Fig. 120.

Fig. 121.

Fig. 122.

Castle.

Hill: ermine, on a fess sable a castle triple towered argent.

Comb—a singular bearing of high antiquity borne by Ponsonby of Ponsonby and Tunstall of Thirland.

Cups.

Argentine: argent, three cups gules.

Cushions, oreilliers.

Earls of Moray: argent, three pillows gules.

Maheu de Redman, in the roll of Henry III.: de goules, a trois boreilers d'or. Possibly these are birds.

Tiara.—The Dukes d'Urbino bore a papal tiara.

Crowns (mural, naval, and others) and *mitres* are not uncommon in arms. The Berkeley crest is a mitre. The *crancelin* or crown of rue was used in 1150 by Saxony. Bernhard of Anhalt bore barry of eight or and sable, a crancelin vert.

Mullet.—This is usually called a spur rowel, but it was in use long before the rowelled spur. Besides being employed as a difference, it is a constituent of numberless coats of arms.

Assheton of Downham: argent, a mullet piereed sable.

But it is generally borne in numbers (see fig. 115).

The *Lymphad* or galley. The bearing of the Lords of the Isles, quartered by the dukes of Argyll for Lorne, is argent, a lymphad, sails furled and oars in action, all sable, flags flying gules (fig. 121).

The *Maunch*, or lady's sleeve—

"A lady's sleeve high-spirited Hastings bore."

The earls of Pembroke bore or, a maunch gules; those of Huntingdon bear argent, a maunch sable. It was borne also by Flamville, Wharton, Maunsel, Conyers, and many others. Bayard took a lady's sleeve and proclaimed it, with a valuable ruby, as a prize to be contended for. Bayard himself won it, and the lady wore it for his sake. Fig. 123 is from the seal of John de Hastings, 1291.

Fig. 123.

The *Battering-ram* is borne by the Berties, earls of Lindsey, sometime dukes of Ancaster, with the allusive motto, "Virtus ariete fortior" (fig. 122).

The *Escarbuncle* was a very early bearing of the Mandevilles. It is a cross of eight rays, set with knobs and the arms ending in fleurs-de-lys. In another form the ends are connected by cross-bars. The escarbuncle of the reign of Henry III. resembles the iron work on doors of that period.

Blount of Bitton: argent, two bars azure, over all an escarbuncle of eight rays gules, fleurettée and pomettée or.

Among musical instruments the *Clarion* is borne by Granville, and is seen on tiles at Neath Abbey. It resembles a pan-pipe. The *Trumpet* is seen on the fine Trumpington brass near Cambridge.

Williams of Thame: azure, two organ pipes saltierwise, the dexter over the sinister, between four saltires argent.

The *Water Budget* or bucket is an early charge identified with the names of Ros and Rose. Ros, however, got it from the Trusbuts of Belvoir, who possibly bore it as lords of Watro in Holderness. Mr. Planché has discovered a drawing of a pair of water budgets in actual use. They were of leather, and carried in pairs on a stick over the shoulder.

Debased Heraldry.

Of debased heraldry there is no lack of examples, and a few are ancient. Thomas de Insula, bishop of Ely (1345–61), bore gules, three bezants, on each a crowned king, robed sable, doubled ermine, sustaining a covered cup in his right hand and a sword in his left, both or. No doubt, like the arms of the sees of Chichester and Salisbury, this extraordinary coat was meant to be painted on a banner. Camden granted a great number of coats, mostly of a complex character, and since his time heraldic taste has not improved. Tetlow (granted 1760) bore "on a book erect gules, clasped and leaved or, a silver penny argent, thereon written the Lord's Prayer; at the top of the book a dove proper, in his beak a crowquill pen sable." Other grants show negroes working in a plantation, Chinese porters carrying cinnamon, etc. The grants to Lord Nelson and his gallant captains, and to the elder Herschel, are utterly unheraldic. It can scarcely be wondered at that Lord Chesterfield, correcting the Garter of his day, remarked, "You foolish man, you don't understand your own foolish business."

Differences and Marks of Cadency.

The object of an armorial bearing having been to distinguish one iron-sheathed warrior from another, it was necessary to provide bearings for the members of a family, all entitled to take the paternal coat. This was managed by the introduction of a difference (French, *brisure*), usually some slight but well-marked alteration, sometimes by inverting the tinctures, sometimes by changing an ordinary or a smaller charge, as a bend for a fess, or a crosslet for a martlet. Where an heiress had been married a part of her coat was often introduced. The object was with a suffi-

cient difference to show the connection with the head of the house. The following examples are from the families of Hastings and Zouch. Females, who wore no armor, did not need distinguishing marks, and bore the coat unbroken.

Sir John Hastings bore (see fig. 123) or, a maunch gules, called "le de plein armes."
Sir William Hastings bore the same, with a label of Pembroke.
Sir John Hastings bore the same, with a border of Valence.
Sir Edmund Hastings bore the same, with a label vert.
Sir Nicholas Hastings bore the same, with a label azure.
Sir Miles Hastings bore or, a fess and a chief, three mullets gules.
Sir Philip Hastings bore the same, with a label azure.
Sir Robert Hastings bore ermine on a chief azure, three mullets or.

The label of Pembroke and border of Valence show the match with the heiress of Valence, earl of Pembroke. Sir Miles formed a distinct branch, that of Daylesford, probably before armorial bearings were fixed; his descendants, however, returned to the maunch.

Sir Alan la Zouch bore gules, bezanty.
Sir William la Zouch bore the same, with a quarter ermine.
Sir William la Zouch bore the same, with a label azure.
Sir Oliver la Zouch bore the same, with a chevron ermine.
Sir Amory la Zouch bore the same, with a bend argent.
Sir Thomas la Zouch bore the same, on a quarter argent a mullet sable.

The quarter ermine is to show the descent from the dukes of Britanny.

These and many others of an early date are suitable for their purpose; but, as armorial bearings became less actually useful, alterations of a different character crept in. The label, however, retained its place. It closely resembles the strap with pendants which from the saddle crossed the horse's chest. The earliest example of its use is said to be by Geoffrey, son of Henry II., in 1153, but a more certain case is the seal of Saher de Quincy, though whether there borne as a charge or as a difference is uncertain. At Caerlavrock Maurice de Berkeley bore a blue label "parceque ces pere vivoit." In Scotland William Fraser, in 1295, uses a label of three points and on each three roses or mullets, probably meant for "fraises" or strawberry leaves. The mullet, crescent, and fleur-de-lys are used as differences about the same time. The label, even then, was most frequently used by the eldest son, but occasionally he used the crescent, and the label was taken by the second son. The royal house generally used the label, but occasionally the border. Edward I., as prince, bore a label of five points azure; Edmund Crouchback, his brother, who married a French princess, charged the label with fleurs-de-lys. His second son, Henry, bore England with a bendlet ermine. Thomas and Edward, second and third sons of Edward I., used labels. Edward IV., as prince, bore on his great seal a label of three, and on his counterseal one of five points. John of Eltham, his brother, bore England with a border of France. The Black Prince, who bore France and England quarterly, added a label argent, and Richard, during his father's life, placed a cross of St. George on the middle point. Lionel, third son of Edward III., having married the heiress of De Clare and De Burgh, used a label and on each point a canton gules, said to be the original arms of De Clare, and on his seal as earl of Ulster each point bore a cross for De Burgh. The number of points was matter of indifference, though usually confined to three. The label itself was, on the whole, and has continued to be, a mark for all the princes of the royal house.

Setting aside the royal family, a new system of differences came into use, and is touched upon by Upton early in the 15th century, though then but imperfect. He gives the crescent to the eldest son, and to the others the label with three or more points in succession. Dame Berners, in 1486, besides employing the billet, crosslet, and other marks, describes a method of differencing by "gerratting," that is, powdering the field with billets or other charges, but the good lady's coats are often mere fancies. The first regular appearance of the modern system is on the effigies of seven Beauchamp cadets in St. Mary's windows at Warwick. There the label, annulet, crescent, martlet, fleur-de-lys, and mullet indicate the several cadets. The label is placed in chief, the rest on the fess point of each surcoat.

The modern marks now regularly admitted are—(1) the label of three points; (2) the crescent; (3) the mullet; (4) the martlet; (5) the annulet; (6) the fleur-de-lys; (7) the rose; (8) the cross moline; (9) the octofoil (fig. 124). The elder son of the elder son places a label upon a label, the second a crescent, and so on, so that the ninth son of a ninth son would bear an octofoil upon an octofoil, pointing out the relationship of each member to the parent stock. Practically, however, marks of cadency are but seldom used. The earls of Harrington indeed, descending from the second son of a second son, place a crescent upon a crescent. Lords Abergavenny and Braybrooke difference their Neville

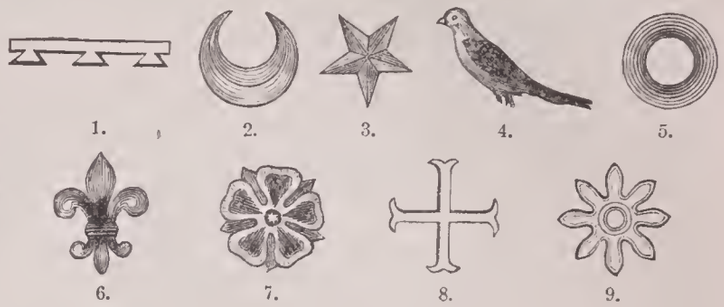


Fig. 124.—Marks of Cadency.

saltire with a rose, as springing from the seventh son of Ralph, earl of Westmoreland. On the other hand Lord Derby, though a cadet, bears his arms unbroken.

Marks of Illegitimacy are very various, and on the earlier coats not to be distinguished from differences. Probably the earliest English example is afforded by Wm. Longspee, natural son of Henry II., who bore six lioncels, no doubt derived from his father, though usually attributed to his wife Ela, heiress of the earldom of Salisbury. His counterseal bears the long sword whence he derived his name. The sons of Richard, brother of Henry III., bore their father's lion of Poitou, inverting the colors, until Sir Geoffrey Cornwall took prisoner the duke of Britanny, when he changed his field to ermine. In the roll of Edward II., Sir John Lovel le Bastard bore Lovel, usually or and gules, with "un label d'azur." Sir Roger Clarendon, son of the Black Prince, has already been mentioned (page 625). John Beaufort, son of John of Gaunt, bore per pale argent, and azure on a bend gules three lions of England, with his father's label. After his semi-legitimization he bore England with a border gobonny argent and azure, the Lancaster colors. Arthur, Viscount Lisle, son of Edward IV., placed a bâton over his father's arms. Sometimes the father's coat was altered. Sir John Stanley bore a coat compounded of Stanley and Lathom. Sometimes a bâton sinister was added, sometimes a border. Strictly a natural son does not adopt his father's quarterings, unless such as are habitually borne conjoined, as the royal arms. The descendants of Charles II. bear the whole arms with a bâton sinister or border; those of William IV. the bâton. With the house of Bourbon the bâton marked the cadets, the bâton sinister the bastards. Sir Gilbert Talbot (1569), son of a bastard son of Sir Gilbert Talbot, was allowed Talbot and the usual five quarterings of the family, with a bendlet sinister over the whole, but this is unusual.

Rules of Blazon.

To blazon a coat of arms is to describe it in the technical language of heraldry; and, although the works of the fathers of heraldric lore contain much irrelevant matter, and some confusion of arrangement, the rules of blazon, by whomsoever devised or perfected, are remarkable for their precision, brevity, and completeness. Great and successful care has been taken to produce clear and simple order, to avoid repetition, and to preserve a certain uniformity of arrangement through much complexity of detail. The technicalities arise in great measure from the use of terms once well known, and the language, as was to be expected, shows traces of the French and Franco-Norman channels through which the "gentle art" reached England.

First comes the description of the field, its color, or the arrangement of the colors (if more than one), and the character of the partition lines when parted. Thus the "parma inglorius alba" would be blazoned "he beareth argent." The coat of Waldgrave is per pale argent and gules; that of D'Ebroicis, earl of Gloucester, was "per pale dancette argent and gules."

Next follow the charges, and first those of most importance and nearest the field, their names, number, and posi-

tion (if an animal, its attitude), and finally the color. The principal charge is that which occupies the principal position. Thus Backhouse of Kellet bore party per saltire, azure and or, a saltire ermine; Bigland of Bigland, azure, two ears of bigg or. Where the principal charge is an ordinary placed between smaller charges, it follows the field: Foliot,—or, a fess between two chevrons gules. The same rule holds where the ordinary is charged, as in Braithwaite of High Wray—gules, on a chevron argent three cross crosslets fitchy sable; or when the two are combined, as Kerr of Cessford,—vert, upon a chevron between three unicorns' heads erased argent, horned and crined or, as many mullets sable. Where the ordinary may be charged, but does not admit of being placed between charges, it is blazoned thus: Russell,—argent, a lion rampant gules, on a chief sable three escallops of the field. If the field be semée of figures (*i. e.*, besprinkled with them in regular order) they follow it: Pierrepoint,—argent, semée of cinquefoils gules, a lion rampant sable. Had the cinquefoils been on the lion instead of on the field the blazon would have run, argent a lion rampant sable, semée of cinquefoils gules.

The arrangement of common charges has already been explained (page 622, fig. 85):—if one, central; if two, per pale; if three, 2 and 1; if more, as must be specified, as in Babington (fig. 9). Such diminutives as are borne in pairs follow their ordinary: Cludde,—argent, a bend between four cotises sable. To avoid repetition, if a tincture occurs twice reference is made to the first. Scott of Abbotsford, —or, two mullets in chief and a crescent in fess, azure, within an orle of the last: and so if the same number of charges occurs twice, the words "as many" are used: Maling of Scarborough,—ermine, on a chevron vert between three hawks' jesses as many roses argent. Upton, who wrote in Latin, is put to strange shifts to express his meaning. He thus blazons the arms of Mortimer (fig. 63):—

"Portavit arma barrata, et caput scuti palatum est et angulatum de azorio et auro, cum quodam scuto simplici de argento." In heraldic French this is, "Il portoit barrée et ung chef palée cunetée d'asur et d'or, et ung escu simple d'argent."

The following, from Menestrier, is the full blazon of the arms of the old kings of France:—

D'asur a trois fleurs-de-lys d'or 2 and 1. Escu timbré d'un casque ouvert d'or placé de front, assorty de ses lambrequins d'or et d'asur, couronné de la couronne imperiale Françoise, entouré des colliers des ordres du St. Esprit et St. Michel, soutenu par deux anges vetus en Levites; la dalmatique des émaux de l'escu tenant chacun un baniere de France; le tout placé sous un grand pavillon d'asur fleur-de-lisé d'or doublé d'ermines; le comble rayonné d'or et couronné de la couronne imperiale Françoise.

Le dit pavillon attaché à la baniere ou oriflamme du Royeaume. Cri du guerre, "Montjoye St. Denis." Devise, "Lilia non laborant neque nent," alluding to the operation of the Salic law.

Marshalling Arms.

Marshalling is the disposing or arranging of such coats of arms as have to be included in one shield. Blazoning deals with the particulars of each coat, marshalling with its position as regards other coats. Arms may be arranged per pale or impaled, or the shield may be divided into as many squares as may be required, when it is said to be quartered. The first coat, that of the bearer, may or may not be repeated in the last quarter as may be required to make up an even number of squares, which, though not necessary, is desirable.

For a time armorial bearings were purely personal, and intended to supply a want only felt by the wearer of armor. Hence, at first, females do not seem to have used them, and when a place was found for them on armorial seals, the coat was regarded as that of their father, and therefore not differenced. For a time they seem to have had a separate shield. On one of the seals of Margaret of France, queen of Edward I., his three lions are displayed upon the point of her tunic, and on her right hand is a shield of France, on her left, one with a lion rampant. On the reverse is a shield of England, and around it, outside, a border of France. Margaret Bruce of Skelton married Robert de Ros. Her seal (1280) bears her effigy, somewhat defaced, so that nothing can be distinguished on her dress, but on her right is a shield of Ros, on her left one of Bruce.

A well-known seal, date about 1347, is that of Joan, daughter of Henry count of Bar, by Eleanor daughter of Edward I. by Eleanor of Castile. Joan was widow of Warren, earl of Surrey. Her seal is circular, with nine compartments. In the centre is Warren for her husband; above and below, England for her grandsire; right and left are two barbels for her father. These four are on lozenges. In the four corner compartments are—(1) and (4) a lion for Leon, and (2) and (3) a castle for Castile, for her grandmother. This is a sort of nebulous quartering.

To this succeeded the allotment to the wife of the sinister half of the husband's shield, displayed as though two shields had been divided vertically and united, omitting therefore the adjacent half of each coat. This is called dimidiation, and the shields so joined constitute an impalement. Another seal of Margaret of France illustrates this practice. In it half of England impales half of France.

Fig. 125.

There is a good example of dimidiation in the tomb of William de Valence at Westminster, where Valence impales Clermont-Nesle, both dimidiated. An early German seal combines half an eagle with half a lion in this way. The arms of the Cinque Ports are remarkable examples of dimidiation. In each, the lions of England are dimidiated with the arms of the special Port. That of Hastings (fig. 125) is party per pale dimidiated, Dexter, gules, three lions passant gardant or; Sinister, azure, three demi-hulks of ships argent. Sometimes one of the coats only was dimidiated. Eleanor (Montendre) was widow of Guy Ferre. Her seal (1348) has a shield of Ferre, a cross moline and over it a bâton, dimidiated, impaling Montendre, a lion within an orle of trefoils. The lion is whole. The seal of Elizabeth, wife of Sir Lawrence Berkerolles (fig. 126),—azure, a chevron or, between three crescents argent, impaling a lion rampant,—is a good example of an impalement without dimidiation (date 1392).

Fig. 126.

Usually the lady has the sinister side, but in the seal of Marion, wife of Sir William Dalziel (1392) this is reversed, as it is in the impaled shield of John of Gaunt, where his wife, a daughter of Peter of Castile and Leon, has the dexter side. Dimidiation is not applicable to all coats. A canton on the sinister coat would be lost, and a chevron be converted into a bend. The tressure, orle, and border were usually, not always, dimidiated; and although this form of impalement has fallen into disuse, these charges are still borne dimidiated, as may be seen with the border and tressure on the tomb of Mary, queen of Scots.

When the lady was the last of her race, various modes were devised for the conservation of her name and arms. Thus on the death (1193) of Robert de Lacy, last of the line of Pontefract, John, constable of Chester, half-brother to Robert by his mother, took the name and arms of Lacy, and was ancestor of the earls of Lincoln of that name. In the same century Isabel, heiress of Earl Warren, married Hamelin Plantagenet, who took the name, and their children bore the arms of Warren; and so with the Mandevilles, earls of Essex.

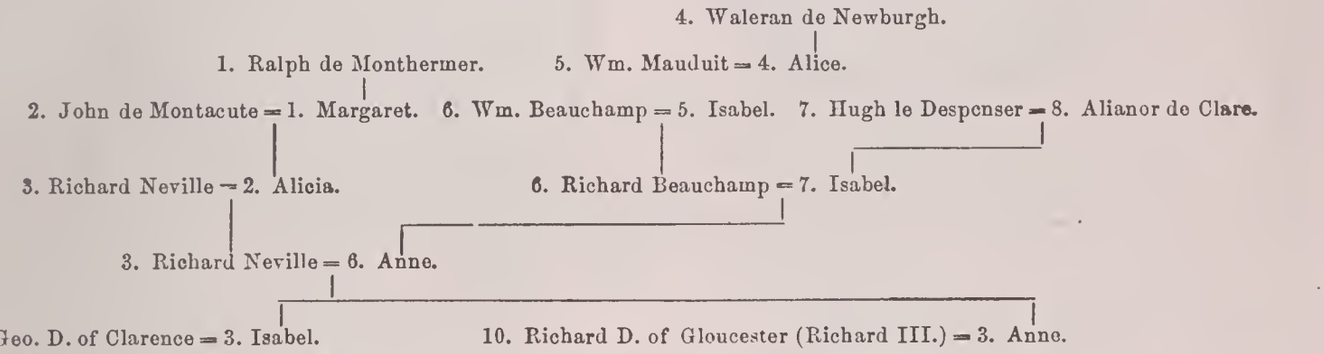
Sometimes a coat was compounded of the two families. Thus Mr. Planché is of opinion that the bend was added to the paternal coat of Bohun, on the marriage with the heiress of Milo, earl of Hereford. Scottish seals show many examples of such composition. Eustacea Colvile, widow of Reginald le Chein, in 1316, bore a cross moline, square pierced, for Colvile, between four cross crosslets fitchy for Chein. About the middle of the 14th century began the practice of placing the arms of females upon a lozenge. As early as 1347 Elizabeth D'Arcy so bears her arms, as in 1356 does Maud Fitz Payne. The seal of Joan Beaufort, widow of James I., affords the earliest Scottish example.

The first step towards a regular method of preserving heraldically the memory of a family extinct in the male

line seems to have been taken in Spain by a process now known as quartering. Eleanor of Castile, queen of Edward I., has upon her tomb a shield divided into four quarters, in the first and fourth of which is Castile, and the second and third Leon. The practice, though not finally regulated, was approved, for on the seal of the "She-wolf of France," queen of Edward II., the shield is quartered (1) England, (2) France, (3) Navarre, (4) Champagne, mixing up confusedly the arms of husband and wife, as they also are upon the shield of Philippa of Hainault, queen of Edward III., who bore quarterly, (1) and (4) England, (2) and (3) Hainault and Holland. A very early instance of regular quartering occurs in the will of Humphrey Bohun, earl of Hereford, dated 11th August, 1319, by which he bequeaths a courte-point quartered with the arms of England and Bohun. This is five years before the accession of Edward III., and makes it probable that the quartered coat of William de Foix at Winchester is original.

Under Edward III. quartering came into general use. The king led the way by quartering France and England, and the earl of Pembroke followed, quartering Hastings and Valence. John Hastings, his son, commemorated on his shield his father's match with Ann daughter of Margaret, duchess of Norfolk, a co-heir of Thomas of Brotherton, and this affords an early instance of the precedence often given in quartering to the royal arms. John Hastings bore quarterly of four—(1) and (4) Brotherton (Plantagenet), (2) Hastings, (3) Valence; and, on another example—(1) and (4) Brotherton, (2) and (3) Hastings quartering Valence. This latter arrangement of sub-quartering shows a considerable advance in the system. Henry IV. combined quartering with dimidiation in a shield long preserved in the window of Christ Church, Newgate, which bore France and England quarterly, impaling France with a bend gobonny, and Navarre quarterly, dimidiated, for Joan of Navarre. In this case the 1st and 3d quarters were removed, and the sinister bearings thus reduced to what may be better blazoned as party per fess, (1) Navarre, (2) France. The French sometimes quartered diagonally, called "Écartèle en sautoir." The old kings of Sicily thus divided their shield: party per saltire, (1) and (4) Aragon, (2) and (3) Swabia. This plan never found favor in England, where a regular system of quartering sprang up, and has continued in use. A quartered shield, though of no special family, is shown by fig. 12.

At first the arms of an heiress were impaled by her husband, but latterly they were placed on a central inescutcheon designated an escutcheon of pretence. The children divided the shield into four quarters, and placed the paternal coat 1 and 4, the maternal 2 and 3. If a second heiress came in, she was placed in No. 3; if a third, in No. 4; if more, the shield was divided as required. The following pedigree will explain the system. In it all the descents that did not bring in an heiress are omitted.



1. Monthermer: or, an eagle displayed vert.
2. Montacute: argent, three fusils conjoined in fess gules.
3. Neville: gules, a saltire argent.
4. Newburgh: checquy or and azure, a chevron ermine.
5. Mauduit: argent, two bars gules.
6. Beauchamp: gules, a fess between six cross crosslets or.
7. Le Despenser: quarterly, 1 and 4 argent, 2 and 3 gules, a fret or, over all a ribbon sable.
8. De Clare: or, three chevrons gules.
9. Clarence: quarterly France and England, a label of three points argent, each charged with a canton gules.
10. Gloucester: quarterly France and England, a label of three points ermine, on each point a canton argent.

The armorial bearings of each generation will be as follows:—

1. Monthermer alone. 2. Montacute impaling Monthermer. 3. Neville impaling quarterly, 1 and 4 Montacute, 2 and 3 Monthermer. 4. Newburgh alone. 5. Mauduit impaling Newburgh. 6. Beauchamp impaling quarterly, 1 and 4 Mauduit, 2 and 3 Newburgh. 7. Le Despenser impaling De Clare.
6. R. Beauchamp: quarterly of four—1 and 4 Beauchamp, 2 Mauduit, 3 Newburgh; impaling quarterly of four—1 and 4 Le Despenser, 2 and 3 De Clare.
3. R. Neville: quarterly of four—1 and 4 Neville, 2 Montacute, 3 Monthermer; impaling quarterly of six—1 and 6 Beauchamp, 2 Mauduit, 3 Newburgh, 4 Le Despenser, 5 De Clare.
9. George, duke of Clarence: France and England quarterly, impaling Isabel Neville quarterly of nine—1 and 9 Neville, 2 Montacute, 3 Monthermer, 4 Beauchamp, 5 Mauduit, 6 Newburgh, 7 Le Despenser, 8 De Clare.

The above, being a well-known and very noble pedigree, has been selected to illustrate the system of quartering, which is explained by the shield (fig. 127), thus emblazoned:—

1, George, duke of Clarence; 2, Neville, who brings in 3, Montacute; 4, Monthermer; 5, Beauchamp, who brings in 6, Mauduit; 7, Newburgh; 8, Le Despenser; 9, De Clare.

Unfortunately the several bearers of these arms were fanciful, and sometimes gave precedence to one and sometimes to another coat, and indeed never used the whole, which would have crowded their shields and caparisons. The four woodcuts, figs. 128, 129, 132 and 133, will illustrate this.

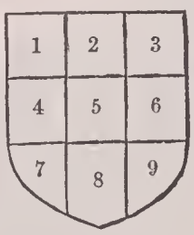


Fig. 127.

They represent the great seals of Richard Beauchamp, earl of Warwick, who married Isabel le Despenser, and Richard Neville, earl of Warwick, who married Anne Beauchamp.

Beauchamp quarters the arms of his wife, but makes De Clare impale Le Despenser, while he himself impales Newburgh. The blazon would thus be quarterly of four grand quarters—I. and IV., Beauchamp impaling Newburgh; II. and III., De Clare impaling Le Despenser (fig. 128). On the counterseal (fig. 129) the earl bears on his shield Beauchamp and Newburgh quarterly, and on his caparisons Beauchamp, Newburgh, De Clare, and Le Despenser also quarterly.

The other is the seal of the king-maker. As lord of Glamorgan he gives precedence to De Clare and Le Despenser, and bears quarterly of four grand quarters—I. and IV. quarterly, De Clare and Le Despenser; II. and III., Montacute and Monthermer; Neville not appearing at all. The crests are those of Beauchamp and Montacute. The remaining supporter is the Neville bull, muzzled, and below are ragged staves for Beauchamp (fig. 132).

The counterseal gives on the shield Neville above with a label, and the swan crest on the helmet. The caparisons are quarterly of four grand quarters: I. quarterly—1, effaced; 2 and 3, Newburgh charged with five pards' heads, jessant fleurs-de-lys for Cantelupe; 4, Beauchamp; II. and III.—1 and 4, De Clare; 2 and 3, Le Despenser; IV.—1 and 4, Beauchamp; 2 and 3, Newburgh (fig. 133).

The rules were also departed from where the royal arms were quartered, as by Devereux, Hastings, and Stafford, when it was usual to place them in the first or second quarter out of their genealogical order. Also in certain cases the quarterings of an heiress are not broken up, but borne combined as a sub-quarter, sometimes called a grand quarter. Thus the royal arms always form a special quarter, and probably the arms of Howard, quartering, as they always do, Brotherton, Mowbray, and Warren, would be so treated.

The English mode of quartering is defective, inasmuch as it affords no proof of purity of descent on both sides. A new man whose father married a Talbot or Clinton heiress would combine their ancient quarterings with his new coat,

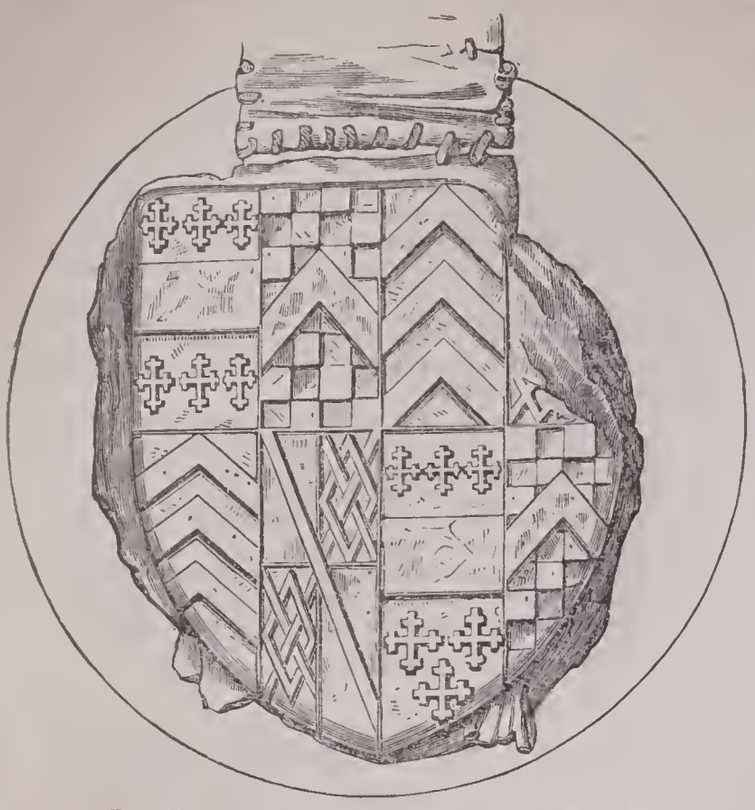
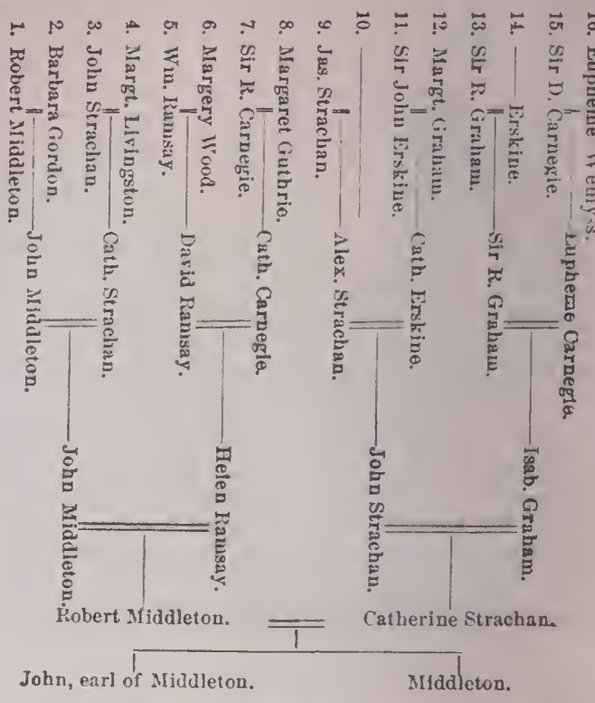


Fig. 128.—Seal of Richard Beauchamp, earl of Warwick.

Fig. 129.—Counterseal of Richard Beauchamp, earl of Warwick.

and few would be the wiser. On the Continent and in Scotland the system is far more perfect, and the quarterings include all ancestors and ancestresses of every kind. There a man who can prove the arms of his father and mother has two quarters; of his grandfather and grandmother, four; and so on. The following scheme, supplied from the family records of Mr. C. J. Middleton, registrar of the prerogative court, the representative in the male line of a Scottish family, the Middletons of Fettercairn, two of whom were earls of Middleton, will explain this. It gives, or nearly gives, the well-known "seize quartiers," without which, in former days, scarcely any important office was ever to be obtained:—



The arms are thus marshalled (fig. 130):—

Quarterly of 16:—1, Middleton, 2, Gordon; 3, Strachan: 4, Livingston, 5, Ramsay; 6, Wood; 7, Carnegie; 8, Guthrie; 9, Strachan, 10, ——; 11, Erskine; 12, Graham, 13, Graham: 14, Erskine; 15, Carnegie; 16, Wemyss.

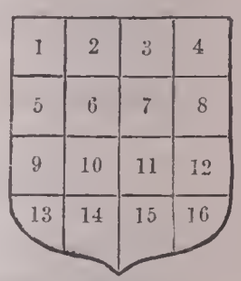


Fig. 130.

When John de Foix, count of Candale, was about to marry Joan, daughter of William de la Pole, duke of Suffolk, by Alice Chaucer, the "probatio nobilitatis" was sought for, though with little success, in England:—

"1, Petitur informatio lineæ De la Pole, et primo quænam fuerit mater Gl. de la Pole; 2do. Quinam fuerint ejusdem pater et mater; 3tio. Quænam fuerit uxor Thomæ Chaucer seu mater Aliacie, etc. . . . Placebit arma gentilitia familiarum Pole, Chauceri, et aliarum, quæ apponuntur in superioribus locula mentis, indicare, aut pictura eum debitis coloribus, aut scriptura, per armorum figuras et colores."

This sort of escutcheon at once placed before the eye the heraldic history of the family for four generations.

Bishops, deans, kings-at-arms, and the heads of certain corporations wear their paternal arms impaled by those of their office. No provision is made for the wife.

Single women or widows bear their arms upon a lozenge. Widows and peeresses use their husbands' supporters. Peeresses in their own right use their own. But no lady uses crest or motto.

A commoner who marries a peeress in her own right uses two shields. On the dexter are his own arms with those of his wife on a scutcheon of pretence ensigned with her coronet; on the sinister the lady's arms alone on a lozenge with supporters and coronet. If the lady be only a dowager peeress, and not an heiress, there are also two shields. On one the husband impales her arms in the ordinary way; on the other are the lady's arms, etc., as a widow, impaled by those of her first husband, with his supporters and coronet, but no crest, and the arms in a lozenge.

A baronet of England or Ireland bears a sinister hand couped gules on an inescutcheon or a canton. It is blazoned "argent, a sinister hand, couped at the wrist and appaumée, gules." Those of Nova Scotia bear argent on a shield of pretence, Scotland ensigned with a crown.

Fig. 131.

Bacon of Redgrave, the premier baronet, bears gules, on a chief argent two mullets pierced sable (fig. 131).

FIG. 132.—Seal of Richard Neville, earl of Warwick.

A knight of an order surrounds his shield, usually a cartouche, with the ribbon and motto of the order. If married he takes a second and sinister shield and thereon impales his wife's arms, the whole within a plain ribbon.

A widower marrying his second wife divides his shield tierce per pale, and places his own arms in the centre, his first wife's on the dexter, his second's on the sinister side. For a greater number there is no strict rule. A certain Sir Gervase Clifton who survived seven wives, placed himself in the centre of the shield, and his wives around him. The widow of two husbands may divide her lozenge tierce per pale, and place her first husband on the dexter side, her second in the centre, and herself in the sinister place; or she may divide the dexter half on her lozenge per fess, and place the arms of the first husband above, and those of the second below.

APPENDAGES.

These include whatever is borne outside the shield, as the crest, badge, motto, supporters, helmet, coronet, and some other additions. Strictly speaking, armorial bearings are confined to the contents of the shield; and heralds have never regarded the appendages as of the same importance.

The *Crest* was the ornament of the headpiece, and afforded protection against a blow. In early rolls of arms it is not noticed. In early seals when it appears it is rarely heraldic. Richard I. wears a sort of fan-shaped ornament, but has a lion passant gardant on the front of his helmet. Edmund Crouchback in 1296 uses distinctly a crest. Of fourteen seals of horsemen in complete armor appended to the barons' letter to the pope in 1301, three only have regular crests, although many have plumes. The three are—Thomas earl of Lancaster and Ralph earl of Gloucester, men of high rank, and Sir John St. John, a great military commander. In the 14th century they became general. In 1355 the count of Hainault presented to Edward III. "unam galeam pretiosam cum apparatu quem idem comes solebat in capite suo gestare." This was the crest of the eagle seen on the count's seal, and which the king regranted at the fords of Annan to Montagu, earl of Salisbury. Edward himself used the lion, which has continued to be the crest of the English sovereigns. Adam de Blencowe (1356–7) had a grant of arms and crest of the Greystoke bearings from William, lord of Greystoke.

Richard Beauchamp, earl of Warwick (died 1439), rests his feet upon the crests of the bear and griffin for Warwick and Montagu. His paternal crest, the swan's head out of a ducal coronet, is placed upon his helmet, beneath his head. The dragon and wyvern were common crests, and the plume of feathers is still used by Scrope and Courtenay. Ralph, Lord Neville of Raby, used the bull's head in 1353; Hastings, a bull's head in 1347. Crests were, like arms, allusive. Grey of Wilton used a "gray" or badger; Lord Welles, a bucket and chain; Botreaux, a buttress. The crest was sometimes placed on a ducal coronet, sometimes rises out of a wreath or torse of the colors of the arms. The coronet below the crest is not a mark of rank. In Carlisle cathedral is the crest of Davidson, a bird rising out of an earl's coronet. This, however, is rare; the coronet so used is generally ducal. Crests were granted and bequeathed. In Germany it is usual to bear the crests of the "seize quartiers" or some of them. This of course is inconsistent with the actual use of the crest in war. At first crests were confined to persons of rank, but they have long been included in every grant of arms. In England two or more can only legitimately be borne when the bearer has from the crown a grant of name and arms in addition to his own, as Chetwynd-Talbot, Fitz-Alan-Howard.

With the crest is usually combined some flowing drapery known as the "panache," "mantling," or *lambrequin*. This seems to have served to protect the helmet from heat and dust, and was also ornamental. It is represented in great perfection on tombs of the 15th and 16th centuries, commonly of some brilliant

FIG. 133.—Counterseal of Richard Neville, earl of Warwick.

color with a lining and tassels. The tilting helmet which supports the head of the effigy of Humphrey de Bohun (died 1267), at Gloucester, is accompanied by a grand early specimen of the lambrequin.

The *Badge* or *Cognizance* was not worn on the helmet, but displayed upon the persons of the retainers of great barons, and sometimes used to ornament the shield or seal. At the celebrated judicial combat at Coventry before Richard II. in 1398, Henry of Lancaster appeared with his housings of blue and green embroidered with swans and antelopes, his badges; and Mowbray had housings of crimson velvet, embroidered with silver lions and mulberry trees, his badges. The bear was the Beauchamp badge, derived possibly from Urso D'Abitot. They also used the ragged staff and the combination of the two.

The seal of Richard III., 1484, as lord of Glamorgan, exhibits the boar as a supporter, and the counterseal repeats it as a badge (figs. 134, 135). This seal well illustrates various heraldic points. Its blazon is per pale, baron and femme; baron, France modern and England quarterly, over all a label of three points; femme, per fess, Beauchamp, and checquy, on a chevron five pards' heads jessant fleurs-de-lys, for Newburgh combined with Cantilupe. The same arms are repeated on the shields and caparisons of the counterseal. Richard married Anne Neville, but the Neville saltire does not appear, only the arms of Beauchamp and Newburgh, both of whom were earls of Warwick.

"The rampant bear chained to the ragged staff" was inherited by the Nevilles and Dudleys, and granted about 1759 to the Grevilles as the owners of Warwick castle. Pelham used a buckle, Percy a crescent, Boucher, Bowen, Dacre, Heneage, Hungerford, Lacy, Stafford, Wake, and Harrington used the knots that bear their names. Gower designates the great nobles of his day by their badges, as is done in the following satirical lines written about 1449:—

> The rote[1] is ded, the swan[2] is goon,
> The fiery cressett[3] hath lost his lyght,
> Therefore Inglond may mak gret mone,
> Were not the helpe of God Almight.
> The castell[4] is wonne, where care begoun
> The portecolys[5] is leyde a doun;
> Yclosed we have ouro Velvette hatte[6],
> That kepyd us from money stormys brown.
> The white lion[7] is leyde to slepe,
> Thorough the envy of the ape clogge,[8]

and so on, through interminable further instances.

The Scottish clans wore native plants for their badges: Chisholm, the alder; Menzies, the ash: M'Intosh, the box, etc.

The Motto.—In times when each chief tenant under the crown brought his own tenants into the field, and led them, distinct war-cries were common. The royal cry was "St. George for England." The French cried, "Montjoye St. Denis;" the *cri de guerre* of Bauffrement was their name; that of Barr, "Au feu;" Seyton, "St. Bennet and Set on." The common Highland cry or slogan was "Claymore;" that of the Medici, "Palle, palle," alluding to their arms. The motto succeeded to this (1291); Bruce of Annandale used "Esto fortis in bello;" Courtenay, "Passez bien devant;" Hastings, "Honorantes me honorabo;" Kirkpatrick used the crest of the bloody dirk with the motto "I mak sicker." The Warren motto, alluding to the earls' resistance to the "quo warranto," was "tenebo;" Vernon, "God save the Vernon," ill exchanged for "Vernon semper viret." The Scottish borderers, who lived by harrying their neighbors by moonlight, used stars and crescents for their arms, and such mottos as "Reparabit cornua Phœbe" for Scott of Harden, or "Watch weel" of Halyburton. In modern times Sir Dudley Ryder died while his patent of peerage was under seal. It was given to his son, who adopted as a motto "Fides servata cineri."

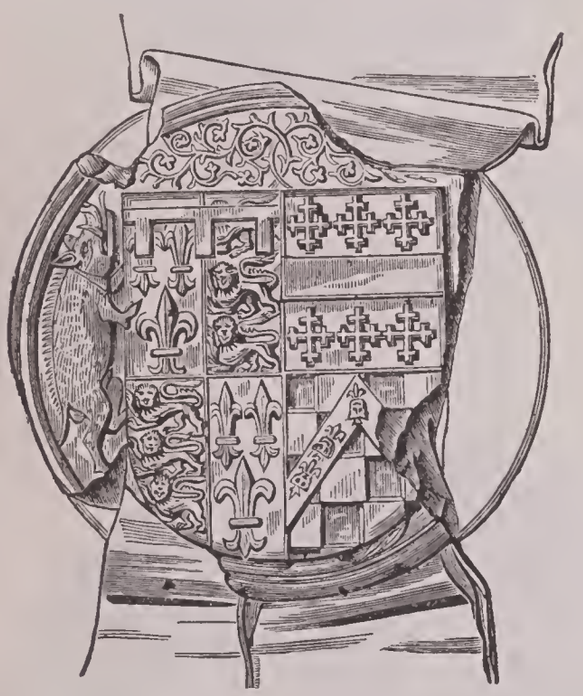


Fig. 134.—Seal of Richard III.

Fig. 135.—Counterseal of Richard III.

Supporters are now placed on either side of the shield, and are usually animals or human figures. They seem to have arisen from the ornaments introduced by the seal engraver, and became heraldic with the practice of quartering. The seal of Edmund Crouchback bears a shield flanked by two wyverns, probably ornaments. That seal (1286) and the seal of Henry of Lancaster in 1300 contain both crest and helm, lambrequin and supporters. The seal of Catherine, queen of Henry IV., has two antelopes, and her husband as prince used two swans. At Naworth the family supporters, of gigantic size, support the principals of the roof of the hall. Under the house of Tudor many families of knightly rank, as Babington, Stanhope, and Luttrel, used supporters, but at this time supporters are only granted to peers, knights of the garter, grand crosses of the bath, Nova Scotia baronets, and a few private persons who hold them by prescription. In Scotland they are used by heads of clans and by a few lowland families. Fletcher of Saltoun uses two griffins.

Another appendage is the *Eagle*, upon which some North Wales families place their shields, and the double-headed variety so used by nobles of the Holy Roman empire.

The *Livery* has long lost its early signification, and is used only for the dress of the retainers in their lord's color. At Richard III.'s coronation 8000 badges of the white boar were wrought upon liveries of fustian. A statute of Henry IV. forbade the use of liveries under heavy penalties, but they reappeared in the Wars of the Roses. Richard III. used "collars of livery," but these were for persons of rank. One remains upon a Neville effigy at Brancepeth.

[1] Duke of Bedford.
[2] Bohun, for duke of Gloucester.
[3] Duke of Exeter.
[4] Rouen.
[5] Beaufort, duke of Somerset.
[6] Cardinal Wolsey.
[7] Duke of Norfolk.
[8] Duke of Suffolk.

Crowns, Coronets, and Symbols of Rank.—The crown is the head attire of a sovereign prince. It is usually closed at the top by four arched bars called diadems, and surmounted by a globe and cross. Edward IV. is said to have first closed the English crown. That now in use is a circle of gold, jewelled, edged above with crosses patée and fleurs-de-lys alternate, and closed above with four bars and the cross and globe called in Germany the Reichsapfel (fig. 136). Since the Restoration the crown of the Princes of Wales has been surmounted by two bars, also with the Reichsapfel (fig. 137.) They also use the plume of three ostrich feathers, with the words "Ich dien," adopted by the Black Prince (fig. 138). Figs. 139 and 140 give representations of the imperial crown of Austria and the crown of the old kings of France. The Pope places three crowns over his mitre or tiara (fig. 141),

Fig. 136.—Crown of England.

Fig. 137.—Crown of the Prince of Wales.

Fig. 138.

Fig. 139.—Crown of Austria.

said to have been severally assumed in 1295, 1335, and 1411. The crown imperial of Charlemagne may be seen on a scutcheon of pretence on the arms of Hanover, as the

Fig. 140.—Crown of France (old).

Fig. 141.—The Pope's Crown.

Fig. 142.—The Sultan's Tiara.

elector's badge of arch-treasurer. The doges of Venice and Genoa bore a peculiar cap or toque, seen in Greek statuary, and upon the figures on the arch of Constantine.

The coronet is the head attire of a noble. In England those of princes of the blood are bordered with crosses patée and fleurs-de-lys under a regulation of 13 Charles II. (fig. 143). The princesses alternate the same ornaments with strawberry leaves (fig. 144).

The coronet of a duke is bordered with eight strawberry leaves (fig. 145), that of a marquis with four alternating with four pearls placed on low points (fig. 146). An earl's coronet has eight strawberry leaves alternating with eight pearls upon tall points (fig. 147). The viscount borders his coronet with an indefinite number of pearls, set close upon the rim (fig.

Fig. 143.

Fig. 144.

Fig. 145.

Fig. 146.

Fig. 147.

Fig. 148.

148). The baron's coronet, granted to the order by Charles II., carries six pearls placed on the rim at equal intervals,—four being seen at once (fig. 149). These coronets are all lined with ermine, and enriched with jewels. On occasions of state, when not worn by the peer, they are carried before him on a cushion. The eldest sons of peers above the rank of viscount wear the coronet due to their father's second title. The crowns of the kings-at-arms are of gold, bordered with and encircled by the motto "Miserere mei Domine." The ducal, as an ancient form of coronet, is often used without reference to rank, as the base for a crest. It was so used by Sir Simon de Felbrigge in 1442.

Fig. 149.

A bishop has neither crest nor coronet, but ensigns his arms with a mitre. The bishops of Durham, while palatines, placed their mitre in a ducal coronet, as—though without authority—do the archbishops (fig. 150). The Berkeley crest is a mitre. The ancient mitre was low, and of linen stiffened with vellum. The central band and the margin, embroidered with fleurs-de-lys or other patterns, were called the orphreys. The pendent side ribbons were the "infulæ." Prelates of the church of Rome ensign their shields with a hat, the tassels of which indicate their rank. A cardinal has four rows of red tassels, arranged 1, 2, 4, 8, or 15 on each side; an archbishop the same, but green. A bishop has three rows, an abbot two; the abbot's hat is black. Prelates and legates place a patriarchal cross in pale behind their shield.

Fig. 150.

The *Helmet* also indicates the rank of the wearer. It is placed above the shield, and beneath the crest. The sovereign and the royal family bear the helmet full-faced or affrontée with six bars, all of gold (fig. 151). Those of dukes and marquises are of gold with five steel bars (fig. 152). The lesser nobles have silver helmets borne in profile with gold ornaments and four silver bars. Those of baronets and knights are of steel, full-faced and open (fig. 153). An esquire's helmet is of steel, represented in profile, with the vizor closed (fig. 154). These distinctions were probably introduced after the Restoration.

The *Mantling* is a sort of cloak or mantle of fur extended behind the shield, and sufficiently ample to include the whole achievement. Those of sovereigns are of gold doubled with ermine, and are called "pavillons." Peers' mantlings are of crimson velvet, doubled with white fur and barred with ermine spots; a duke has four bars, a marquis three and a half, an earl three, a viscount two and a half, and a baron two. Commoners use red mantlings lined with white fur. The prior of St. John, whose place was on the right of the temporal barons, used a sable mantling doubled with murrey. The pavillon of France was of blue velvet, powdered with gold fleurs-de-lys, and lined with ermine. Such a mantling may be seen behind the arms of Beaumont in Rothley Temple chapel, in right of their descent from the blood-royal of France.

Fig. 151.

Fig. 152.

Fig. 153.

Fig. 154.

Certain officers of state accompanied their armorial shields with exterior marks of their rank. The Earl Marshal placed two truncheons saltirewise behind his shield, tipped above with the arms of England, and below with his own arms. His deputy places one truncheon in bend dexter.

In Scotland the Lord High Constable, the earl of Errol, places on either side of his shield an arm issuant from a cloud, and grasping a sword. Under the old monarchy the French colonels commandant placed the standards of their regiments saltirewise behind their shields.

The Lords High Admiral have been variously distinguished. Thomas de Berkeley bears on his brass a collar of tritons. Thomas, duke of Exeter, sealed with a ship and his arms on the mainsail. The anchor in some form or other was a common emblem.

Merchants' marks are scarcely heraldic, though they took the place of arms with the trading classes. They were usually monograms of the name or initials. They were protected by law as marks on goods, and are seen on merchants' tombs and sometimes in architecture.

Funeral Escutcheons.

Some of the most valuable records in the College of Arms are the certificates of funerals conducted under their superintendence and authority. These gorgeous and expensive ceremonials have happily fallen into disuse, save on very rare occasions, and for royal persons or eminent public characters. The last private funeral conducted with anything like the ancient ceremonial was that of Charles, earl of Shrewsbury, in 1828. All that is now usual is the suspension of a shield of arms in a large black lozenge-shaped frame called a hatchment or achievement against the wall of the house of the deceased. It is usually placed over the

entrance at the level of the second floor, and remains for from six to twelve months, when it is removed to the parish church. Even this custom, scarcely consistent with living in hired houses and burying in cemeteries, is falling into disuse, though still not uncommon.

If for a bachelor, the hatchment bears upon a shield his arms, crest, and other appendages, the whole on a black ground. If for a single woman her arms are represented

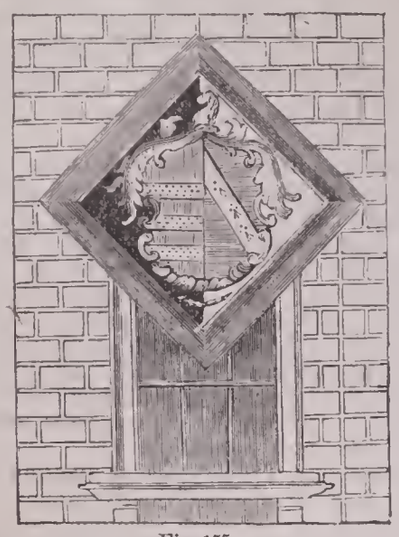


Fig. 155.

upon a lozenge, bordered with knotted ribbons, also on a black ground. If the hatchment be for a married man (as in fig. 155), his arms upon a shield impale those of his wife; or if she be an heiress they are placed upon a scutcheon of pretence, and crest and other appendages are added. The dexter half of the ground is black, the sinister white. For a wife whose husband is alive the same arrangement is used, but the sinister ground only is black. For a widower the same is used as for a married man, but the whole ground is black; for a widow the husband's arms are given with her own, but upon a lozenge, with ribbons, without crest or appendages, and the whole ground is black. When there have been two wives or two husbands the ground is divided into three parts per pale, and the division behind the arms of the survivor is white. Colors and military or naval emblems are sometimes placed behind the arms of military or naval officers. It is thus easy to discern from the hatchment the sex, condition, and quality, and possibly the name of the deceased.

In Scottish hatchments it is not unusual to place the arms of the father and mother of the deceased in the two lateral angles of the lozenge, and sometimes the 4, 8, or 16 genealogical escutcheons are ranged along the margin.

Undertakers are fond of substituting "In cœlo quies" or some such commonplace for the family motto. This is irregular.

The literature of heraldry commences with the treatises of Sassoferrato about 1358, De Fosse in the reign of Richard II., and Upton about 1441, all written in Latin and printed by Sir E. Bysshe in 1654. They are followed by the *Boke of St. Albans*, written by Dame Juliana Berners, prioress of Sopwell, and printed in 1486. These, especially those of Upton and Dame Juliana, are valuable. The lady writes in a mixture of early English and Latin, but her descriptions are intelligible and copious. These writers were followed by a crowd of others, of whom the chief were Gerard Leigh, Ferne, and Morgan, who wrote in the latter half of the 16th century. Their great aim was to elevate their subject by tracing back the use of armoiries to the patriarchs and heroes of Jewish and pagan antiquity, whom they invested with coats of arms on the type of those used by Norman barons. There are traces of this folly in Dame Juliana, but it reached its height in the writings of her successors, and was not quite extinguished when Guillim wrote his *Display of Heraldry* in 1610. Guillim, whose work is still a standard, wrote in English, but as late as 1654 and 1688 Spelman, in his *Aspilogia*, and John Gibbon strove hard to restore the use of a dead language upon a subject to which it was eminently unsuitable. In 1722 and 1780 were published the excellent volumes of Nisbet, chiefly relating to Scotland, and of Edmondson, whose list or ordinary of bearings was long very useful to those who seek to identify the

Fig. 156.—Arms of the Dukes of Marlborough.

The above figure represents the armorial achievement of the dukes of Marlborough, princes of the Holy Roman Empire and of Mindelheim in Swabia. The arms are quarterly—1 and 4, Churchill, sable, a lion rampant, and on a canton argent a cross of St. George; 2 and 3, Spencer, quarterly argent and gules, in the second and third a fret or, over all on a bend sable 3 escallops of the first; in chief, as an augmentation, upon an escutcheon of pretence argent a cross of St. George, charged with an inescutcheon azure, 3 fleurs-de-lys or; the whole contained within the garter, ensigned with a ducal coronet, and placed upon the breast of an imperial eagle. Crests—1, Churchill, a lion conchant gardant argent, supporting with his dexter paw a banner gules, thereon a dexter hand couped apaumé of the first, staff or; 2, Spencer, out of a ducal coronet or a griffin's head argent, armed or, gorged with a bar gemelle gules, between two wings expanded of the second. Between the crests the closed crown of a prince of the empire. Supporters—two wyverns argent, wings expanded. Motto—"Fiel pero desdichado."

name to which a coat belongs, until superseded by the very laborious and far more complete work of Papworth.

Recently the same critical spirit that has pervaded the works of our historians has been applied with equal diligence to the whole subject of heraldry; a number of authors, led by Planché, Boutell, Seton, Nichols, and Lower, have set aside all the fabulous pretensions and baseless assertions of the earlier writers, have sifted the old evidence and adduced much that is new. The whole subject of heraldic and quasi-heraldic seals has been brought under notice by the publication of Laing's fine plates of Scottish seals; and it may truly be said that the real origin and growth of the use of armorial bearings is placed before the reader in the books of these writers in a truthful and most attractive form. (G. T. C.)

HERAT is a city of great interest both historically and geographically, and is of even greater interest politically, its importance at the present day being indicated by its popular designation of the "key of India." Its origin is lost in antiquity. The name first appears in the list of primitive Zoroastrian settlements contained in the *Vendidád Sadé*, where, however, like most of the names in the same list,—such as *Sughdu* (Sogdia), *Mourú* (Merv or Margus), *Haraquiti* (Arachotus or Arghend-ab), *Haetumant* (Etymander or Helmand), and *Ragha* (or Argha-stán)—it seems to apply to the river or river-basin, which was the special centre of population. This name of *Haroyu*, as it is written in the *Vendidád*, or *Hariwa*, as it appears in the inscriptions of Darius, is a cognate form with the Sanskrit *Sarayu*, which signifies "a river," and its resemblance to the ethnic title of Aryan (Sans. *Arya*) is purely fortuitous; though from the circumstance of the city being named "Aria Metropolis" by the Greeks, and being also recognized as the capital of Ariana, "the country of the Arians," the two forms have been frequently confounded. Of the foundation of Herat (or Heri, as it is still often called) nothing is known. We can only infer from the colossal character of the earth-works which surround the modern town, that, like the similar remains at Bost on the Helmand and at Ulán Robát of Arachosia, they belong to that period of Central-Asian history which preceded the rise of Achæmenian power, and which in Grecian romance is illustrated by the names of Bacchus, of Hercules, and of Semiramis.

The natural advantages of Herat are mainly due to its river, which, rising in the high uplands 350 miles to the eastward, where the Koh-i-Bábá, the prolongation of the Hindú-kúsh, bifurcates into the two parallel ranges of the Sufíd-koh or "white mountains" to the north and the Siyáh-koh or "black mountains" to the south, passes in the upper part of its course through a succession of rolling downs of the finest pasture-land, and lower down traverses a more contracted valley, enlivened, however, throughout with smiling villages and orchards, till it reaches the eastern limit of the alluvial plain of Herat. Here at the present day nine large canals (in former times there were twenty) carry off the waters of the Heri-rúd for the irrigation of the circumjacent plain, which on a rough calculation may be said to contain nearly 400 square miles of land available for cultivation. M. Khanikoff, who visited Herat in 1858, observes that nowhere in the East,—not even at Samarcand or Bokhara or Ispahán, where the art of canalization is supposed to be carried to perfection,—had he seen watercourses constructed with so much skill, or maintained with so much care, as in the valley of the Heri-rúd; and he adds that, although at the period of his visit nine-tenths of the villages of the plain, which in ordinary times amount to nearly 500, were partially in ruins and the adjoining fields laid waste, the cereal produce of the remaining lands was still far in excess of the wants of the settled inhabitants. The Heri-rúd, passing between 3 and 4 miles to the south of Herat, where it is spanned by a magnificent bridge of twenty-three arches, called the *Púl-i-málán*, continues its course westward to the extremity of this rich and fertile plain; it then turns north through an arid country for some 200 miles to Sarakhs, receiving two small streams from the west, the Áb-i-Jám and Áb-i-Meshed, and forming the territorial boundary between Persia and Afghanistan. As the Heri-rúd is formed of the converging drainage of the Sufíd-koh and Siyáh-koh ranges, and its volume thus depends on the extent of snow that falls in the mountains, it is impossible to define with any exactitude the limit of its northern course; but in ordinary seasons water is rarely found in the river bed beyond Sarakhs, and never does the stream penetrate to the northward of a line uniting Abiverd and Merv; and it is of the more importance to note this geographical feature, as in many of our modern maps the line of the Heri-rúd, or Tejend, as it is called in its lower course, is prolonged through the desert 200 miles to the north-westward of Sarakhs.

The city of Herat is in 34° 22′ N. lat. and 62° 9′ E. long. It is very centrically situated, great lines of communication radiating from it in all directions—southward to Seistan (200 miles), south-eastward to Kandahar (370 miles), eastward to Cabul (550 miles), northward by Mymeneh to Bokhara (600 miles) and by Merv to Khiva (700 miles), while to the westward four routes lead into Persia by Turbat to Meshed (215 miles), and by Birjend to Kermán (400 miles), to Yezd (500 miles), or to Ispahán (600 miles). The city forms a quadrangle of nearly a mile square (more accurately about 1600 yards by 1500 yards); on the western, southern, and eastern faces the line of defence is almost straight, the only projecting points being the gateways, but on the northern face the contour is broken by a double outwork, consisting of the *Ark* or citadel, which is built of sun-dried brick on a high artificial mound within the enceinte, and a lower work at its foot, called the *Ark-i-now*, or "new citadel," which extends 100 yards beyond the line of the city wall. That which distinguishes Herat from all other Oriental cities, and at the same time constitutes its main defence, is the stupendous character of the earthwork upon which the city wall is built. This earthwork averages 250 feet in width at the base and about 50 feet in height, and as it is crowned by a wall 25 feet high and 14 feet thick at the base, supported by about 150 semi-circular towers, and is further protected by a ditch 45 feet in width and 16 in depth, it presents an appearance of imposing strength. Whether the place is really as strong as it looks has been differently estimated. General Ferrier, who resided for some time in Herat in 1846, states that the city is nothing more than an immense redoubt, and gives it as his opinion that as the line of wall is entirely without flanking defences, the place could not hold out for twenty days against a European army; and M. Khanikoff, who, though not a professional soldier, was a very acute observer, further remarks that the whole interior of the city is dominated from the rising ground at the north-east angle, while the water supply both for the ditch and the city would be at the mercy of an enemy holding the outside country, the wells and reservoirs inside the wall, which would then be alone available, being quite inadequate to the wants of the inhabitants; but on the other hand all experience testifies to the defensibility of the position. Not to speak of the sieges which Herat sustained at the hands of Jenghiz Khan, of Timur, and of Ahmed Shah, we have only to remember that in 1837 the Afghans of Herat beat off the continuous attack for nearly ten months of a Persian army of 35,000 regular troops, supported by 50 pieces of artillery, and in many cases directed and even commanded by Russian officers. The truth seems to be that Herat, though in its present state quite unfit to resist a European army, possesses great capabilities of defence, and might by a skilful adaptation of the resources of modern science be made almost impregnable. A British engineer officer, Major Sanders, calculated in 1840 that at an outlay of sixty or seventy thousand pounds, which would include the expense of deepening the ditch, clearing the glacis and esplanade, providing flanking defences and repairing the walls, etc., throughout, Herat might be rendered secure against any possible renewal of the attack by Persia; but of course if an attack by a well-appointed European army were anticipated, more extensive preparations for defence would be required, including probably the erection of two independent forts on the high ground at Mosallá and Thaleh-bengi.

The city possesses five gates, two on the northern face, the Kutab-chak near the north-east angle of the wall, and the Malik at the re-entering angle of the Ark-i-now; and three others in the centres of the remaining faces, the Irák gate on the west, the Kandahar gate on the south, and the Khushk gate on the east face. Four streets called the *Chahar-súk*, and running from the centre of each face, meet in the centre of the town in a small domed quadrangle. The principal street runs from the south or Kandahar gate to the market in front of the citadel, and is covered in with a vaulted roof through its entire length, the shops and buildings of this bazaar being much superior to those of the other streets, and the merchants' caravanserais, several of which are spacious and well built, all opening out on this great thoroughfare. Near the central quadrangle of the

city is a vast reservoir of water, the dome of which is of bold and excellent proportions. It is stated by General Ferrier to have been constructed by command of Shah Abbas, and to be a *chef d'œuvre* of its kind. It is supposed to contain above a twelve months' supply of water for the entire city, but, as M. Khanikoff observes, it is within easy mortar range of the high ground at the north-east angle of the city, and might thus be destroyed by a few well-directed shells, in which case the ruins of the dome would fill up the basin and the water supply would be lost. The only other public building of any consequence in Herat is the great mosque or *Mesjid-i-Juma*, which comprises an area of 800 yards square, and must have been a most magnificent structure. It was erected towards the close of the 15th century, during the reign of Shah Sultan Hussein of the family of Timur, and is said when perfect to have been 465 feet long by 275 feet wide, to have had 408 cupolas, 130 windows, 444 pillars, and 6 entrances, and to have been adorned in the most magnificent manner with gilding, carving, precious mosaics, and other elaborate and costly embellishments. Now, however, it is falling rapidly into ruin, the ever-changing provincial governors who administer Herat having neither the means nor the inclination to undertake the necessary repairs. Neither the palace of the Charbagh within the city wall, which was the residence of the British mission in 1840–41, nor the royal quarters in the citadel deserve any special notice. At the present day, with the exception of the *Chahar-súk*, where there is always a certain amount of traffic, and where the great diversity of race and costume imparts much liveliness to the scene, Herat presents a very melancholy and desolate appearance. The mud houses in rear of the bazaars are for the most part uninhabited and in ruins, and even the burnt brick buildings are becoming everywhere dilapidated. The city is besides one of the filthiest in the East, as there are no means of drainage or sewerage, and garbage of every description lies in heaps in the open streets.

With regard to the population, it fluctuates so rapidly, according to the circumstances of the period, that it is impossible to give any estimate of its normal strength. When Christie visited the city in 1809 it was in a very prosperous condition, having been undisturbed for fifty years, and was supposed to contain 100,000 inhabitants. A. Conolly in 1828 reduced the numbers to 45,000. Before the Persian siege in 1837 the population was estimated at 70,000, but at the close of the war 6000 or 7000 were all that remained. In 1845, at the time of General Ferrier's visit, the numbers had increased again to 22,000, and continued to increase to the time of the capture of the place by Dost Mahomed Khan in 1863, when there were at least 50,000 inhabitants within the walls. Since that time Herat has been a mere provincial city governed from Cabul, and its average population has ranged between 20,000 and 30,000, within which limits must be confined its present estimate. Present pop. 40,000.

The maximum population of which the enceinte would seem to be capable may be put at Christie's estimate of 100,000, and it is manifest therefore that when Herat contained a population of a million and a half, as is testified by so many contemporary authorities, the present city could have been only the citadel of this vast metropolis, the great mass of buildings lying along the slopes of the northern hills, where for a space of some 4 miles in length by 3 miles in breadth the surface of the plain, strewed over its whole extent with pieces of pottery and crumbling bricks, is also broken here and there by earthen mounds and ruined walls, the debris of palatial structures which at one time were the glory and wonder of the East. Of these structures indeed some have survived to the present day in a sufficiently perfect state to bear witness to the grandeur and beauty of the old architecture of Herat. The mosque of the Mosellá, for instance, originally built in the 12th century, but restored or rather rebuilt at the end of the 15th century, and intended for the reception of the body of the Imam Reza which Shah Sultan Hussein wished to remove from Meshed to Herat, is, even in its present state of ruin and decay, one of the most imposing and elegant structures to be seen in Asia. "The mosque," says General Ferrier, "is completely covered with a mosaic of glazed bricks in varied and beautiful patterns, and the cupola is of amazing dimensions. Several arcades supported by pillars in brick equal the proportions of the arch of Ctesiphon, and the seven magnificent minarets that surround it may be said to be intact, for the upper part of them only is slightly injured." Scarcely inferior in beauty of design and execution, though of more moderate dimensions, is the tomb of the saint Abdullah Ansári, in the same neighborhood. This building, which was erected by Shah Rokh Mirza, the grandson of Timur, nearly 500 years ago, contains some exquisite specimens of sculpture in the best style of Oriental art. Adjoining the tomb also are numerous marble mausoleums, the sepulchres of princes of the house of Timur; and especially deserving of notice is a royal building tastefully decorated by an Italian artist named Geraldi, who was in the service of Shah Abbas the Great. The locality, which is further enlivened by gardens and running streams, is named *Gazir-gáh*, and is a favorite resort of the Herátis. It is held indeed in high veneration by all classes, and the famous Dost Mahomed Khan is himself buried at the foot of the tomb of the saint. Two other royal palaces named respectively *Bagh-i-Shah* and *Takht-i-Sefer*, are situated on the same rising ground somewhat further to the west. The buildings are now in ruins, but the view from the pavilions, shaded by splendid plane trees on the terraced gardens formed on the slope of the mountain, is said to be very beautiful.

The population of Herat and the neighborhood is of a very mixed character. The original inhabitants of Ariana were no doubt of the Aryan family, and immediately cognate with the Persian race, but they were probably intermixed at a very early period with the Sacæ and Massagetæ, who seem to have held the mountains from Cabul to Herat from the first dawn of history, and to whom must be ascribed—rather than to an infusion of Turco-Tartaric blood introduced by the armies of Jenghiz and Timur—the peculiar broad features and flattish countenance which distinguish the inhabitants of Herat, Seistan, and the eastern provinces of Persia from their countrymen further to the west. Under the government of Herat, however, there are a very large number of tribes, ruled over by separate and semi-independent chiefs, and belonging probably to different nationalities. The principal group of tribes is called the *Chahar-Aimák*, or "four races," the constituent parts of which, however, are variously stated by different authorities both as to strength and nomenclature. Mountstuart Elphinstone, by far the best general authority on Afghan questions, gives the original four tribes as the Taimenís, the Hazárehs, the Taimúrís, and Zúrís; Khanikoff, on the other hand, whose forte was ethnography, and who made his inquiries on the spot, describes the *Chahar-Aimák* as the Kipchaks (100,000 families), the Jamshídís (12,000), the Taimenís (60,000), and the Firoz-kohis (10,000 to 12,000); while Pottinger substitutes the Sooní Hazárchs of Kilchnow for the Kipchaks of Khanikoff, and raises the Firoz-kohi Aimáks to 30,000 families. These tribes all dwell in the mountains to the north-east, the east, and the south-east of Herat, and number in the aggregate perhaps a million souls. Major Taylor, who made special inquiries on the subject in 1856, found that the governor of Herat could raise for fighting purposes from these tribes and the allied Turcomans of Merv 47,000 horse and 23,000 foot, but matters have very much changed since Herat came under the government of Cabul in 1863, the recent policy being to lower the fighting force of the semi-independent chiefs, and to substitute infantry regiments raised and paid by the central authority. At present there are perhaps ten such regiments, which can be supplemented by about 10,000 horse and 10,000 irregular foot.

The trade of Herat is also subject to great fluctuation. From its central geographical position it must naturally be an emporium of commerce between Persia, Turkestan, Afghanistan, and India, while owing to the richness of the valley, which can usually furnish supplies for 150,000 men over and above the consumption of the fixed inhabitants, as well as to the mineral wealth of the adjoining mountains and the industrial activity of the city population, especially in regard to silk and woollen manufactures (the carpets of Herat being famous throughout the East), the country rapidly recovers from the effects of war, and its normal condition may be said to be that of prosperity and abundance.

In actual territory Herat extends east and west from near the sources of the Heri-rúd about 300 miles to the Persian frontier beyond Ghorián, and north and south from the Merv boundary, in about 36° lat., 200 miles to the northern limit of Seistan. The inhabitants of the city of Herat are for the most part Shiahs, and in regard to language and habits, as well as religion, are Persians rather than Afghans. There are, however, both in the town and in the neighboring villages a certain number of Afghan colonists, who have been settled there—the greater part by Nadir Shah—during the last 150 years, as well as Hazárchs, Jamshídís, and Taimenís, with a fair sprinkling of Hindus and some forty families of Jews. The net revenue of the valley and its immediate dependencies in ordinary times is under £100,000 per annum, but the vizier Yar Mahomed Khan is supposed in the plenitude of his power, and when he had for a time brought a great part of Seistan under his sway, to have realized double that amount from the entire province.

To trace in any detail the fortunes of Herat would be to write the modern history of the East, for there has hardly been a dynastic revolution, or a foreign invasion, or a great civil war in Central Asia since the time of the Prophet, in which Herat has not played a conspicuous part and suffered accordingly. Under the Tahirides of Khorassan, the Soffarians of Seistan, and the

Samanides of Bokhara, it flourished for some centuries in peace and progressive prosperity; but during the succeeding rule of the Ghaznevide kings its metropolitan character was for a time obscured by the celebrity of the neighboring capital of Ghazni, until finally in the reign of Sultan Sanjar of Merv about 1157 the city was entirely destroyed by an irruption of the Ghoz, the predecessors, in race as well as in habitat, of the modern Turcomans. Herat gradually recovered under the enlightened Ghoride kings, who were indeed natives of the province, though they preferred to hold their court amid their ancestral fortresses in the mountains of Ghor, so that at the time of Jenghiz Khan's invasion it equalled or even exceeded in populousness and wealth its sister capitals of Balkh, Merv, and Nishapoor, the united strength of the four cities being estimated at three millions of inhabitants. But this Moghul visitation was most calamitous; forty persons, indeed, are stated to have alone survived the general massacre of 1232, and as a similar catastrophe overtook the city at the hands of Timur in 1398, when the local dynasty of Kurt which had succeeded the Ghorides in eastern Khorassan was put an end to, it is astonishing to find that early in the 15th century Herat was again flourishing and populous, and the favored seat of the art and literature of the East. It was indeed under the princes of the house of Timur that most of the noble buildings were erected, of which the remains still excite our admiration at Herat, while all the great historical works relative to Asia, such as the *Rozet-es-Sefá*, the *Habíb-es-seir*, *Hafiz Abrú's Tarikh*, the *Matlá'a-es-Sa'adin*, etc., date from the same place and the same age. Four times was Herat sacked by Turcomans and Uzbegs during the centuries which intervened between the Timuride princes and the rise of the Afghan power, and it has never in modern times attained to anything like its old importance. Afghan tribes, who had originally dwelt far to the east, were first settled at Herat by Nadir Shah, and from that time they have monopolized the government and formed the dominant element in the population. It will be needless to trace the revolutions and counter-revolutions which have followed each other in quick succession at Herat since Ahmed Shah Durâni founded the Afghan monarchy about the middle of the last century. Let it suffice to say that Herat has been throughout the seat of an Afghan government, sometimes in subordination to Cabul and sometimes independent. Persia indeed for many years showed a strong disposition to reassert the supremacy over Herat which was exercised by the Suffavean kings, but Great Britain, disapproving of the advance of Persia towards the Indian frontier, steadily resisted the encroachment; and, indeed, after helping the Herátis to beat off the attack of the Persian army in 1838, the British at length compelled the shah in 1857 at the close of his war with them to sign a treaty recognizing the future independence of the place, and pledging Persia against any further interference with the Afghans. In 1863 Herat, which for fifty years previously had been independent of Cabul, was incorporated by Dost Mahomed Khan in the Afghan monarchy, and such is the present condition of the principality, the actual Governor Ayúb Khan being the uterine brother and deputy of Yacúb Khan, who recently signed with the Government of India the famous treaty of Gandamak. (H. C. R.)

HÉRAULT, a department in the south of France, formed from parts of the old province of Languedoc, is bounded on the N. E. by Gard, N. W. by Aveyron and Tarn, and S. by Aude and the Gulf of Lyons. It has an area of 2444 square miles, and is situated between 43° 10′ and 44° N. lat., 2° 30′ and 4° 10′ E. long. Its greatest length is 84 miles, and its greatest breadth 50. About a third of the department consists of moorland, heath, and common, a fourth of arable land, a sixth of vineyards, and an eighth of wood. The southern prolongation of the Cevennes mountains forms the north boundary of the department. The highest point is about 4250 feet above the sea-level. The ridge forms the watershed between the waters of the Atlantic and the Mediterranean, and from it there flow the Vidourle, Mosson, Hérault, Livron, and Orb. Of these the Hérault, 80 miles long, is the chief, and gives name to the department. The Vidourle forms the boundary between the department and that of Gard. The high mountains of the north are partly barren, partly wooded. In the extensive plains of the centre the vine and olive flourish, and figs, mulberries, and other fruit-trees are to be met with nearly in all parts. Grain is chiefly produced in the south. The soil of the north is chalky clay, of the centre light gravel, and of the south a strong rich loam. The "garrigues" are considerable portions of waste land, covered with heath and shrubs. St. Loup, Couques, and St. Thibéry, the first of which is 750 feet high, are extinct volcanic cones. The greater part of the south coast consists of a series of salt marshes, separated from the sea by a narrow strip of land. The marsh of Thau, the largest, stretches from the mouth of the Hérault, and communicates, through the marsh of Frontignan, with that of Mauguio, on the eastern frontier of the department. The Canal du Midi, after stretching about 30 miles into the department, terminates at Agde. From Cette the navigation is kept up through the marshes by the canals of Agde and Radelle to Aigues Mortes. The coast line of the department is 66 miles long. In the valleys and at the foot of the mountains the climate is delightfully mild. Fish abound in the salt marshes. The vegetable productions comprise aromatic and dyeing plants; the ilex oak prevails in the forests. The mineral wealth of the department is considerable. Mines of lignite, coal, iron, copper, and lead are wrought. It produces magnificent blocks of marble, also alabaster, gypsum, granite, sandstone, potters' clay, alum; and the marshes supply France with salt. At Gabian there is a petroleum well. Wine and oil constitute the chief agricultural wealth of the department. The red wines of St. Georges, St. Drézéry, St. Christol, and the white wines of Frontignan and Lunel, are held in high estimation. Considerable quantities of wheat, oats, and potatoes are grown. There is a large amount of excellent pasturage, and horses and sheep are extensively reared. Mulberries, pomegranates, figs, raisins and other dried fruits, and olives are prepared for exportation. The chief manufactures are woollen and cotton cloth, silk, perfumery, soap, and chemical substances. The department has Montpellier for its capital, and is divided into the arrondissements of Montpellier, Béziers, Lodève, and St. Pons, with 36 cantons and 331 communes. The population was 429,878 in 1872, and 489,421 in 1901.

HERBARIUM, or HORTUS SICCUS, a collection of plants so dried and preserved as fully to illustrate their several specific characters. Since the same plant, owing to peculiarities of climate, soil, and situation, degree of exposure to light, and other influences, may vary greatly according to the locality in which it occurs, it is only by gathering together for comparison and study a large series of examples of each species illustrative of the flora of different regions that the laws of vegetable morphology, and many more points of scientific interest, can be satisfactorily determined. Thus, from the herbarium may be acquired a knowledge of those details concerning the minuter structure of individual plants which are of necessity omitted in works of systematic botany, as also of the relative taxonomic importance of the characters to be met with in large groups of forms.

Commencing with British herbaria, the collection of the Royal Herbarium at Kew, generally acknowledged to be at once the most extensive and the best preserved and most orderly in the world, comprises some 100,000 species, many of them represented by numerous specimens. It is arranged, for easy reference, in cases situate between the windows of the building containing it, the atmosphere of which is kept dry by means of hot-water pipes. In the intervening spaces are tables for the purpose of study, which is further facilitated by the presence in the same building of a large and valuable botanical library. Next in importance is the herbarium of the British Museum, which comprises assemblages of specimens gathered by numerous eminent botanists. The collection of Dillenius is deposited at Oxford, and that of the late Professor Harvey at Trinity College, Dublin. The original herbarium of Linnæus is in the possession of the Linnean Society of London. With the more important British herbaria are to be ranked also those of Cambridge and Edinburgh. The collections of Jussieu and St. Hilaire are included in the large herbarium of the Jardin des Plantes at Paris, and in the same city is the extensive private collection of Dr. Cosson. At Geneva are three large collections,—De Candolle's, containing the typical specimens of the *Prodromus*, Delessert's fine series, and Boissier's Mediterranean and Oriental plants. The university of Göttingen has had bequeathed to it the largest collection (exceeding 40,000 specimens) ever made by a single individual—that of the late Professor Grisebach. At the herbarium in Brussels are the specimens obtained by the traveller Martius, the majority of which formed the groundwork of his *Flora Brasiliensis*. Other national herbaria sufficiently extensive to subserve the requirements of the systematic botanist exist at Berlin, St. Petersburg, Vienna, Leyden, Stockholm, Upsala, Copenhagen, and Florence. Of those in the United States of America, the chief, formed by Asa Gray, is the property of Harvard university; others are to be seen at Yale and Columbia colleges and at New York and Michi-

gan universities. The Herbarium at Melbourne, Australia, under Baron Müller, has attained large proportions; and that of the Botanical Garden of Calcutta is noteworthy as the repository of numerous specimens described by writers on Indian botany.

Specimens of flowering plants and vascular cryptogams are, at Kew, generally mounted on sheets of stout smooth paper, of uniform quality, and in most cases 17 inches long by 11 inches broad; the palms and their allies, however, and some ferns, require a size of 22 by 14 inches. The tough but flexible coarse gray paper (German *Fliesspapier*), upon which on the Continent specimens are commonly fixed by gummed strips of the same, is less hygroscopic than ordinary cartridge paper, but has the disadvantage of affording harborage in the inequalities of its surface to a minute insect, *Atropos pulsatoria*, L., which commits great havoc in damp specimens, and which, even if noticed, cannot be dislodged without difficulty. The majority of plant specimens are most suitably fastened on paper by a mixture of equal parts of gum tragacanth and gum arabic made into a thick paste with water. Rigid leathery leaves are affixed by means of glue, or, if they present too smooth a surface, by stitching at their edges. Where, as in private herbaria, the specimens are not liable to be handled with great frequency, a stitch here and there round the stem, tied at the back of the sheet, or slips of paper passed over the stem through two slits in the sheet and attached with gum to its back, or simply strips of gummed paper laid across the stem, may be resorted to. A new adhesive substance, a kind of fish glue, has lately come into use for this purpose, and is highly spoken of. To preserve from insects, the plants, after mounting, are brushed over with a liquid formed by the solution of ¼ ℔ each of corrosive sublimate and carbolic acid in 1 gallon of methylated spirits. They are then laid out to dry on shelves made of a network of stout galvanized iron wire. After this are written, usually in the right-hand corner of the sheet, or on a label there affixed, the designation of each species, the date and place of gathering, and the name of the collector. Information as to economical or medicinal properties may either be added thereto, or mentioned on the back of the sheet. It is especially important to attach to the name of the plant the initials or abbreviated name of the author by whom it was first described; *e. g.*, the words *Ulva lactuca* alone, might signify either of two distinct plants, the one described by Linnæus, the other by Agardh. When the generic name has been altered, but the specific name has been retained, the name of the original describer of the plant is placed in brackets before the name of the later author. Thus the *Enteromorpha Grevillei* of Thuret, having been renamed, has become *Ulva Grevillei* (Thur.), Le Jolis. The value of specimens in private herbaria is greatly enhanced by briefly stating on the lower left-hand corner of the sheet the characters that distinguish it from the plants most nearly resembling it. Other particulars as to habit, local abundance, soil, and claim to be indigenous may be written on the back of the sheet, or on a slip of writing paper attached to its edge. It is convenient to place in a small envelope gummed to an upper corner of the sheet any flowers, seeds or leaves needed for dissection or microscopical examination, especially where from the fixation of the specimen it is impossible to examine the leaves for oil-receptacles, and where seed is apt to escape from ripe capsules and be lost. The addition of a careful dissection of a flower greatly increases the value of the specimen. To ensure that all shall lie evenly in the herbarium the plants should be made to occupy as far as possible alternately the right and left sides of their respective sheets. The species of each genus are then arranged either systematically or alphabetically in separate covers of stout, usually light brown paper, or, if the genus be large, in several covers with the name of the genus clearly indicated in the lower left-hand corner of each, and opposite it the names or reference numbers of the species. Undetermined species are relegated to the end of the genus. Thus prepared, the specimens are placed on shelves or movable trays, at intervals of about 6 inches, in an air-tight cupboard, on the inner side of the door of which, as a special protection against insects, is suspended a muslin bag containing a piece of camphor.

The systematic arrangement varies in different herbaria. The works usually followed are—for dicotyledons, De Candolle's *Prodromus*, and Endlicher's or Bentham and Hooker's *Genera Plantarum;* for monocotyledons, Kunth's *Enumeratio;* for ferns, Hooker and Baker's *Synopsis Filicum;* for mosses, Müller's *Synopsis Muscorum Frondosorum;* for algæ, Kützing's *Phycologia generalis;* for hepaticæ, Gottschie, Lindenberg, and Nees ab Esenbeck's *Synopsis Hepaticarum;* and for other groups of cryptogamic plants the treatises of various authors scattered through numerous scientific publications. In certain herbaria, as in those of Boissier and Delessert at Geneva, the authority of the *Prodromus* is accepted only in the absence of any more recent treatise, or of a complete monograph on a family. For the members of large genera, *e. g.*, *Piper* and *Ficus*, since the number of cosmopolitan or very widely distributed species is comparatively few, a geographical grouping is found specially convenient by those who are constantly receiving parcels of plants from known foreign sources. The ordinary systematic arrangement possesses the great advantage, in the case of large genera, of readily indicating the affinities of any particular specimen with the forms most nearly allied to it in type. In the United States the species in the genera, and the genera in the orders, are usually arranged alphabetically, and the orders serially; sometimes, however, the genera are placed alphabetically throughout without reference to the orders. The alphabetical arrangement, provided works on systematic botany are referred to for the identification of particular plants, possesses the advantage of permitting ready reference to any given species, and also of being independent of changes of classification; but in Europe it is rarely adopted, on account of the counterbalancing practical inconveniences it is considered to present. Instead of keeping a catalogue of the species contained in the herbarium, which, owing to the constant additions, would be almost impossible, such species are usually ticked off with a pencil in the systematic work which is followed in arranging them, so that by reference to this work it is possible to see at a glance whether the specimen sought is in the herbarium, and what species are still wanted. The custom commonly prevalent in Continental, especially German, herbaria of placing the dried specimens loosely between sheets of papers not always of uniform character is liable to lead to the admixture of nearly allied forms in intricate genera, such as *Rubus*, *Rosa*, *Hieracium*, *Salix*, etc., unless a label is attached to each specimen, a precaution not always adopted. In Germany Endlicher's system is much followed for flowering plants, with the exception of palms, for which Martius's arrangement is preferred. At Geneva De Candolle's original herbarium is arranged in exact accordance with his *Prodromus*. In the other large herbaria in that city, the mounting and arrangement of the specimens are conducted much as in England, with the exception that smaller-sized sheets of paper are used for cryptogams.

Specimens intended for the herbarium should be collected when possible in dry weather, care being taken to select plants or portions of plants in sufficient number and of a size adequate to illustrate all the characteristic features of the species. When the root-leaves and roots present any peculiarities, they should invariably be collected, but the roots should be dried separately in an oven at a moderate heat. Roots and fruits too bulky to be placed on the sheets of the herbarium may be conveniently arranged in glass-covered boxes contained in drawers. The best and most effective mode of drying specimens is learned only by experience, different species requiring special treatment according to their several peculiarities. The chief points to be attended to are to have a plentiful supply of botanical drying paper, so as to be able to use about six sheets for each specimen; to change the paper at intervals of six to twelve hours; to avoid contact of one leaf or flower with another; and to increase the pressure applied only in proportion to the dryness of the specimen. To preserve the color of flowers pledgets of cotton wool, which prevent bruising, should be introduced between them, as also, if the stamens are thick and succulent, as in *Digitalis*, between these and the corolla. A flower dissected and gummed on the sheets will often retain the color which it is impossible to preserve in a crowded inflorescence. Before placing in a screw-press, should that be used, a flat sheet of lead or some other suitable weight should be laid upon the top of the pile of specimens, so as to keep up a continuous pressure. Succulent specimens, as many of the *Orchidaceæ*, and sedums and various other Crassulaceous plants, require to be killed by immersion in boiling water before being placed in drying paper, or, instead of becoming dry, they will grow between the sheets. When, as with some plants like *Verbascum*,

the thick hard stems are liable to cause the leaves to wrinkle in drying by removing the pressure from them, small pieces of bibulous paper or cotton wool may be placed upon the leaves near their point of attachment to the stem. When a number of specimens have to be submitted to pressure, ventilation is secured by means of frames corresponding in size to the drying paper, and composed of strips of wood or wires laid across each other, so as to form a kind of network. Another mode of drying is to keep the specimens in a box of dry sand in a warm place for ten or twelve hours, and then press them in drying paper. A third method consists in placing the specimens within bibulous paper, and enclosing the whole between two plates of coarsely perforated zinc supported in a wooden frame. The zinc plates are then drawn close together by means of straps, and suspended before a fire until the drying is effected. By the last two methods the color of the flowers may be well preserved. When the leaves are finely divided, as in *Conium*, much trouble will be experienced in lifting a half-dried specimen from one paper to another; but the plant may be placed in a sheet of thin blotting paper, and the sheet containing the plant, instead of the plant itself, can then be moved. Thin straw-colored paper, such as is used for biscuit bags, may be conveniently employed by travellers unable to carry a quantity of bibulous paper. It offers the advantage of fitting closely to thick-stemmed specimens, and of rapidly drying. A light but strong portfolio, to which pressure by means of straps can be applied, and a few quires of this paper, if the paper be changed night and morning, will be usually sufficient to dry all except very succulent plants. When a specimen is too large for one sheet, and it is necessary, in order to show its habit, etc., to dry the whole of it, it may be divided into two or three portions, and each placed on a separate sheet for drying. Specimens may be judged to be dry when they no longer cause a cold sensation when applied to the cheek, or assume a rigidity not evident in the earlier stages of preparation.

Each class of flowerless or cryptogamic plants requires special treatment for the herbarium.

Marine algæ are usually mounted on tough smooth white cartridge paper in the following manner. Growing specimens of good color and in fruit are if possible selected, and cleansed as much as practicable from adhering foreign particles, either in the sea or a rocky pool. Some species rapidly change color, and cause the decay of any others with which they come in contact. This is especially the case with the *Ectocarpi*, *Desmarestiæ*, and a few others, which should therefore be brought home in a separate vessel. In mounting, the specimen is floated out in a flat white dish containing sea-water, so that foreign matter may be detected, and a piece of paper of suitable size is placed under it, supported either by the fingers of the left hand or by a palette. It is then pruned, in order clearly to show the mode of branching, and is spread out as naturally as possible with the right hand. For this purpose a bone knitting-needle answers well for the coarse species, and a camel's-hair pencil for the more delicate ones. The paper with the specimen is then carefully removed from the water by sliding it over the edge of the dish so as to drain it as much as possible. If during this process part of the fronds run together, the beauty of the specimen may be restored by dipping the edge into water, so as to float out the part and allow it to subside naturally on the paper. The paper, with the specimen upwards, is then laid on bibulous paper for a few minutes to absorb as much as possible of the superfluous moisture. When freed from excess of water it is laid on a sheet of thick white blotting-paper, and a piece of smooth washed calico is placed upon it (unwashed calico, on account of its "facing," adheres to the sea-weed). Another sheet of blotting-paper is then laid over it; and, a number of similar specimens being formed into a pile, the whole is submitted to pressure, the paper being changed every hour or two at first. The pressure is increased, and the papers are changed less frequently as the specimens become dry, which usually takes place in thirty-six hours. Some species, especially those of a thick or leathery texture, contract so much in drying that without strong pressure the edges of the paper become puckered. Other species of a gelatinous nature, like *Nemaleon* and *Dudresnaia*, may be allowed to dry on the paper, and need not be submitted to pressure until they no longer present a gelatinous appearance. Large coarse algæ, such, for instance, as the *Fucaceæ* and *Laminariæ*, do not readily adhere to paper, and require soaking for some time in fresh water before being pressed. The less robust species, such as *Sphacelaria scoparia*, which do not adhere well to paper, may be made to do so by brushing them over either with milk carefully skimmed, or with a liquid formed by placing isinglass (½ oz.) and water (1½ oz.) in a wide-mouthed bottle, and the bottle in a small glue-pot or sauce-pan containing cold water, heating until solution is effected, and then adding 1 oz. of rectified spirits of wine; the whole is next stirred together, and when cold is kept in a stoppered bottle. For use, the mixture is warmed to render it fluid, and applied by means of a camel's-hair brush to the under side of the specimen, which is then laid neatly on paper. For the more delicate species, such as the *Callithamnia* and *Ectocarpi*, it is an excellent plan to place a small fruiting fragment, carefully floated out in water, on a slip of mica of the size of an ordinary microscopical slide, and allow it to dry. The plant can then be at any time examined under the microscope without injuring the mounted specimen. Many of the fresh-water algæ which form a mere crust, such as *Palmella cruenta*, may be placed in a vessel of water, where after a time they float like a scum, the earthy matter settling down to the bottom, and may then be mounted by slipping a piece of mica under them and allowing it to dry. *Oscillatoriæ* may be mounted by laying a portion on a silver coin placed on a piece of paper in a plate, and pouring in water until the edge of the coin is just covered. The alga by its own peculiar movement will soon form a radiating circle, perfectly free from dirt, around the coin, which may then be removed. There is considerable difficulty in removing mounted specimens of algæ from paper, and therefore a small portion preserved on mica should accompany each specimen, enclosed for safety in a small envelope fastened at one corner of the sheet of paper. Filamentous diatoms may be mounted like ordinary seaweeds, and, as well as all parasitic algæ, should whenever possible be allowed to remain attached to a portion of the alga on which they grow, some species being almost always found parasitical on particular plants. Ordinary diatoms and desmids may be mounted on mica, as above described, by putting a portion in a vessel of water and exposing it to sunlight, when they rise to the surface, and may be thus removed comparatively free from dirt or impurity. Owing to their want of adhesiveness, they are, however, usually mounted on glass as microscopic slides, either in glycerin jelly, Canada balsam, or some other suitable medium.

Lichens are generally mounted on sheets of paper of the ordinary size, several specimens from different localities being laid upon one sheet, each specimen having been first placed on a small square of paper which is gummed on the sheet, and which has the locality, date, name of collector, etc., written upon it. This mode has some disadvantages attending it: such sheets are difficult to handle; the crustaceous species are liable to have their surfaces rubbed; the foliaceous species become so compressed as to lose their characteristic appearance; and the spaces between the sheets caused by the thickness of the specimen permit the entrance of dust. A plan which has been found to answer well is to arrange them in cardboard boxes, either with glass tops or in sliding covers, in drawers—the name being placed outside each box, and the specimens gummed into the boxes. Lichens for the herbarium should, whenever possible, be sought for on a slaty or laminated rock, so as to procure them on flat thin pieces of the same, suitable for mounting. Specimens on the bark of trees require pressure until the bark is dry, lest they become curled; and those growing on sand or friable soil, such as *Coniocybe furfuracea*, should be laid carefully on a layer of gum in the box in which they are intended to be kept. Many lichens, such as the *Verrucariæ* and *Collemaceæ*, are found in the best condition during the winter months. In mounting collemas it is advisable to let the specimen become dry and hard, and then to separate a portion from adherent mosses, earth, etc., and mount it separately so as to show the branching of the thallus. *Pertusariæ* should be represented by both fruiting and sorediate specimens.

The larger species of fungi, such as the *Agaricini* and *Polyporei*, etc., are prepared for the herbarium by cutting a slice out of the centre of the plant so as to show the outline of the pileus, the attachment of the gills, and the character of the interior of the stem. The remaining two halves of the pileus are then lightly pressed, as well as the central slices, between bibulous paper until dry, and the whole is then "poisoned," and gummed on a sheet of paper in such a manner as to show the under surface of the one and the upper surface of the other half of the pileus on the same sheet. As it is impossible to preserve the natural colors of fungi, the specimens should, whenever possible, be accompanied by a colored drawing of the plant. Microscopic fungi are usually preserved in envelopes, or simply attached to sheets of paper, or mounted as microscopic slides. Those fungi which are of a dusty nature, like the *Myxomycetes*, may, like the lichens, be preserved in small boxes, and arranged in drawers. Fungi under any circumstances form the least satisfactory portion of an herbarium.

Mosses when growing in tufts should be gathered just before the capsules have become brown, divided into small flat portions, and pressed lightly in drying paper. During this process the capsules ripen, and are thus obtained in a perfect state. They are then preserved in envelopes attached to a sheet of paper of the ordinary size, a single perfect specimen being washed, and spread out near the envelope so as to show the habit of the plant. For attaching it to the paper a strong mucilage of gum tragacanth, containing an eighth of its weight of spirit of wine, answers best. If not preserved in an envelope the calyptra and operculum are very apt to fall off and become lost. Scale-mosses are mounted in the same way, or may be floated out in water like sea-weeds, and dried in white blotting paper under strong pressure before gumming on paper, but are best mounted as microscopic slides, care being taken to show

the stipules. The specimens should be collected when the capsules are just appearing above or in the colesule or calyx; if kept in a damp saucer they soon arrive at maturity, and can then be mounted in better condition, the fruit-stalks being too fragile to bear carriage in a botanical tin case without injury.

Of the *Characeæ* many are so exceedingly brittle that it is best to float them out like sea-weeds, except the prickly species, which may be carefully laid out on bibulous paper, and when dry fastened on sheets of white paper by means of gummed strips. Care should be taken in collecting charæ to secure, in the case of diœcious species, specimens of both forms, and also to get when possible the roots of those species on which the small granular starchy bodies or gemmæ are found, as in *C. fragifera*. Portions of the fructification may be preserved in small envelopes attached to the sheets.

See Bentham, *Proc. Linn. Soc. Lond.*, 1869–70, p. xlvi.; Johann Nave, *Handy Book to the Collection and Preparation of Freshwater and Marine Algæ*, etc., Lond.; G. Rainann, *Das Herbarium*, Berlin; and Lasègue's *Musée botanique de M. Benjamin Delessert*, Paris, 1845. (E. M. H.)

HERBART, Johann Friedrich (1776–1841), was born of cultured parents at Oldenburg in 1776. He showed his bent towards philosophy while still a child, and after studying under Fichte at Jena gave his first philosophical lectures at Göttingen in 1805, whence he removed in 1809 to occupy the chair formerly held by Kant at Königsberg. Here he also established and conducted a seminary of pædagogy till 1833, when he returned once more to Göttingen, and remained there as professor of philosophy till his death in 1841. His works were collected and published in twelve volumes by his disciple Hartenstein (Leipsic, 1850–52).

Philosophy, according to Herbart, begins with reflection upon our empirical conceptions, and consists in the reformation and elaboration of these,—its three primary divisions being determined by as many distinct forms of elaboration. Logic, which stands first, has to render our conceptions and the judgments and reasonings arising from them clear and distinct. But some conceptions are such that the more distinct they are made the more contradictory their elements become; so to change and supplement these as to make them at length thinkable is the problem of the second part of philosophy, or Metaphysics. There is still a class of conceptions requiring more than a logical treatment, but differing from the last in not involving latent contradictions, and in being independent of the reality of their objects, the conceptions, viz., that embody our judgments of approval and disapproval; the philosophic treatment of these conceptions falls to Æsthetic.

In Herbart's writings logic receives comparatively meagre notice; he insisted strongly on its purely formal character, and expressed himself in the main at one with Kantians such as Fries and Krug.

As a metaphysician he starts from what he terms "the higher scepticism" of the Hume-Kantian sphere of thought, the beginnings of which he discerns in Locke's perplexity about the idea of substance. By this scepticism the real validity of even the *forms* of experience is called in question on account of the contradictions they are found to involve. And yet that these forms are "given" to us, as truly as sensations are, follows beyond doubt when we consider that we are as little able to control the one as the other. To attempt at this stage a psychological inquiry into the origin of these conceptions would be doubly a mistake; for we should have to use these unlegitimated conceptions in the course of it, and the task of clearing up their contradictions would still remain, whether we succeeded in our inquiry or not. But how are we to set about this task? We have given to us a conception A uniting among its constituent marks two that prove to be contradictory, say M and N; and we can neither deny the unity nor reject one of the contradictory members. For to do either is forbidden by experience; and yet to do nothing is forbidden by logic. We are thus driven to the assumption that the conception is contradictory because incomplete; but how are we to supplement it? What we have must point the way to what we want, or our procedure will be arbitrary. Experience asserts that M is the same (*i. e.*, a mark of the same concept) as N, while logic denies it; and so—it being impossible for one and the same M to sustain these contradictory positions—there is but one way open to us; we must posit *several* Ms. But even now we cannot say one of these Ms is the same as N, another is not; for every M must be both thinkable and valid. We may, however, take the Ms not singly but together; and again, no other course being open to us, this is what we must do; we must assume that N results from a combination of Ms. This is Herbart's method of relations, the counterpart in his system of the Hegelian dialectic.

In the *Ontology* this method is employed to determine what in reality corresponds to the empirical conceptions of substance and cause, or rather of inherence and change. But first we must analyze this notion of reality itself, to which our scepticism had already led us, for, though we could doubt whether "the given" is what it appears, we cannot doubt that it is something; the conception of the real thus consists of the two conceptions of being and quality. That which we are compelled to "posit," which cannot be sublated, is that which *is*, and in the recognition of this lies the simple conception of being. But when is a thing thus posited? When it is posited as we are wont to posit the things we see and taste and handle. If we were without sensations, *i. e.*, were never bound against our will to endure the persistence of a presentation, we should never know what being is. Keeping fast hold of this idea of absolute position, Herbart leads us next to the quality of the real. (1) This must exclude everything negative; for non-A sublates instead of positing, and is not absolute, but relative to A. (2) The real must be absolutely simple; for if it contain two determinations, A and B, then either these are reducible to one, which is the true quality, or they are not, when each is conditioned by the other and their position is no longer absolute. (3) All quantitative conceptions are excluded, for quantity implies parts, and these are incompatible with simplicity. (4) But there may be a plurality of "reals," albeit the mere conception of being can tell us nothing as to this. The doctrine here developed is the first cardinal point of Herbart's system, and has obtained for it the name of "pluralistic realism."

The contradictions he finds in the common-sense conception of inherence, or of "a thing with several attributes," will now become obvious. Let us take some thing, say A, having n attributes, $a, b, c \ldots$: we are forced to posit each of these because each is presented in intuition. But in conceiving A we make, not n positions, still less $n+1$ positions, but one position simply; for common sense removes the absolute position from its original source, sensation. So when we ask, What is the one posited? we are told—the possessor of $a, b, c \ldots$, or in other words, their seat or substance. But if so, then A, as a real, being simple, must $= a$; similarly it must $= b$; and so on. Now this would be possible if $a, b, c \ldots$ were but "contingent aspects" of A, as *e.g.*, 2^3, $\sqrt{64}$, $4+3+1$ are contingent aspects of 8. Such, of course, is not the case, and so we have as many contradictions as there are attributes; for we must say A is a, is not a, is b, is not b, etc. There must then, according to the method of relations, be several As. For a let us assume $A_1 + A_1 + A_1 \ldots$; for b, $A_2 + A_2 + A_2 \ldots$; and so on for the rest. But now what relation can there be among these several As, which will restore to us the unity of our original A or substance? There is but one; we must assume that the first A of every series is identical, just as the centre is the same point in every radius. By way of concrete illustration Herbart instances "the common observation that the properties of things exist only under external conditions. Bodies, we say, are colored, but color is nothing without light, and nothing without eyes. They sound, but only in a vibrating medium, and for healthy ears. Color and tone present the appearance of inherence, but on looking closer we find they are not really immanent in things but rather presuppose a communion among several." The result then is briefly thus.—In place of the one absolute position, which in some unthinkable way the common understanding substitutes for the absolute positions of the n attributes, we have really a series of two or more positions for each attribute, every series, however, beginning with the same (as it were, central) real (hence the unity of substance in a group of attributes), but each being continued by different reals (hence the plurality and difference of attributes in unity of substance). Where there is the appearance of inherence, therefore, there is always a plurality of reals; no such correlative to substance as attribute or accident can be admitted at all. Substantiality is impossible without causality, and to this as its true correlative we now turn.

The common-sense conception of change involves at bottom the same contradiction of opposing qualities in one real. The same A that was $a, b, c \ldots$ becomes $a, b, d \ldots$; and this, which experience thrusts upon us, proves on reflection unthinkable. The metaphysical supplementing is also fundamentally as before. Since c depended on a series of reals $A_3 + A_3 + A_3 \ldots$ in connection with A, and d may be said similarly to depend on a series $A_4 + A_4 + A_4 \ldots$, then the change from c to d means, not that the central real A or any real has changed, but that A is now in connection with A_4, etc., and no longer in connection with A_3, etc.

But to think a number of reals "in connection" (*Zusammensein*) will not suffice as an explanation of phenomena; something or other must happen when they are in connection; what is it? The answer to this question is the second hinge-point of Herbart's theoretical philosophy. What "actually happens" as distinct from all that seems to happen, when two reals A and B are together is that, assuming them to differ in quality, they tend to disturb each other to the extent of that difference, at the same time that each preserves itself intact by resisting, as it were, the other's disturbance. And so, by coming into connection with different reals the "self-preservations" of A will vary accordingly, A remaining the same through all; just as, by way of illustration, hydrogen remains the same in water

and in ammonia, or as the same line may be now a normal and now a tangent. But to indicate this opposition in the qualities of the reals A + B, we must substitute for these symbols others, which, though only "contingent aspects" of A and B, *i. e.*, representing their relations, not themselves, yet like similar devices in mathematics enable thought to advance. Thus we may put $A = \alpha + \beta - \gamma$, $B = m + n + \gamma$; γ then represents the character of the self-preservations in this case, and $\alpha + \beta + m + n$ represents all that could be observed by a spectator who did not know the simple qualities, but was himself involved in the relations of A to B; and such is exactly our position.

Having thus determined what really is and what actually happens, our philosopher proceeds next to explain synthetically the objective semblance (*der objective Schein*) that results from those. But if this construction is to be truly objective, *i. e.*, valid for all intelligences, ontology must furnish us with a clue. This we have in the forms of Space, Time, and Motion which are involved whenever we think the reals as being in, or coming into, connection, and the opposite. These forms then cannot be merely the products of our psychological mechanism, though they may turn out to coincide with these. Meanwhile let us call them "intelligible," as being valid for all who comprehend the real and actual by thought, although no such forms are predicable of the real and actual themselves. The elementary spatial relation Herbart conceives to be "the contiguity (*Aneinander*) of two points," so that every "pure and independent line" is discrete. But an investigation of dependent lines which are often incommensurable forces us to adopt the contradictory fiction of partially overlapping, *i. e.*, divisible points, or in other words, the conception of Continuity.[1] But the contradiction here is one we cannot eliminate by the method of relations, because it does not involve anything real; and in fact as a necessary outcome of an "intelligible" form, the fiction of continuity is valid for the "objective semblance," and no more to be discarded than say $\sqrt{-1}$. By its help we are enabled to comprehend what actually happens among reals to produce the appearance of matter. When three or more reals are together, each disturbance and self-preservation will (in general) be imperfect, *i. e.*, of less intensity than when only two reals are together. But "objective semblance" corresponds with reality; the spatial or external relations of the reals in this case must, therefore, tally with their inner or actual states. Had the self-preservations been perfect, the coincidence in space would have been complete, and the group of reals would have been inextended; or had the several reals been simply contiguous, *i. e.*, without connection, then, as nothing would actually have happened, nothing would appear. As it is we shall find a continuous molecule manifesting attractive and repulsive forces; attraction corresponding to the tendency of the self-preservations to become perfect, repulsion to the frustration of this. Motion, even more evidently than space, implicates the contradictory conception of continuity, and cannot, therefore, be a real predicate, though valid as an intelligible form and necessary to the comprehension of the objective semblance. For we have to think of the reals as absolutely independent and yet as entering into connections. This we can only do by conceiving them as originally moving through intelligible space in rectilinear paths and with uniform velocities. For such motion no cause need be supposed; motion, in fact, is no more a state of the moving real than rest is, both alike being but relations, with which, therefore, the real has no concern. The changes in this motion, however, for which we *should* require a cause, would be the objective semblance of the self-preservations that actually occur when reals meet. Further, by means of such motion these actual occurrences, which are in themselves timeless, fall for an observer in a definite time—a time which becomes continuous through the partial coincidence of events.

But in all this it has been assumed that we are spectators of the objective semblance; it remains to make good this assumption, or, in other words, to show the possibility of knowledge; this is the problem of what Herbart terms Eidolology, and forms the transition from metaphysic to psychology. Here, again, a contradictory conception blocks the way, that, viz., of the Ego as the identity of knowing and being, and as such the stronghold of idealism. The contradiction becomes more evident when the ego is defined to be a subject (and so a real) that is its own object. As real and not merely formal, this conception of the ego is amenable to the method of relations. The solution this method furnishes is summarily that there are several objects which mutually modify each other, and so constitute that ego we take for the presented real. But to explain this modification is the business of psychology; it is enough now to see that the subject like all reals is necessarily unknown, and that, therefore, the idealist's theory of knowledge is unsound. But though the simple quality of the subject or soul is beyond knowledge, we know what actually happens when it is in connection with other's reals, for its self-preservations then are what we call sensations. And these sensations are the sole material of our knowledge; but they are not given to us as a chaos but in definite groups and series, whence we come to know the relations of those reals, which, though themselves unknown, our sensations compel us to posit absolutely.

In his *Psychology* Horbart rejects altogether the doctrine of mental faculties as one refuted by his metaphysics, and tries to show that all psychical phenomena whatever result from the action and interaction of elementary ideas or presentations (*Vorstellungen*). The soul being one and simple, its separate acts of self-preservation or primary presentations must be simple too, and its several presentations must become united together. And this they can do at once and completely when, as is the case, for example, with the several attributes of an object, they are not of opposite quality. But otherwise there ensues a conflict in which the opposed presentations comport themselves like forces and mutually suppress or obscure each other. The act of presentation (*Vorstellen*) then becomes partly transformed into an effort, and its product, the idea, becomes in the same proportion less and less intense till a position of equilibrium is reached; and then at length the remainders coalesce. We have thus a statics and a mechanics of mind which investigate respectively the conditions of equilibrium and of movement among presentations. In the statics two magnitudes have to be determined:—(1) the amount of the suppression or inhibition (*Hemmungssumme*), and (2) the ratio in which this is shared among the opposing presentations. The first must obviously be as small as possible: thus for two totally-opposed presentations a and b, of which a is the greater, the *inhibendum* $= b$. For a given degree of opposition this burden will be shared between the conflicting presentations in the inverse ratio of their strength. When its remainder after inhibition $= 0$, a presentation is said to be on the threshold of consciousness, for on a small diminution of the inhibition the "effort" will become actual presentation in the same proportion. Such total exclusion from consciousness is, however, manifestly impossible with only two presentations,[2] though with three or a greater number the residual value of one may even be negative. The first and simplest law in psychological mechanics relates to the "sinking" of inhibited presentations. As the presentations yield to the pressure, the pressure itself diminishes, so that the velocity of sinking decreases, *i. e.*, we have the equation $(S - \sigma)\, dt = d\sigma$, where S is the total *inhibendum*, and σ the intensity actually inhibited after the time t. Hence $t = \log \frac{S}{S - \sigma}$, and $\sigma = S\,(1 - e^{-t})$. From this law it follows, for example, that equilibrium is never quite obtained for those presentations which continue above the threshold of consciousness, while the rest which cannot so continue are very speedily driven beyond the threshold. More important is the law according to which a presentation freed from inhibition and rising anew into consciousness tends to raise the other presentations with which it is combined. Suppose two presentations p and π united by the residua r and ρ; then the amount of p's "help" to π is r, the portion of which appropriated by π is given by the ratio $\rho : \pi$; and thus the initial help is $\frac{r\rho}{\pi}$.

But after a time t, when a portion of ρ represented by ω has been actually brought into consciousness, the help afforded in the next instant will be found by the equation

$$\frac{r\rho}{\pi} \cdot \frac{\rho - \omega}{\rho}\, dt = d\omega,$$

from which by integration we have the value of ω,

$$\omega = \rho\left(1 - e^{-\frac{rt}{\pi}}\right).$$

So that if there are several πs connected with p by smaller and smaller parts, there will be a definite "serial" order in which they will be revived by p; and on this fact Herbart rests all the phenomena of the so-called faculty of memory, the development of spatial and temporal forms, and much besides. Emotions and volitions, he holds, are not directly self-preservations of the soul, as our presentations are, but variable states of such presentations resulting from their interaction when above the threshold of consciousness. Thus when some presentations tend to force a presentation into consciousness, and others at the same time tend to drive it out, that presentation is the seat of painful feeling; when, on the other hand, its entrance is favored by all, pleasure results. Desires are presentations struggling into consciousness against hindrances, and when accompanied by the supposition of success become volitions. Transcendental freedom of will in Kant's sense is an impossibility. Self-consciousness is the result of an interaction essentially the same in kind as that which takes place

[1] Hence Herbart gives the name Synechology to this branch of metaphysics, instead of the usual one, Cosmology.

[2] Thus, taking the case above supposed, the share of the inhibendum falling to the smaller presentation b is the fourth term of the proportion $a + b : a :: b : \frac{ab}{a+b}$; and so b's remainder is $b - \frac{ab}{a+b} = \frac{b^2}{a+b}$, which only $= 0$ when $a = \infty$.

when a comparatively simple presentation finds the field of consciousness occupied by a long-formed and well-consolidated "mass" of presentations—as, *e. g.*, one's business or garden, the theatre, etc., which promptly inhibit the isolated presentation if incongruent, and unite it to themselves if not. What we call Self is, above all, such a central mass, and Herbart seeks to show with great ingenuity and detail how this position is occupied at first chiefly by the body, then by the seat of ideas and desires, and finally by that first-personal Self which recollects the past and resolves concerning the future. But at any stage the actual constituents of this "complexion" are variable; the concrete presentation of Self is never twice the same. And, therefore, finding on reflection any particular concrete factor contingent, we abstract the position from that which occupies it, and so reach the speculative notion of the pure Ego.

Æsthetics elaborates the "ideas" involved in the expression of taste called forth by those relations of object which acquire for them the attribution of beauty or the reverse. The beautiful (καλόν) is to be carefully distinguished from the allied conceptions of the useful and the pleasant, which vary with time, place, and person; whereas beauty is predicated absolutely and involuntarily by all who have attained the right standpoint. Ethics, which is but one branch of æsthetics, although the chief, deals with such relations among volitions (*Willensverhältnisse*) as thus unconditionally please or displease. These relations Herbart finds to be reducible to five, which do not admit of further simplification; and corresponding to them are as many moral ideas (*Musterbegriffe*), viz.:—(1) *Internal Freedom*, the underlying relation being that of the individual's will to his judgment of it; (2) *Perfection*, the relation being that of his several volitions to each other in respect of intensity, variety, and concentration; (3) *Benevolence*, the relation being that between his own will and the thought of another's; (4) *Right*, in case of actual conflict with another; and (5) *Retribution* or *Equity*, for intended good or evil done. The ideas of a final society, a system of rewards and punishments, a system of administration, a system of culture, and a "unanimated society," corresponding to the ideas of law, equity, benevolence, perfection, and internal freedom respectively, result when we take account of a number of individuals. Virtue is the perfect conformity of the will with the moral ideas; of this the single virtues are but special expressions. The conception of duty arises from the existence of hindrances to the attainment of virtue. A general scheme of principles of conduct is possible, but the subsumption of special cases under these must remain matter of tact. The application of ethics to things as they are with a view to the realization of the moral ideas is moral technology (*Tugendlehre*), of which the chief divisions are Pædagogy and Politics.

In *Theology* Herbart held the argument from design to be as valid for divine activity as for human, and to justify the belief in a supersensible real, concerning which, however, exact knowledge is neither attainable nor on practical grounds desirable.

Among the post-Kantian philosophers Herbart doubtless ranks next to Hegel in importance, and this without taking into account his very great contributions to the science of education. His disciples speak of theirs as the "exact philosophy," and the term well expresses their master's chief excellence and the character of the chief influence he has exerted upon succeeding thinkers of his own and other schools. His criticisms are worth more than his constructions; indeed for exactness and penetration of thought he is quite on a level with Hume and Kant. His merits in this respect, however, can only be appraised by the study of his works at first hand. But we are most of all indebted to Herbart for the enormous advance psychology has been enabled to make, thanks to his fruitful treatment of it, albeit as yet but few among the many who have appropriated and improved his materials have ventured to adopt his metaphysical and mathematical foundations. (J. W.*)

HERBELOT, Barthélemy d' (1625–1695), Orientalist, was born December 4, 1625, at Paris. As soon as he had completed the ordinary course in classics and philosophy at the university of his native city he devoted himself to the study of the Oriental languages, and went to Italy to perfect himself in them by converse with the Orientals who frequented its seaports. There he made the acquaintance of his fellow-savants Lucas Holstenius and Leo Allatius, and attracted the favorable notice of the cardinals Grimaldi and Bamberini. On his return to France after a year and a half, he was received into the house of Fouquet, superintendent of finance, who gave him a pension of 1500 livres. Losing this on the disgrace of Fouquet in 1661, he was appointed secretary and interpreter of Eastern languages to the king. A few years later he again visited Italy, when the grand-duke Ferdinand II. of Tuscany presented him with a large number of valuable Oriental MSS., and tried to attach him to his court. Herbelot, however was recalled to France by Colbert, and received from the king a pension equal to the one he had lost. In 1692 he succeeded D'Auvergne in the chair of Syriac, in the Collége de France. He died at Paris, December 8, 1695. His great work is the *Bibliothèque Orientale, ou dictionnaire universel contenant tout ce qui fait connaître les peuples de l'Orient*, which occupied him nearly all his life, and was published in 1697 by Galland. It is based on the immense Arabic dictionary of Hajji Khalfa, of which indeed it is largely an abridged translation, but it also contains the substance of a vast number of other Arabic and Turkish compilations and manuscripts. With all his learning, the author seems to have been deficient in critical sagacity, and there is consequently a want of minute accuracy in many of its details, and of harmony between its various parts. It is, however, even yet, the one available source for much information to others than Oriental scholars, and as such it retains its importance.

The *Bibliothèque* has been reprinted at Maestricht (fol. 1776), and at the Hague (4 vols. 4to, 1777–99). The latter edition is enriched with the contributions of Schultens, Reiske, and others. Herbelot's other works, none of which have been published, comprise an *Oriental Anthology*, and an *Arabic, Persian, Turkish, and Latin Dictionary*.

HERBERT, George (1593–1633), one of the best of English religious poets, was born near the town of Montgomery on the 3d of April, 1593. He was a brother of Lord Herbert of Cherbury, noticed below. Educated privately till the age of twelve, he was then sent to Westminster School, and in 1608 he became a student at Trinity College, Cambridge, where he was made B. A. in 1611, M. A. and major fellow of the college in 1615, and orator for the university in 1619. In his capacity as orator he was several times brought into contact with King James. About the same time also he appeared as the champion of Anglicanism against Andrew Melville, the famous Scotch Presbyterian. He numbered among his friends Dr. Donne, Sir Henry Wotton, Izaak Walton, Bishop Andrewes, and Francis Bacon, who consulted Herbert about several of his works, and dedicated to him his translation of the Psalms. During his youth he was a courtier, dancing attendance on King James, and "enjoying his genteel humor for clothes;" and the king rewarded his attentions by the gift of a sinecure worth £120 a year. The death of his patrons the duke of Richmond, the marquis of Hamilton, and King James, approaching ill-health, and the influence of his mother finally induced him, not without a struggle, to take holy orders. In July, 1626, he was appointed prebendary of Layton Ecclesia, in the county of Huntingdon. Shortly before his induction (1630) to the parsonage of Bemerton, near Salisbury, he married Miss Jane Danvers after three days' acquaintance. Mr. Danvers had been set on the marriage for a long time, and had often spoken of his daughter Jane to Herbert, and "so much commended Mr. Herbert to her that Jane became so much a Platonic as to fall in love with Mr. Herbert unseen." The story of the poet's life at Bemerton, as told by Walton, is one of the most exquisite pictures in literary biography. He devoted much time to explaining the meaning of the various parts of the Prayer-Book, and held services twice every day, at which many of the parishioners attended, and some "let their plough rest when Mr. Herbert's saints-bell rung to praise, that they might also offer their devotions to God with him." Next to Christianity itself he loved the English Church. He was passionately fond of music, and usually went twice a week to attend the cathedral service at Salisbury. Walton illustrates Herbert's kindness to the poor by many touching anecdotes. He had not been three years in Bemerton when he succumbed to ill-health. He died in 1633.

Herbert's works are—*The Temple* (1631); a few miscellaneous poems; a collection of proverbs entitled *Jacula Prudentum* (1640); and *The Country Parson*, which did not appear till 1652. *The Temple* is a collection of religious poems marked by unity of sentiment and inspiration. The chief faults of the book are obscurity, verbal conceits, and a forced ingenuity which shows itself in grotesque puns, odd metres, and occasional want of taste. In spite of these drawbacks, the quaint beauty of Herbert's style and his genuine poetical feeling give *The Temple* a high place in literature. The following poems are the gems of the collection:—"The Church Porch," "The Agony," "Sin," "Sunday," "Virtue," "Man," "The British Church,"

"The Quip," "The Collar," "The Pulley," "The Flower," "Aaron," and "The Elixir." The finest of all is his poem on "Man," which is Miltonic in its sublimity of conception, and shows how poets, in their loftier moods, often anticipate the discoveries of science and the most far-reaching speculations of philosophy. Herbert and Keble are the poets of Anglican theology. No book is fuller of devotion to the Church of England than *The Temple*. No poem in our language exhibits more of the spirit of true Christianity. Every page is marked by transparent sincerity, and reflects the beautiful character of "holy George Herbert."

Among recent editions of Herbert's works the following may be mentioned:—*Works in Prose and Verse*, with life by Izaak Walton, and notes by S. T. Coleridge, 1846; Gilfillan's edition, in his "Library of the British Poets," 1853; Willmott's edition, 1854; Professor Nichol's edition, 1863; and the Aldine edition by the Rev. Dr. A. B. Grosart. For further information consult Walton's *Life*, and *England's Antiphon*, by George Macdonald, 1871.

HERBERT, Henry William (1807–1858), novelist and writer on sports, son of the Hon. and Rev. William Herbert, dean of Manchester, a son of the first earl of Carnarvon, was born in London, April 7, 1807. He was educated at Eton and at Caius College, Cambridge, where he graduated M. A. in 1828. Having become involved in debt he emigrated to America, and from 1831 to 1839 was teacher of Greek in a private school in New York. In 1833 he commenced the *American Monthly Magazine*, which he edited till 1835. In 1834 he published his first novel, *The Brothers, a Tale of the Fronde*, which was followed by a number of others, all of them obtaining a certain degree of popularity. He was also successful in a series of historical studies, such as *The Cavaliers of England, The Knights of England, France, and Scotland, The Chevaliers of France*, and *The Captains of the Old World*, and wrote numerous contributions to magazines; but he is best known for his works on sporting, published by him under the pseudonym of Frank Forester. These include *The Field Sports of the United States and British Provinces* (1849), *Frank Forester and his Friends* (1849), *The Fish and Fishing of the United States* (1850), *The Young Sportsman's Complete Manual*, and *The Horse and Horsemanship in the United States and British Provinces of North America* (1858). Herbert was a man of varied accomplishments, but of somewhat dissipated habits. He died by his own hand at New York, May 17, 1858.

HERBERT Sir Thomas (1606–1682), traveller and author, was born at York in 1606. Several of his ancestors were aldermen and merchants in that city, and they could trace their connection with the great Herbert family represented by the earl of Pembroke. His grandfather Alderman Herbert, who died in 1614, left him real estate of considerable value. He went to Oxford in 1621 and became a commoner of Jesus College, but afterwards removed to Cambridge at the invitation of his mother's brother, Dr. Ambrose Akroyd. Having gone to London, he was introduced to the earl of Pembroke, through whose influence he obtained an appointment in the suite of Sir Dodmore Cotton, who was about to leave as ambassador for Persia in company with Sir Robert Shirley. Sailing in March, 1627, they visited the Cape, Madagascar, Goa, and Surat, having landed at Gombroon, they travelled inland to Asharoff, and thence to Cazbeen, where both the chiefs of the expedition died. Herbert reached England again in 1629, and in 1630, to his great disappointment, his patron the earl of Pembroke died suddenly. After this he travelled on the Continent for more than a year. From his return in 1631 till about two years after his marriage in 1638 he retained his ambition for court favor, but failing in this he retired, probably to his estate of Tintern in Monmouthshire, till the outbreak of the civil war, when he sided with the parliament. In 1646 he was appointed to attend the king with his other servants. Becoming a devoted royalist, he continued with his majesty during the last two eventful years of his life, and at the Restoration he was rewarded with the title of baronet (1660). He resided at Westminster till the great plague, when he returned to York and bought Petergate House, where he died on the 1st March, 1682.

It was in 1634 that Herbert first published his *Description of the Persian Monarchy now beinge The Orientall Indyes, Iles and other parts of the Greater Asia and Africk*. Four years later a new and enlarged edition appeared under the title of *Some Yeares Travels into Africa and Asia the Great*; a third edition followed in 1664, and a fourth in 1677. The work is evidently the production of a man of considerable scholarship and activity of mind, and altogether ranks as one of the best records of 17th century travel. It is illustrated with woodcuts, among which the sketch of the dodo, the specimen of the cuneiform inscriptions, and the view of Persepolis deserve to be mentioned. Herbert's *Threnodia Carolina, or Memoirs of the two last years of the reign of that unparalleld prince of ever blessed memory King Charles I.*, was in great part printed at the author's request in Wood's *Athenæ Oxonienses*, but it did not appear in its entirety till Dr. Charles Goodall published his Collection of Tracts in 1702. A reprint was issued by G. and W. Nicol in 1813. Sir William Dugdale is understood to have received assistance from Herbert in preparing the fourth volume of the *Monasticon Anglicanum*; and Mr. Drake has printed in the appendix to his *Eboracum* two papers from Herbert's pen on the church of St. John at Beverly and the collegiate church of Ripon. The best account of Sir Thomas Herbert is that by Robert Davies, F. S. A., York, which appeared in *The Yorkshire Archæological and Topographical Journal*, part iii., pp. 182–214 (1870). It contains a facsimile of the long inscription on Herbert's tomb.

HERBERT Lord, of Cherbury (1582–1648) Edward Herbert, Lord Herbert of Cherbury, soldier, diplomatist, historian, and religious philosopher, was born at Eyton in Shropshire in 1582, and was descended from an ancient line of illustrious soldiers, to which the earls of Pembroke belonged. Sent to Oxford in his twelfth year, he married an heiress, his kinswoman, in his fifteenth, and returned to the university to prosecute his "beloved studies." He was knighted soon after the accession of James I., and for a year or two fulfilled the functions of sheriff of his county. In 1608 he went abroad, at Paris gaining the esteem and love of the old Constable de Montmorency, and beginning an acquaintance with scholars like Casaubon, Gassendi, and Grotius. Next year he served as a volunteer in the Low Countries under the prince of Orange, whose intimate friend he became, and also took part in the campaigns of 1614 and 1615. Between the latter campaigns he visited Italy, and on his return was arrested in France for recruiting Huguenots for the service of the duke of Savoy. In 1618 he was sent as ambassador extraordinary to the court of France, and, though recalled for a few months through the hostility of the French king's favorite, he soon returned to Paris as ordinary ambassador. In 1625 he came back to England, where, with the exception of one or more short visits to Paris, he spent the rest of his life. Created Lord Herbert of Castle Island in 1625, he was raised by Charles I. to the English peerage in 1631 as Baron Herbert of Cherbury. In the civil war he sided at first with the court, and subsequently declared for the parliament, but the part he played was not a prominent one. His castle of Montgomery was, however, destroyed during the war, and he received an indemnity for his loss from the parliament. He died 20th August, 1648.

"It is impossible to draw his picture well who hath several countenances," Herbert says of Henry VIII., Horace Walpole made a bold attempt to sketch Herbert's character by declaring that in his case "the history of Don Quixote was the life of Plato." To his contemporaries Herbert was mainly known as a high-spirited man of the world, of great knightly and courtier-like accomplishments, who, though stiff and stately, was on the smallest actual provocation ready and able to defend his honor with his sword. He maintained the character of ambassador with dignity, but his diplomacy was not attended by much success. It is as author that Herbert is chiefly remembered. And though in 1633 the *De Veritate* received the official imprimatur of the bishop of London's chaplain, on the strength of the same work the writer was soon after held up to abhorrence as an atheist. As a resolute opponent of empiricism in philosophy, he is unquestionably entitled to rank as one of the heralds of the philosophy of Reid and the Scottish metaphysicians. In the theological sphere he is justly claimed as the father of English deism, and doubtless exercised a strong influence on the religious thought of England. His views were not so novel as he thought them to be, but he was an original and very independent thinker; and, as his chief work was published but a few years after the *Novum Organum*, and many years before any of the works of Descartes or Hobbes, Herbert deserves a marked place in the van of modern speculation.

Herbert's first and most important work is the *De Veritate prout distinguitur a Revelatione, a Verisimili, a Possibili, et a*

Falso (Paris, 1624; translated into French, but never into English). It combines a theory of knowledge with a partial psychology, a methodology for the investigation of truth, and a scheme of natural religion. The author's method is prolix and often far from clear; the book is no compact system, but it contains the skeleton and much of the soul of a complete philosophy. Giving up all past philosophizings as useless, Herbert professedly endeavors to constitute a new and true system. Truth, which he defines as a just confirmation of the faoulties with one another and with their objects, he distributed into four classes or stages:—(1) truth in the thing or the truth of the object; (2) truth of the appearanoe; (3) truth of the apprehension (*conceptus*); (4) truth of the intellect. The faculties of the mind are as numerous as the differences of their objects, and are accordingly innumerable: but they may be arranged in four groups. The first and fundamental and most certain group is the *Natural Instinct*, to which belong the κοιναὶ, ἔννοιαι, the *Notitiæ Communes*, which are the "received prinoiples of demonstration," existing in every sane and sound man, against which it is *nefas* to dispute. The second group, the next in certainty, is the *Sensus Internus* (under which head Herbert discusses amongst others love, hate, fear, conscience with its *communis notitia*, and free will); the third is the *Sensus Externus;* and the fourth is *Discursus*, reasoning, to which, as being the least certain, we have recourse when the other faculties fail. The ratiocinative faoulties proceed by division and analysis, by questioning, and are slow and gradual in their movement; they take aid from the other faculties, those of the *instinctus naturalis* being always the final test. Herbert's categories or questions to be used in investigation are ten in number,—whether (a thing is), what, of what sort, how much, in what relation, how, when, where, whence, wherefore. No faculty, rightly used, can err "even in dreams," badly exercised, reasoning becomes the source of almost all our errors. The discussion of the *notitiæ communes* is the most characteristio part of the book. The exposition of them, though highly dogmatic, is at times strikingly Kantian in substance. "So far are these elements or sacred principles from being derived from experience or observation that without some of them, or at least some one of them, we can neither experience nor even observe." Unless we felt driven by them to explore the nature of things, "it would never occur to us to distinguish one thing from another." It cannot be said that Herbert proves the existence of the common notions; he does not deduce them or even give any list of them. But each faculty has its common notion; and they may be distinguished by six marks, their *priority, independence, universality, certainty, necessity* (for the well-being of man), and *immediacy*. Law is based on certain *common notions;* so is religion. Though Herbert expressly defines the scope of his book as dealing with the intellect, not faith, it is the common notions of religion he has illustrated most fully; and it is plain that it is in this part of his system that he is chiefly interested. The common notions of religion are the famous five articles, whioh became the charter of the English deists:—(1) that there is a supreme god; (2) that he ought to be worshipped; (3) that virtue and piety form the chief part of that worship; (4) that sins should be repented of; (5) that there are rewards and punishments in another life. To these doctrines, which constitute the faith of the true catholic and orthodox church, it is not easy to add anything that can make men more virtuous or godly. There is little polemic against the received form of Christianity, but Herbert's attitude towards the church's doctrine is distinctly negative, though he admits the possibility, under certain conditions, of specific and supernatural revelation. In the *De Religione Gentilium* (Lond., 1645) ho gives what may be called, in Hume's words, "a natural history of religion." By examining the heathen religions Herbort finds, to his great delight, that under all their absurdities the five great articles were recognized. The heathen, yearning for the supreme God, saw Him in His works and worshipped Him in the most glorious of His creatures, the heavenly bodies. It was crafty priests who insisted on the necessity of multifarious rites and ceremonies, and developed full-fledged polytheism. The same vein is maintained in the tracts *De Causis Errorum* and *De Religione Laici*. Herbert's first historical work is the *Expeditio Buckinghami Ducis* (1656), an account of Buckingham's ill-fated expedition in 1627. *The Life and Raigne of King Henry VIII.* (1649), in pithy English, is called by Walpole "a masterpiece of historio biography," but is ill-proportioned and is digested into annals. It abounds in picturesque but prolix accounts of sieges and pageants at home and abroad; the sketch of the Reformation history is so dispassionate as to suggest a lack of keen sympathy with either party. Henry's character is very leniently judged. *The Life of Herbert by Himself* (first published by Horace Walpole in 1764) gives a vivacious and interesting account of his early life down to the return from his embassy, dwelling mainly, with something of an old man's garrulity and a famous man's vanity, on the romantic and ohivalrous incidents in his career. Herbert's poems, Latin and English, are of small value.

There are sketches of Herbert in Leland's *Deistical Writers*, Lechler's *Geschichte des Englischen Deismus*, and elsewhere; but the only adequate work is M. Charles de Rémusat's *Lord Herbert de Cherbury, sa Vie et ses Œuvres* (Paris, 1874).

HERCULANEUM. The ruins of the buried city of Herculaneum are situated about two-thirds of a mile from the Portici station of the railway from Naples to Pompeii. They are less frequently visited than the ruins of the latter city, not only because they are smaller in extent and of less obvious interest, but also because they are more difficult of access. The history of their discovery and exploration, and the artistic and literary relics which they have yielded, are worthy, however, of particular notice. The small part of the city which has been restored to the light of day in the spot called *Gli scavi nuovi* (the new excavations) was discovered in the present century. But the more important works were executed in the last century; and of the buildings then explored at a great depth, by means of tunnels, none are visible except the theatre, the orchestra of which lies 85 feet below the surface of the soil.

The brief notices of the classical writers inform us that Herculaneum[1] was a small city of Campania between Neapolis and Pompeii, that it was situated between two streams at the foot of Vesuvius on a hill overlooking the sea, and that its harbor was at all seasons safe. With regard to its earlier history nothing is known. The account given by Dionysius repeats a tradition which was most natural for a city bearing the name of Hercules. Strabo follows up the topographical data with a few brief historical statements—Ὅσκοι εἶχον καὶ ταύτην καὶ τὴν ἐφεξῆς Πομπηίαν . . . εἶτα Τυῤῥηνοὶ καὶ Πελασγοί, μετὰ ταῦτα Σαννῖται. But leaving the questions suggested by these names, such as that of the domination of the Etruscans in Campania,[2] as well as the other questions recently discussed in regard to the origin of Pompeii, which might have an intimate relation with our subject, it is sufficient here to say that the first historical record about Herculaneum has been handed down by Livy (viii. 25), where he relates in what manner the city fell under the power of Rome during the Samnite wars. It remained faithful to Rome for a long time, but it joined the Italian allies in the Social War. Having submitted anew in June of the year 665 (88 B. C.), it appears to have been less severely treated than Pompeii, and to have escaped the imposition of a colony of Sulla's veterans, although Zumpt has suspected the contrary (*Comm. Epigr.*, i. 259). It afterwards became a municipium, and enjoyed great prosperity towards the close of the republic and in the earlier times of the empire, since many noble families of Rome selected this pleasant spot for the construction of splendid villas, one of which indeed belonged to the imperial house (Seneca, *De Ira*, iii.). By means of the Via Campana it had easy communication north-westward with Neapolis, Puteoli, and Capua, and thence by the Via Appia with Rome; and southwards with Pompeii and Nuceria, and thence with Lucania and the Bruttii. In the year 63 A. D. it suffered terribly from the earthquake which, according to Seneca, "Campaniam nunquam securam hujus mali, indemnem tamen, et toties defunctam metu magna strage vastavit. Nam et Herculanensis oppidi pars ruit dubieque stant etiam quæ relicta sunt" (*Nat. Quæst.*, vi. 1). Hardly had Herculaneum completed the restoration of some of its principal buildings (*cf.* Mommsen, *I. N.*, n. 2384; *Catalogo del Museo Nazionale di Napoli*, n. 1151) when it fell beneath the great eruption of the year 79, described by Pliny the younger (*Ep.* vi. 16, 20), in which Pompeii also was destroyed with other flourishing cities of Campania. According to the commonest account, on the 23d August of that year Pliny the elder, who had command of the Roman fleet at Misenum, set out to render assistance to the soldiers stationed at Retina, near Her-

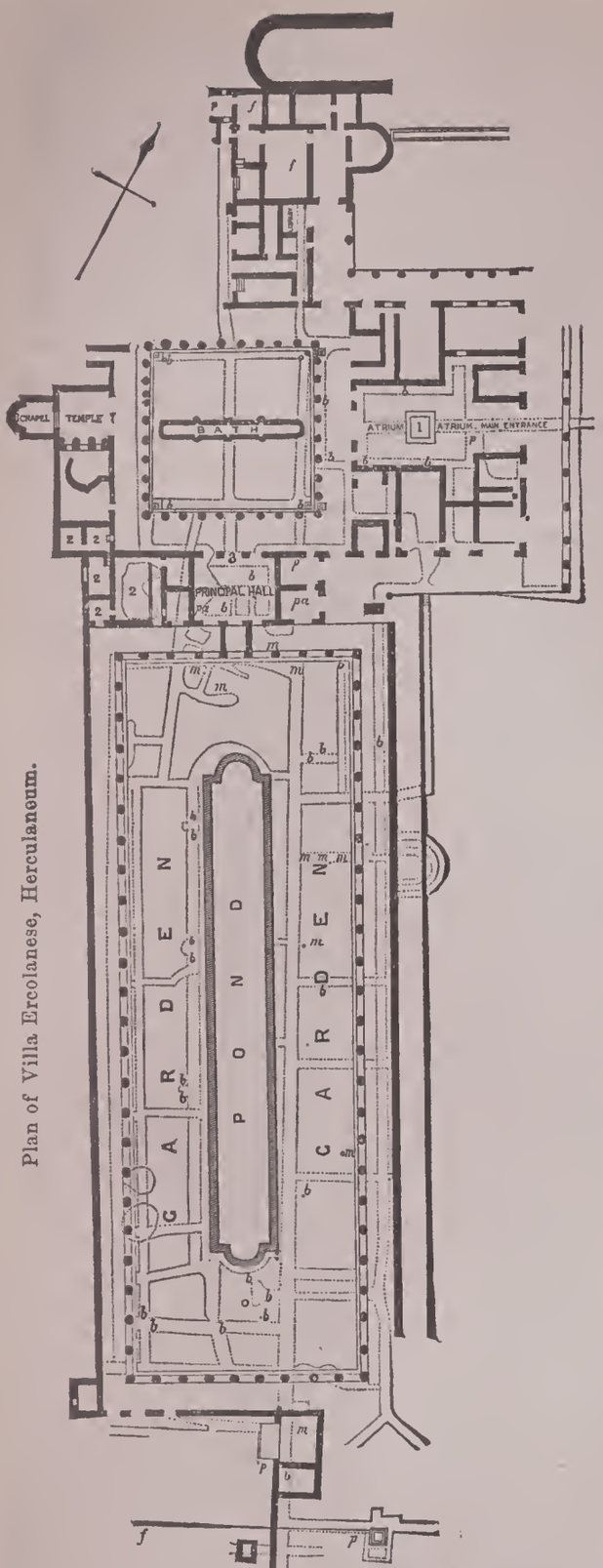
[1] A fragment of L. Sisenna calls it "Oppidum tumulo in excelso loco propter mare, parvis mœnibus, inter duas fluvias, infra Vesuvium collocatum" (lib. iv., fragm. 53, Peters). Of one of these rivers this historian again makes mention in the passage where probably he related the capture of Herculaneum by Minatius Magius and T. Didius (Velleius Paterculus, ii. 16). Further topographical details are supplied by Strabo, who, after speaking about Naples, continues—ἐχόμενον δὲ φρούριόν ἐστιν Ἡράκλειον ἐκκείμενην εἰς τὴν θάλατταν ἄκραν ἔχον, καταπνεόμενον Λιβὶ θαυμαστῶς ὥςθ' ὑγιεινὴν ποιεῖν τὴν κατοικιαν. Dionysius of Halicarnassus relates that Hercules, in the place where he stopped with his fleet on the return voyage from Iberia, founded a little city (πολίχνην), to which he gave his own name; and he adds that this city was in his time inhabited by the Romans, and that, situated between Neapolis and Pompeii, it had λιμένας ἐν παντὶ καίρῳ βεβαίους (i. 44).

[2] Disputed by Niebuhr, *Hist. of Rome*, vol. i. p. 76, and by Mommsen, *Die Unteritalischen Dialekte*, 1850, p. 314.

culaneum, as there was no escape except by sea, but, the little harbor having been on a sudden filled up so as to be inaccessible, he was obliged to abandon to their fate those people of Herculaneum and Retina who had managed to flee from their houses, overwhelmed in a moment by the material poured forth by Vesuvius. But the text of Pliny the younger, where this account is given, has been subjected to various interpretations; and from the comparison of other classical testimonies and the study of the excavations it has been concluded that it is impossible to determine the date of the catastrophe, though there are satisfactory arguments to justify the statement that the event took place in the autumn. The opinion that immediately after the first outbreak of Vesuvius a torrent of lava was ejected over Herculaneum was refuted by the scholars of the last century, and their refutation has been recently confirmed by Beulé (*Le Drame du Vésuve*, p. 240 *sq.*). And if the last recensions of the passage quoted from Pliny are to be accepted, Retina is not the name of the harbor described by Beulé (*ib.*, p. 122, 247), but the name of a lady who had implored succor, the wife of Cæsius Bassus, or rather Tascius (*cf.* Pliny, ed. Keil, Leipsic, 1870; Aulus Persius, ed. Jahn, *Sat.* vi.). The shore, moreover, according to the new and accurate studies of the engineer Michele Ruggiero, director of the excavations, was not altered by the causes adduced by Beulé (p. 125), but by a simpler event. "It is certain," he says (*Pompei e la Regione Sotterrata dal Vesuvio l'anno 79*, Naples, 1879, p. 21 *sq.*), "that the districts between the south and west, and those between the south and east, were overwhelmed in two quite different modes. From Torre Annunziata (which is believed to be the site of the ancient Oplontii) to San Giovanni a Teduccio, for a distance of about 9 miles, there flowed a muddy eruption which in Herculaneum and the neighboring places, where it was most abundant, raised the level of the country more than 65 feet. The matter transported consisted of soil of various kinds,—sand, ashes, fragments of lava, pozzolana, and whitish pumice, enclosing grains of uncalcined lime, similar in every respect to those of Pompeii. In the part of Herculaneum already excavated, the corridors in the upper portions of the theatre are compactly filled, up to the head of the arches, with pozzolana and pumice transformed into tuff (which proves that the formation of this stone may take place in a comparatively short time). Tuff is also found in the lowest part of the city towards the sea in front of the few houses that have been discovered; and in the very high banks that surround them, as also in the lowest part of the theatre, there are plainly to be seen earth, sand, ashes, fragments of lava and pumice, with little distinction of strata, almost always confused and mingled together, and varying from spot to spot in degree of compactness. It is clear that this immense congeries of earth and stones could not flow in a dry state over those 5 miles of country (in the beginning very steep, and at intervals almost level), where certainly it would have been arrested and all accumulated in a mound; but it must have been borne along by a great quantity of water, the effects of which may be distinctly recognized, not only in the filling and choking up even of the most narrow, intricate, and remote parts of the buildings, but also in the formation of the tuff, in which water has so great a share; for it cannot be supposed that enough of it has filtered through so great a depth of earth. The torrent ran in a few hours to the sea, and formed that shallow or lagoon called by Pliny *Subitum Vadum*, which prevented the ships approaching the shores." Hence it is that, while many made their escape from Pompeii (which was overwhelmed by the fall of the small stones and afterwards by the rain of ashes), comparatively few can have managed to escape from Herculaneum, and these, according to the interpretation given to the inscription preserved in the National Museum (Mommsen, *I. N.*, n. 2455), found shelter in the neighboring city of Neapolis, where they inhabited a quarter called that of the buried city (Suetonius, *Titus*, 8). The name of Herculaneum, which for some time remained attached to the site of the disaster, is mentioned in the later itineraries; but in the course of the Middle Ages all recollection of it perished.

In 1709, while Prince Elbeuf of the house of Lorraine, in command of the armies of Charles VI., was seeking crushed marble to make plaster for his new villa near Portici, he learned from the peasants that there were in the vicinity some pits from which they not only quarried excellent marble, but had extracted many statues in the course of years (see Jorio, *Notizia degli scavi d'Ercolano*, Naples, 1827). In 1738, while Colonel D. Rocco de Alcubierre was directing the works for the construction of the "Reali Delizie" at Portici, he received orders from Charles III. to begin excavations on the spot where it had been reported to the king that the Elbeuf statues had been found. At first it was believed that a temple was being explored, but afterwards the inscriptions proved that the building was a theatre. This discovery excited the greatest commotion among the scholars of all nations; and many of them hastened to Naples to see the marvellous statues of the Balbi and the paintings on the walls. But everything was kept private, as the Government wished to reserve to itself the right of illustrating the monuments. First of all Monsignor Bayardi was brought from Rome and commissioned to write about the antiquities which were being collected in the museum at Portici under the care of Camillo Paderni, and when it was recognized that the prelate had not sufficient learning, and by the progress of the excavations other most abundant material was accumulated, about which at once scholars and courtiers were anxious to be informed, Bernardo Tanucci, having become secretary of state in 1755, founded the Accademia Ercolanese, which published the principal works on Herculaneum (*Le Pitture ed i Bronzi d'Ercolano*, 8 vols., 1757, 1792; *Dissertationis Isagogicæ ad Herculanensium voluminum explanationem pars prima*, 1797). The criterion which guided the studies of the academicians was far from being worthy of unqualified praise, and consequently their work did not always meet the approval of the best scholars who had the opportunity of seeing the monuments. Among these was Winckelmann, who in his letters gave ample notices of the excavations and the antiquities which he was able to visit on several occasions. Other notices were furnished by Gori, *Symbolæ litterariæ Florentinæ*, 1748, 1751, by Marcello Venuti, *Descrizione delle prime scoperte d'Ercolano*, Rome, 1748, and Scipione Maffei, *Tre lettere intorno alle scoperte d'Ercolano*, Verona, 1748. The excavations, which continued for more than forty years (1738–1780), were executed at first under the immediate direction of Alcubierre (1738–1741), and then with the assistance of the engineers Rorro and Bardet (1741–1745), Carl Weber (1750–1764), and Francesco La Vega. After the death of Alcubierre (1780), the last-named was appointed director-in-chief of the excavations; but from that time the investigations at Herculaneum were intermitted, and the researches at Pompeii were vigorously carried on. Resumed in 1827, the excavations at Herculaneum were shortly after suspended, nor were the new attempts made in 1866 with the money bestowed by King Victor Emmanuel attended with success, being impeded by the many dangers arising from the houses built overhead. The meagreness of the results obtained by the occasional works executed in the present century, and the fact that the investigators were unfortunate enough to strike upon places already explored, gave rise to the opinion that the whole area of the city had been crossed by tunnels in the time of Charles III. and in the beginning of the reign of Ferdinand IV. And although it is recognized that the works had not been prosecuted with the caution that they required, yet in view of the serious difficulties that would attend the collection of the little that had been left by the first excavators, every proposal for new investigations has been abandoned. But in a memoir which Professor Barnabei read in the Reale Accademia dei Lincei (*Atti della R. Ac.*, series iii., vol. ii. p. 751), he undertook to prove that the researches made by the Government in the last century did not cover any great area. The antiquities excavated at Herculaneum in the last century form a collection of the highest scientific and artistic value. There are marble statues of astonishing art and perfect preservation, of which it is sufficient to mention the two equestrian statues of the Balbi (*Museo Borbonico*, vol. ii. pl. xxxviii.–ix.) and the so-called statue of Aristocles. With the exception of a few pieces, nearly all the great bronzes of the museum belong to Herculaneum. It is thence that we have obtained the reposing Hermes, the drunken Silenus, the sleeping Faunus, the dancing girls, the bust called Plato's, that believed to be Seneca's, the two quoit-throwers or discoboli, and so many master-pieces more, figured by the academicians in their volume on the bronzes. Mural paintings of extraordinary beauty were also discovered, such as those that represent Theseus after the slaughter of the Minotaur (Helbig, *Wandgemälde*, Leipsic, 1878, No. 1214) and Chiron teaching Achilles the art of playing on the lyre (*ibid.*, No. 1291). Notwithstanding the recent discoveries of the stupendous paintings in the gardens of the Villa Farnesina on the banks of the Tiber, the monochromes of Herculaneum remain among our finest specimens of the exquisite taste and consummate skill displayed by the ancient artists. Among the best preserved is Leto and Niobe, which has been the subject of so many studies and so many publications (*ibid.*, No. 1706). There is also a considerable number of lapidary inscriptions edited in vol. ii. of the epigraphic collection of the *Cat. del Mus. Naz. di Napoli*.

But all these antiquities do not seem to afford adequate sup-



Plan of Villa Ercolanese, Herculaneum.

1. Impluvium.
2. Marble Pavements.
3. Mosaics.
4. Marble Belvedere.

port for the opinion of those who, pointing out that those marvels were found for the most part in two or three buildings, conclude that similar riches would be found in other houses if the excavations were resumed. For their contention is that Herculaneum was not only a much greater city than Pompeii, but had attained a more exquisite Greek culture, because a large body of the Greek colonists expelled from the cities of Southern Italy had settled there either through their own numerical strength or through the favor of the Samnite confederation, whose conquests had placed it above all alarm at the advance of an already vanquished race. But in support of these assertions, more proof seems to be required than the fact that only two Samnite inscriptions have been found in Herculaneum (*cf* Fabretti, *Glossarium Italicum*, No 2784, 2784 *bis*), whilst at Pompeii they have been met with in great numbers; since, if it is borne in mind that in a later age Herculaneum was a municipium as well as Pompeii, and had the same political life, we must seek another explanation of the circumstance that in Pompeii there are so many inscriptions relative to municipal affairs, while in Herculaneum there are none. On the other hand, the classical tradition does not force us to believe that the city was so small as the academicians held it to be. The plan published in the *Dissertatio Isagogica* represents nine *insulæ* or blocks, each having the proportions of the sides of the Villa Suburbana or Villa Ercolanese discovered in the place called the wood of St. Agostino It was believed that this place was in the suburb, because it was divided from the rest of the inhabited area by a narrow valley formed by the washing of the rain (*Diss. Isag*, p 30). If this was correctly determined, the same cannot be said of the circuit of the city, as the walls have not been discovered. Nor are the investigations sufficient to fix precisely the ancient shore line. The discovery of the Villa Suburbana contributed to magnify the greatness of Herculaneum, within its walls were collected statues of marble and of bronze, and the famous library, of which, counting both entire and fragmentary volumes, 1803 papyri have been preserved. Among the nations which took the greatest interest in the discovery of the Herculaneum library the most honorable rank belongs to England, which sent Bishop Hayter and other scholars to Naples to solicit the publication of the volumes Of the 341 papyri which have been unrolled, 195 have been published (*Herculanensium voluminum quæ supersunt*, Naples, 1793–1809; *Collectio altera*, 1862–1876). They contain works by Epicurus, Demetrius, Polistratus, Colotes, Chrysippus, Carniscus, and Philodemus. The names of the authors are in themselves sufficient to show that the library belonged to a person whose principal study was the Epicurean philosophy But of the great master of this school only a few works have been found. Of his treatise Περὶ φύσεως, divided into 37 books, it is known that there were three copies in the library (*Coll alt.*, vi.) Quite recently Professor Comparetti, studying the first fasciculus of volume xi. of the same new collection recognized most important fragments of the *Ethics* of Epicurus, and these he published in 1879 in Nos ix. and xi. of the *Rivista di Filologia ed Istruzione classica*, Turin. Even the other authors above mentioned are but poorly represented, with the exception of Philodemus, of whom 26 different treatises have been recognized But all these philosophic discussions, belonging for the most part to an author less than secondary among the Epicureans, fall short of the high expectations excited by the first discovery of the library Among the many volumes unrolled only a few are of historical importance,—that edited by Bücheler, which treats of the philosophers of the academy (*Acad. phil. index Hercul.*, Greifswald, 1859), and that edited by Comparetti, which deals with the historians ("Papiro ercolanese inedito," in *Rivista di Fil. ed Ist. class.* anno iii., fasc x.–xii.) To appreciate the value of the volumes unrolled but not yet published (for 146 vols. were only copied and not printed), the student must await the appearance of Comparetti's paper "Relazione sui papiri ercolanesi," read in the Reale Accad. dei Lincei, which will appear in the "Proceedings" of the academy for 1879 Contributions of some value have been made to the study of Herculaneum fragments by Spengel ("Die Hercul Rollen," in *Philologus*, 1863, suppl. vol.), and Gompertz (*Hercul. Studien*, Leipsic 1865–66, *cf. Zeitschr. f österr Gymn.*, 1867–1872). There are in the library some volumes written in Latin, which, according to Boot (*Notice sur les manuscrits trouvés à Herculaneum*, Amsterdam, 1845), were found tied up in a bundle apart. Of these we know 18, but they are all so damaged that hardly any of them can be deciphered. One with verses relating to the battle of Actium is believed to belong to a poem of Rabirius. The numerical preponderance of the works of Philodemus led some people to believe that this had been the library of that philosopher. But quite recently Professor Comparetti has come to the conclusion that the library was collected by Lucius Piso Cæsoninus (see *Pompei e la Regione Sotterrata dal Vesuvio*, Naples, 1879. p. 259 *sq*) A new support to the theory of Professor Comparetti is furnished by the epigraphic fragment edited by De Petra (*ib.* p 251 *sq*), but Dr. Mau takes up a counter position,—he is the first to do so,—and shows that the fragment must have another interpretation (*Bull. Inst. di Corr. Arch.*, 1880) Professor De Petra has also published the official notices upon the antiquities unearthed in the sumptuous villa, giving the plan executed by Weber and recovered by chance by the director of excavations Michele Ruggiero This plan, which is here reproduced from De Petra's monograph,[1] is the only satisfactory document for the topography of Herculaneum, for the plan of the theatre published in the *Bullettino archeo-*

[1] The diagram shows the arrangement and proportions of the Villa Ercolanese, *p* indicating pictures, *b* bronzes, *m* marble statues or busts, *pa* papyri, and *f* fountains. The dotted lines show the course taken by the excavations, which began at the lower part of the plan.

logico-italiano (Naples, 1861, i. p. 53, tab. iii.) was executed in 1747, when the excavations were not completed. And even for the history of the "finds" made in the *Villa Suburbana* the necessity for further studies makes itself felt, since there is a lack of agreement between the accounts given by Alcubierre and Weber and those communicated to the *Philosophical Transactions* (London, vol. x.) by Camillo Paderni, conservator of the Portici Museum. It is hoped, therefore, that among the papers recovered by Ruggiero there may be others which will shed light on what remains dark in the topography of the buried city.

Among the older works relating to Herculaneum, in addition to those already quoted, may be mentioned De Brosses, *Lettre sur l'état actuel de la ville souterraine d'Heracléa*, Paris, 1750; Seigneux de Correvon, *Lettre sur la découverte de l'ancienne ville d'Herculane*, Yverdon, 1770; David, *Les antiquités d'Herculaneum*, Paris, 1780; D'Ancora Gaetano, *Prospetto storico-fisico degli scavi d'Ercolano e di Pompei*, Naples, 1803; Venuti, *Prime Scoverte di Ercolano*, Rome, 1748; and Romanelli, *Viaggio ad Ercolano*, Naples, 1811. A full list will be found in vol. i. of *Museo Borbonico*, Naples, 1824, pp. 1–11. (F. B.)

HERCULES (Old Latin, *Hercoles, Hercles*) is the Latinized form of the mythical Heracles, the chief national hero of Hellas, who has part in all the most important myths of the generation before that which embraces the Homeric warriors at Troy. The name Ἡρακλῆς is compounded of *Hera*, the goddess, and the stem of κλέος, "glory." The thoroughly national character of Heracles is shown by his being the mythical ancestor of the Dorian dynastic tribe, while revered by Ionian Athens, Lelegian Opus, and Æolo-Phœnician Thebes, and closely associated with the Achæan heroes Peleus and Telamon. The Perseid Alcmene, wife of Amphitryon of Tiryns, was Hercules's mother, Zeus his father (see ALCMENE). After his putative father he is often called Amphitryoniades, and Alcides too, after the Perseid Alcæus, father of Amphitryon. His mother and her husband lived at Thebes in exile as guests of King Creon. By the craft of Hera, his foe through life, his birth was delayed, and that of Eurystheus, son of Sthenelus of Argos, hastened, Zeus having in effect sworn that the elder of the two should rule the realm of Perseus. Hera sent two serpents to destroy the new-born Hercules, but he strangled them. He was trained in all manly accomplishments by heroes of the highest renown in each, until he slew Linus, his instructor in music, with the lyre. Thereupon he was sent to tend Amphitryon's oxen, and at this period slew the lion of Mount Cithæron. By the subjection of the Minyans of Orchomenus he won Creon's daughter, Megara, to wife. Her children by him he killed in a frenzy induced by Hera. After purification he was sent by the Pythia to serve Eurystheus. The apologue of Prodicus on the *Choice of Hercules* between pleasure and virtue was founded on his obedience to the oracle. Thus began the cycle of the twelve labors:—

1. Wrestling with the Nemean lion.
2. Destruction of the Lernean hydra.
3. Capture of the Arcadian hind (a *stag* in art).
4. Capture of the boar of Erymanthus, while chasing which he fought the Centaurs and killed his friends Chiron and Pholus, this homicide leading to Demeter's institution of *mysteries*.
5. Cleansing of the stables of Augeas.
6. Shooting the Stymphalian birds.
7. Capture of the Cretan bull subsequently slain by Theseus at Marathon.
8. Capture of the man-eating mares of the Thracian Diomedes.
9. Seizure of the girdle of Hippolyte, queen of the Amazons.
10. Bringing the oxen of Geryones from Erythia in the far west, which errand involved many adventures in the coast lands of the Mediterranean, and the setting up of the "Pillars of Hercules" at the Straits of Gibraltar.
11. Bringing the golden apples from the garden of the Hesperides.
12. Carrying Cerberus from Hades to the upper world.

Most of the labors lead to various adventures called πάοεργα. Their common order and selection, due to Apollodorus and Diodorus Siculus, are later than Euripides, who omits 5, 6, and 7, and seems to count the victory over Cycnus in Phthiotis, the bearing of the heavens for Atlas, and the freeing of the seas from dangerous monsters. In Homer we read of unspecified labors for Eurystheus, of the struggle with the sea monster of the Troad, and of wars. Hesiod mentions labors 1, 2, and 10, and the freeing of Prometheus. It is a mistake to suppose that legends of Hercules's struggles with monstrous embodiments of evil are not of high antiquity, though we cannot say positively which are old and which comparatively late. Some enumerations give only 10 labors. The late lists probably rest partly on astronomical ideas.

On Hercules's return to Thebes he gave his wife Megara to his friend and charioteer Iolaus, son of Iphicles, and by beating Eurytus of Œchalia and his sons in a shooting match won a claim to the hand of his daughter Iole, whose family, however, except her brother Iphitus, withheld their consent to the union. Iphitus persuaded Hercules to search for Eurytus's lost oxen, but was killed by him at Tiryns in a frenzy. He consulted the Pythia about a cure for the consequent madness, but she declined to answer him. Whereupon he seized the oracular tripod, and so entered upon a contest with Apollo, which Zeus stopped by sending a flash of lightning between the combatants. The Pythia then sent him to serve the Lydian queen Omphale. He then with Telamon, Peleus, and Theseus took Troy. He next helped the gods in the great battle against the giants. He took part in the Argonautic voyage and the Calydonian boar hunt, made war against Augeas, and against Nestor and the Pylians, and restored Tyndarcus to the sovereignty of Lacedæmon. He sustained many single combats, one very famous struggle being the wrestling with the Libyan Antæus, son of Poseidon and Ge (Earth), who had to be held in the air, as he grew stronger every time he touched his mother, Earth. Hercules withstood Ares, Poseidon, and Hera, as well as Apollo. The close of his career is assigned to Ætolia and Trachis. He wrestles with Achelous for Deianeira ("destructive to husband"), daughter of Œneus, king of Calydon, vanquishes the river god, and breaks off one of his horns, which as a horn of plenty is found as an attribute of Hercules in art. Driven from Calydon for homicide, he goes with Deianeira to Trachis. On the way he slays the centaur Nessus, who persuades Deianeira that his blood is a love-charm. From Trachis he wages successful war against the Dryopes and Lapithæ as ally of Ægimius king of the Dorians, who promised him a third of his realm, and after his death adopted Hyllus, his son by Deianeira. Finally Hercules attacks Eurytus, takes Œchalia, and carries off Iole. Thereupon Deianeira, prompted by love and jealousy, sends him a tunic dipped in the blood of Nessus, and the unsuspecting hero puts it on just before sacrificing at the headland of Cenæum in Eubœa. Mad with pain, he seizes Lichas, the messenger who had brought the fatal garment, and hurls him on the rocks; and then he wanders in agony to Mount Œta, where he mounts a pyre, which, however, no one will kindle. At last Pœas, father of Philoctetes, takes pity on him, and is rewarded with the gift of his bow and arrows. The immortal part of Hercules passes to Olympus, where he is reconciled to Hera and weds her daughter Hebe.

In one aspect Hercules is clearly a sun-god, being identified, especially in Cyprus and in Thasos (as Makar), with the Tyrian Melkarth. He is again a representative of endurance and effort in the cause of Hellenic civilization and enterprise. Sundry of his exploits may be based on actual achievements of tribes and leaders of men, but it is impossible to unravel satisfactorily the tangled strands which make up this highly elaborate myth, though the separate existence of some is clearly discernible. The close connection of the hero with both Thebes and Argos suggests actual relations between the two states. The Lydian episode shows traces of Eastern influence. The second, fifth, and sixth labors may be solar, but yet they suggest reclamation of marsh land. The third and twelfth are the most obviously solar, the horned hind representing the moon, and the carrying of Cerberus to the upper world an eclipse. It may be admitted as highly probable that the last episode of the hero's tragedy is a complete solar myth developed at Trachis. The winter sun is seen rising over the Cenæan promontory to toil across to Mount Œta and disappear over it in a bank of fiery cloud. The fatality by which Hercules kills so many friends as well as foes recalls the destroying Apollo; while his career frequently illustrates the Delphic views on blood-guiltiness and expiation. As Apollo's champion Hercules is Daphnephoros, and fights Cycnus and Amyntor to keep open the sacred way from Tempe to Delphi. As the Dorian tutelar he aids Tyndareus and Ægimius. As patron of maritime adventure (ἡγεμόνιος) he struggles with Nereus and Triton, slays Eryx and Busiris, and perhaps captures the wild horses and oxen,

which may stand for pirates. As a god of athletes he is often a wrestler (*παλαίμων*), and founds the Olympian games. In comedy and occasionally in myths he is depicted as voracious (*βουφάγος*). He is also represented as the companion of Dionysus, especially in Asia Minor. The "Resting" (*ἀναπανόμενος*) Hercules is, as at Thermopylæ and near Himera, the natural tutelar of hot springs in conjunction with his protectress Athena, who is usually depicted attending him on ancient vases. The glorified Hercules was worshipped both as a god and a hero. In the Attic deme Melita he was invoked as *ἀλεξίκακος* ("Helper in ills"), at Olympia as *καλλίνικος* ("Nobly-victorious"), in the rustic worship of the Œtæans as *κορνοπίων* (*κόρνοπες*, "locusts"), by the Erythræans of Ionia as *ἰποκτόνος*, ("Canker-worm-slayer"). In Italy he was, like Apollo, Musagetes ("Leader of the Muses"). He was *σωτήρ* ("Saviour"), *i. e.*, a protector of voyagers, at Thasos and Smyrna, and in Italy, where tithes were vowed to him to be spent in entertainment. Games in his honor were held at Thebes and Marathon. In early poetry, as often in art, he is an archer, afterwards a club-wielder and fully-armed warrior. In early art the adult Hercules is bearded, but not long-haired. Later he is sometimes youthful and beardless, always with short curly hair and thick neck, the lower part of the brow prominent. A lion's skin is generally worn or carried. Lysippus worked out the finest type of sculptured Hercules, of which the Farnese by Glycon is a grand specimen. The infantine struggle with serpents was a favorite subject.

Quite distinct was the Idæan Hercules, a Cretan Dactyl connected with the cult of Rhea or Cybele. The Greeks recognized Hercules in an Egyptian deity *Chom* and an Indian *Dorsanes*, not to mention personages of other mythologies. Hercules is supposed to have visited Italy on his return from Erythia, when he slew Cacus, son of Vulcan, the giant of the Aventine mount in Rome, who had stolen his oxen. To this victory was assigned the founding of the *Ara maxima*. With respect to the Roman relations of the hero, it is manifest that the native myths of Recaranus, or Sancus, or Dius Fidius, were transferred to the Hellenic Hercules.

The best account of the Hercules myths and cults is by L. Preller, *Griechische Mythologie*, 3d ed., Berlin, 1875. See also Hillan, *De Herculis Romani fabula et cultu*, Münster, 1850; and Bréal, *Hercule et Cacus*, Paris, 1863. (C. A. M. F.)

HERDER, Johann Gottfried von (1744–1803), one of the most prolific and influential writers that Germany has produced, was born in Mohrungen, a small town near Königsberg, in 1744. Like his contemporary Lessing, with whose literary aims his own had so much in common, Herder had throughout his life to struggle against adverse circumstances. His father was poor, having to put together a subsistence by uniting the humble offices of sexton, choir singer, and petty schoolmaster. Gottfried seems to have got some rudimentary instruction from his father, after which he was sent to the grammar school (gymnasium) of his native town. The mode of discipline practised by the pedantic and irritable old man who stood at the head of this institution was not at all to the young student's liking, and the impression made upon him stimulated him later on to work out his projects of school reform. The hardships of his early years drove him to introspection and to solitary communion with nature, and thus favored a more than proportionate development of the sentimental and poetic side of his mind. When quite young he expressed a wish to enter the church, but his aspirations were somewhat rudely discouraged by the local clergyman. In 1762, at the age of eighteen, he went up to Königsberg with the intention of studying medicine, but finding himself unequal to the operations of the dissecting-room, he abandoned this object, and by the help of one or two friends and his own self-supporting labors, followed out his earlier idea of the clerical profession by joining the university. There he came under the influence of Kant, who was just then passing from physical to metaphysical problems. Without becoming a disciple of Kant, the young Herder was deeply stimulated to fresh critical inquiry by that thinker's revolutionary ideas in philosophy. To Kant's lectures and conversations he further owed something of his large interest in cosmological and anthropological problems. Among the writers whom he most carefully read were Plato, Hume, Shaftesbury, Leibnitz, Diderot, and Rousseau. Another personal influence under which he fell at Königsberg, and which was destined to be far more permanent, was that of Hamann, "the northern Mage." This writer had already won a name, and in the young Herder he found a mind well fitted to be the receptacle and vehicle of his new ideas on literature. From this vague, incoherent, yet clever writer our author acquired some of his strong feeling for the natural naïf element in poetry, and for the earliest developments of national literature. Even before he went to Königsberg he had begun to compose verses, and at the age of twenty he took up the pen as a chief occupation. His first published writings were occasional poems and articles contributed to the *Königsberg Journal*. Soon after this he got a double appointment at Riga, as assistant master at the cathedral school, and as curate to the suburban churches. In this busy commercial town, in somewhat improved pecuniary and social circumstances, he developed the main ideas of his writings. In the year 1767 he published his first considerable work *Fragmente über die neuere deutsche Literatur*, which at once made him widely known and secured for him the favorable interest of Lessing. From this time he continued to pour forth a number of critical writings on literature, art, etc. His bold ideas on these subjects, which were a great advance even on Lessing's doctrines, naturally excited hostile criticism, and in consequence of this opposition, which took the form of aspersions on his religious orthodoxy, he resolved to leave Riga. He was much carried away at this time by the idea of a radical reform of social life in Livonia, which (after the example of Rousseau) he thought to effect by means of a better method of school-training. With this plan in view he began (1769) a tour through France, England, Holland, etc., for the purpose of collecting information respecting their systems of education. It was during the solitude of his voyage to France, when on deck at night, that he first shaped his idea of the genesis of primitive poetry, and of the gradual evolution of humanity. Having received an offer of an appointment as travelling tutor and chaplain to the young prince of Eutin-Holstein, he abandoned his somewhat visionary scheme of a social reconstruction of a Russian province. He has, however, left a curious sketch of his projected school reforms. His new duties led him to Strasburg, where he met the young Goethe, on whose poetical development he exercised so potent an influence. At Darmstadt he made the acquaintance of Caroline Flachsland, to whom he soon became betrothed, and who for the rest of his life supplied him with that abundance of consolatory sympathy which his sensitive and rather querulous nature appeared to require. The engagement as tutor did not prove an agreeable one, and he soon threw it up (1771) in favor of an appointment as court preacher and member of the consistory at Bückeburg. Here he had to encounter bitter opposition from the orthodox clergy and their followers, among whom he was received as a free thinker. His health continued poor, and a fistula in the eye, from which he had suffered from early childhood, and to cure which he had undergone a number of painful operations, continued to trouble him. Further, pecuniary difficulties, from which he never long managed to keep himself free, by delaying his marriage, added to his depression. The correspondence between Herder and Caroline Flachsland indicates a relationship which offers a curious parallel and contrast to that of Lessing and his future wife under very similar circumstances. Notwithstanding these trying circumstances he resumed literary work, which his travels had interrupted. For some time he had been greatly interested by the poetry of the north, more particularly Percy's *Reliques*, the poems of "Ossian" (in the genuineness of which he like many others believed), and the works of Shakespeare. Under the influence of this reading he now finally broke with classicism and became the leader of the new "Sturm und Drang" movement. He co-operated with a band of young writers at Darmstadt and Frankfort, including Goethe, who in a journal of their own sought to diffuse the new ideas of Herder. His marriage took place in 1773. In 1776 he obtained through Goethe's influence the post of upper court preacher and upper member of the consistory at Weimar, where he passed the rest of his life. There he enjoyed the society of Goethe, Wieland, Jean Paul (who came to Weimar in order to be near Herder), and others, the patronage of the court, with whom as a preacher he was very popular, and an opportunity of carrying out some of his pet ideas of school reform. Yet the social atmosphere of the place did not suit him. His personal relations with

Goethe again and again became embittered. He had not the poet-minister's liking for the elegant frivolities of court life, while the efforts of Goethe and Schiller to make Weimar a dramatic centre repelled his austerely moral nature. All this, added to ill-health, served to intensify a natural irritability of temperament, and the history of his latter Weimar days is a rather dreary page in the chronicles of literary life. He had valued more than anything else a teacher's influence over other minds, and as he began to feel that he was losing it he grew jealous of the success of those who had outgrown this influence. Yet while presenting these unlovely traits, Herder's character was on the whole a worthy and attractive one. This seems to be sufficiently attested by the fact that he was greatly liked and esteemed, not only in the pulpit but in private intercourse, by cultivated women like the countess of Bückeburg, the duchess of Weimar, and Frau von Stein, and, what perhaps is more, was exceedingly popular among the gymnasium pupils, in whose education he took so lively an interest. While during the last years of his life he produced much that is of little value, he wrote also some of his best works, among others his collection of popular poetry, *Stimmen der Völker;* his most notable original poem, the *Cid;* his celebrated work on Hebrew poetry, *Vom Geist der hebräischen Poesie;* and his *opus magnum*, the *Ideen zur Philosophie der Geschichte.* Towards the close of his life he occupied himself like Lessing with speculative questions in philosophy and theology. The boldness of some of his ideas cost him some valuable friendships, as that of Jacobi, Lavater, and even of his early teacher Hamann. He died in the year 1803, full of new literary plans up to the very last.

Herder's writings were for a long time regarded as of temporary value only, and fell into neglect. Recent criticism, however, has tended very much to raise their value by tracing out their wide and far-reaching influence. The number of publications relating to Herder that have appeared during the last few years shows that there is a revival of interest in this writer. His writings are very voluminous, and to a large extent fragmentary and devoid of artistic finish; nevertheless they are nearly always worth investigating for the brilliant suggestions in which they abound. His place in German literature has already been faintly indicated in tracing his mental development. Like Lessing, whose work he immediately continued, he was a pioneer of the golden age of this literature. Lessing had given the first impetus to the formation of a national literature by exposing the folly of the current imitation of French writers. But in doing this he did not so much call his fellow-countrymen to develop freely their own national sentiments and ideas as send them back to classical example and principle. Herder on the contrary fought against all imitation as such, and bade German writers be true to themselves and their national antecedents. As a sort of theoretic basis for this adhesion to national type in literature, he conceived the idea that literature and art, together with language and national culture as a whole, are evolved by a natural process, and that the intellectual and emotional life of each people is correlated with peculiarities of physical temperament and of material environment. In this way he became the originator of that genetic or historical method which has since been applied to all human ideas and institutions. Herder was thus an evolutionist, but an evolutionist still under the influence of Rousseau. That is to say, in tracing back the later acquisitions of civilization to impulses which are as old as the dawn of primitive culture, he did not, as the modern evolutionist does, lay stress on the superiority of the later to the earlier stages of human development, but rather became enamored of the simplicity and spontaneity of those early impulses which, since they are the oldest, easily come to look like the most real and precious. Yet even in this way he helped to found the historical school in literature and science, for it was only after an excessive and sentimental interest in primitive human culture had been awakened that this subject would receive the amount of attention which was requisite for the genetic explanation of the later acquisitions of the species. This historical idea was carried by Herder into the regions of poetry, art, religion, language, and finally into human culture as a whole. It colors all his writings, and is intimately connected with some of the most characteristic attributes of his mind, a quick sympathetic imagination, a fine feeling for local differences, and a scientific instinct for seizing the sequences of cause and effect.

Herder's works easily arrange themselves in an ascending series, corresponding to the way in which the genetic or historical idea was developed and extended. First come the works on poetic literature, art, language, and religion as special regions of development. Secondly, we have in the *Ideen* a general account of the process of human evolution. Thirdly, there are a number of writings which, though inferior in interest to the others, may be said to supply the philosophic basis of his leading ideas. (1) In the region of poetry Herder sought to persuade his countrymen, both by example and precept, to return to a natural and spontaneous form of utterance. His own poetry is voluminous, and as a whole has but little value. Herder was a skilful verse-maker but hardly a creative poet. His best poetry consists of translations of popular song, in which he shows a rare sympathetic insight into the various feelings and ideas of peoples as unlike as Greenlanders and Spaniards, Indians and Scotch. In the *Fragmente* he aims at nationalizing German poetry and freeing it from all extraneous influence. He ridicules the ambition of German writers to be classic, as Lessing had ridiculed their eagerness to be French. "Let us," he says, "be idiotistic writers, adapting ourselves to the peculiarities of our people and our language; whether we are classic posterity may find out." In his sweeping condemnation of contemporary writers, he does not exempt even Klopstock, with whose feeling for nature he has so much sympathy, but whose poems appear to him exotic in sentiment and ideas. He looked at poetry as a kind of "proteus among the people, which changes its form according to language, manners, habits, according to temperament and climate, nay, even according to the accent of different nations." This fact of the idiosyncrasy of national poetry he illustrated with great fulness and richness in the case of Homer, the nature of whose works he was one of the first to elucidate, the Hebrew poets (*Geist der hebräischen Poesie*), and the poetry of the north as typified in "Ossian." This same idea of necessary relation to national character and circumstance is also applied to dramatic poetry, and more especially to Shakespeare. Lessing had done much to make Shakespeare known to Germany, but he had regarded him in contrast to the French dramatists with whom he also contrasted the Greek dramatic poets, and accordingly did not bring out his essentially modern and Teutonic character. Herder does this, and in doing so shows a far deeper understanding of Shakespeare's genius than his predecessor had shown. His appreciative criticisms of *Hamlet*, *Othello*, and other plays are worthy of being read along with those of later German critics. (2) The views on art contained in Herder's *Silvæ*, *Plastik*, etc., are chiefly valuable as a correction of the excesses into which reverence for Greek art had betrayed Winckelmann and Lessing, by help of his fundamental idea of national idiosyncrasy. He argues against the setting up of classic art as an unchanging type, valid for all peoples and all times. He was one of the first to bring to light the characteristic excellences of Gothic art. Beyond this, he eloquently pleaded the cause of painting as a distinct art, which Lessing in his desire to mark off the formative arts from poetry and music had confounded with sculpture. He regarded this as the art of the eye, while sculpture was rather the art of the organ of touch. Painting being less real than sculpture, because lacking the third dimension of space, and a kind of dream, admitted of much greater freedom of treatment than this last. Herder had a genuine appreciation for early German painters, and helped to awaken the modern interest in Albrecht Dürer. (3) By his work on language *Ueber den Ursprung der Sprache*, Herder may be said to have laid the first rude foundations of the science of comparative philology and that deeper science of the ultimate nature and origin of language. It was specially directed against the supposition of a divine communication of language to man. Its main argument is that speech is a necessary outcome of that special arrangement of mental forces which distinguishes man, and more particularly from his habits of reflection. "If," Herder says, "it is incomprehensible to others how a human mind could invent language, it is as incomprehensible to me how a human mind could be what it is without discovering language for itself." The writer does not make that use of the fact of man's superior organic endowments which one might expect from his general conception of the relation of the physical and the mental in human development. (4) Herder's services in laying the foundations of a comparative science of religion and mythology are even of greater value than his somewhat crude philological speculations. In opposition to the general spirit of the 18th century he saw, by means of his historic sense, the naturalness of religion, its relation to man's wants and impulses. Thus with respect to early religious beliefs he rejected Hume's notion that religion sprang out of the fears of primitive men, in favor of the theory that it represents the first attempts of our species to explain phenomena. He thus intimately associated religion with mythology and primitive poetry. As to later forms of religion, he appears to have held that they owe their vitality to their embodiment of the deep-seated moral feelings of our common humanity. His high appreciation of Christianity, which con-

trasts with the contemptuous estimate of the contemporary rationalists, rested on a firm belief in its essential humanity, to which fact, and not to conscious deception, he attributes its success. His exposition of this religion in his sermons and writings was simply an unfolding of its moral side. In his later life, as we shall presently see, he found his way to a speculative basis for his religious beliefs. (5) Herder's masterpiece, the *Ideen*, has the ambitious aim of explaining the whole of human development in close connection with the nature of man's physical environment. Man is viewed as a part of nature, and all his widely differing forms of development as strictly natural processes. It thus stands in sharp contrast to the anthropology of Kant, which opposes human development conceived as the gradual manifestation of a growing faculty of rational free will to the operations of physical nature. Herder defines human history as "a pure natural history of human powers, actions, and propensities, modified by time and place." The *Ideen* shows us that Herder is an evolutionist after the manner of Leibnitz, and not after that of more modern evolutionists.[1] The lower forms of life prefigure man in unequal degrees of imperfection; they exist for his sake, but they are not regarded as representing necessary antecedent conditions of human existence. The genetic method is applied to varieties of man, not to man as a whole. It is worth noting, however, that Herder in his provokingly tentative way of thinking comes now and again very near ideas made familiar to us by Mr. Spencer and Mr. Darwin. Thus in a passage in book xv. chap. ii., which unmistakably foreshadows Mr. Darwin's idea of a struggle for existence, we read: "Among millions of creatures whatever could preserve itself abides, and still after the lapse of thousands of years remains in the great harmonious order. Wild animals and tame, carnivorous and graminivorous, insects, birds, fishes, and man are adapted to each other." With this may be compared a passage in the *Ursprung der Sprache*, where there is a curious adumbration of Mr. Spencer's idea that intelligence, as distinguished from instinct, arises from a growing complexity of action, or, to use Herder's words, from the substitution of a more for a less contracted sphere.[2] Herder is more successful in tracing the early developments of particular peoples than in constructing a scientific theory of evolution. Here he may be said to have laid the foundations of the science of primitive culture as a whole. His account of the first dawnings of culture, and of the ruder Oriental civilizations, is marked by genuine insight. On the other hand, the development of classic culture is traced with a less skilful hand. Altogether this work is rich in suggestion to the philosophic historian and the anthropologist, though marked by much vagueness of conception and hastiness of generalization. (6) Of Herder's properly metaphysical speculations little needs to be said. He was too much under the sway of feeling and concrete imagination to be capable of great things in abstract thought. It is generally admitted that he had no accurate knowledge either of Spinoza, whose monism he advocated, or of Kant, whose critical philosophy he so fiercely attacked. His sympathy with the one and his antipathy to the other were intimately connected with the essential character of his mind, which was more synthetic than analytic, regarded things in their concrete surroundings rather than in abstract isolation. It was but one step more to the man who had learnt to view poetry, art, language, etc., in their connection with social and physical surroundings, and to conceive of human history in its relation to physical events, to bring together the great aggregates of material and spiritual phenomena under one total conception of a single substance or God. Herder's Spinozism, which is set forth in his little work, *Vom Erkennen und Empfindung der menschlichen Seele*, is much less logically conceived than Lessing's. It is the religious aspect of it which attracts him, the presentation in God of an object which at once satisfies the feelings and the intellect. With respect to his attacks on the critical philosophy in the *Metakritik*, it is easy to understand how his concrete mind, ever alive to the unity of things, instinctively rebelled against that analytic separation of the mental processes which Kant attempted. However crude and hasty this critical investigation, it helped to direct philosophic reflection to the unity of mind, and so to develop the post-Kantian line of speculation. Herder was much attracted by Schelling's writings, but appears to have disliked Hegelianism because of the atheism it seemed to him to involve. In the *Caligone*, a work directed against Kant's *Critic of Judgment*, Herder argues for the close connection of the beautiful and the good. To his mind the content of art, which he conceived as human feeling and human life in its completeness, was much more valuable than the form, and so he was naturally led to emphasize the moral element in art. Thus his theoretic opposition to the Kantian æsthetics is but the reflection of his practical opposition to the form-idolatry of the Weimar poets.

The most valuable original sources of information on Herder, next to his own works (of which a new edition, critically revised by B. Suphan, is just appearing), are the *Erinnerungen aus dem Leben J. G. von Herder*, by Herder's wife; *J. G. von Herder's Lebensbild*, by his son Emil; and his letters, edited by Düntzer and Herder's grandson. The general reader will find a sufficient account of Herder in a number of recent biographical works. Among these the fullest are Ch. Joret's *Herder et la Renaissance Littéraire en Allemagne* (which unfortunately does not deal with the latter part of his life), and R. Haym's *Herder nach seinem Leben und seinen Werken*. The account of Herder in Hettner's *Literaturgeschichte* is very full and interesting. (J. S.)

[1] See article Evolution, vol. viii. p. 666.

[2] Herder's relation to modern evolutionists is dealt with in F. von Barenbach's *Herder als Vorgänger Darwins*.

HEREFORD, an inland English county on the south Welsh border, is bounded on the N. by Salop, S. by Monmouthshire and Gloucestershire, E. by Worcestershire, and W. by Radnorshire and Brecknockshire. Its circular shape is indented by spurs of adjacent counties, and its outlying parts have by an act of William IV. 7 and 8 been incorporated with the counties in which they are situated. Its greatest length from Ludford by Ludlow to the Doward Hills, near Monmouth, is 38 miles; its greatest breath from Cradley to Clifford, near Hay, 35. Its area according to the census of 1901 is 532,898 statute acres, or 832 square miles. It is divided into 11 hundreds and 221 parishes, and is a bishop's see, of which the cathedral city is the centre of the county. Pop. 114,401. Plate XIV.

Its chief rivers are the Wye and Lug. The former, rising near the source of the Severn on the summit of Plinlimmon, forms the boundary between Brecon and Radnor ere it enters Herefordshire near Clifford, and, flowing past Hereford, Ross, and Monmouth, falls into the Severn near Chepstow. A striking feature of the Wye is its sinuosity, especially between Hereford and Monmouth. Its never very effectual navigation has been put an end to by railway enterprise, and its salmon fisheries are now so protected by legal enactment that there is no longer a danger of Hereford apprentices being fed on salmon "ad nauseam." The Lug, a first rate trout stream, rising in Radnorshire, enters Herefordshire near Presteign, and, passing by Aymestry, Kingsland, and Leominster, joins the Wye below Mordiford Bridge, south-east of Hereford. The Arrow also rises in Radnorshire, and flowing past Kington and Pembridge joins the Lug near Monkland, and the Frome, having its source near Bromyard, joins the same river near Mordiford, while the Ledden runs past Ledbury to join the Severn near Gloucester. All these, as well as the Teme, a boundary line of the northeast of the county, are more or less famous trout streams.

The soil is generally marl and clay, but in various parts contains calcareous earth in mixed proportions. Westward the soil is tenacious and retentive of water; on the east it is a stiff and often reddish clay. In the south is found a light sandy loam. The subsoil is mostly limestone, in some parts the Old Red Sandstone, and a species of red and white veined marble. Where the soil does not rest on limestone, it is sometimes a silicious gravel, or contains fuller's earth and yellow ochres. Limestone, quarried at Aymestry and Nash to the northwest of the county, and at Ledbury, Woolhope, and elsewhere, is successfully applied as a manure for arable land and pasture. For the physical history of the county reference must be made to Murchison's *Siluria*, or Symonds's *Records of the Rocks*, where the upheaval and denudation in the Woolhope valley and over the central dome of Haughwood and similar questions are discussed.

The climate is variable, owing to the damp and fogs, which moisten the earth and account for its great verdure, as well as to its large proportion of timber, not only in parks and on landed estates, but almost on every hedgerow. In spite, however, of the prevalence of rheumatism, Herefordshire is reckoned healthy, ranks high in the statistics of longevity, and enjoys a comparative immunity from diseases of the respiratory organs.

The surface of the county is undulated in long ridges, as if by subterranean ripples. Ash and oak coppices and larch plantations clothe its hill-sides and crests. Its lowlands are studded with pear and apple orchards, of such productiveness that Herefordshire sometimes, as well as Kent, is called the garden of England. The apple crop, generally large, is enormous one year out of four. Twenty hogsheads of cider, which is the county beverage, have been made from an acre of orchard, twelve being the ordinary yield. Hops are another staple of the county, the vines of which are planted in rows on ploughed land. As early as Camden's day a Herefordshire adage coupled Weobley ale with Leominster bread, indicating the county's capacity to produce fine wheat and barley, as well as hops. On the Worcestershire border above 10,000 acres are taken up in hop-plantations, and about Ledbury the clay lands are noted for wheat and hops.

SHROPSHIRE
WORCESTERSHIRE
RADNORSHIRE
BRECKNOCKSHIRE
MONMOUTHSHIRE
GLOUCESTERSHIRE
HEREFORD
LEOMINSTER
Ludlow
Tenbury
Bromyard
Ledbury
Ross
Newent
Mitcheldean
Drybrook
Lidbrook
Coleford
Newnham
Abergavenny
MONMOUTH
Presteigne
Knighton
Kington
Hay
Clun
Titterstone Clee Hill
Cleobury Mortimer
Scale of Miles

Herefordshire is also famous as a breeding county for its cattle of bright red hue, with mottled or white faces and sleek silky coats. The Horefords are stalwart and healthy, and, though not good milkers, put on more meat and fat at an early age, in proportion to food consumed, than almost any other variety. They produce the finest beef, and are more cheaply fed than Devons or Durhams, with which they are advantagoously crossed. As a dairy county Hereford does not rank high. Its small, white-faced, hornless, symmetrical breed of sheep known as "the Ryelands," from the district near Ross, where it was bred in most perfection, made the county long famous both for the flavor of its meat and the merino-like texture of its wool. Fuller says of this that it was best known as "Lempster ore," and the finest in all England. In its original form the breed is extinct, crossing with the Leicester having improved size and stamina at the cost of the fleece, and the chief breeds of sheep on Herefordshire farms at present are Shropshire Downs, Cotswolds, and Radnors, with their crosses. Agricultural horses of good quality are bred in the north, and saddle and coach horses may be met with at the fairs, especially Orleton, Brampton Bryan, and Huntington. Herefordshire has progressed greatly in farming within the last half century. Turnip and green-crop husbandry, with improved rotation, is the general rule, and an average yield of wheat is from 28 to 30 bushels an acre, while about Ross and the "Old Red" districts a yield of 40 bushels is obtained. Breeders' names from the county are famous at the national cattle shows, and the number, size, and quality of the stock are seen in their supply of the metropolitan and other markets. Prize Herefords are constantly exported to the colonies.

The county has no manufactures to speak of. Woollen goods have never been a successful staple of trade at Hereford; yarns and coarse woollens are made, however, in small quantities at Leominster and Kington. There are iron foundries for agricultural implements at Kington and Ross.

The agricultural returns of Great Britain for 1879 give the following statistics for Herefordshire:—

Corn crops (two-thirds being wheat and barley)	103,252	acres.
Green crops (of which two-thirds are turnips and swedes)	34,671	"
Grasses under rotation	40,092	"
Permanent pasture	246,533	"
Hops	5,947	"
Bare, fallow, and uncropped arable land	11,098	"

Live Stock.

Horses	21,206
Cattle	77,402
Sheep	340,741
Pigs	24,169

In all but the last item the live stock presents a marked increase on 1878; in corn crops there is a decreased acreage, in green crops and permanent pasture a considerable increase, and the area in hops is the same as in the previous year.

According to the parliamentary return of 1873 the county was divided among 13,731 proprietors, owning a total area of 506,559 acres, with a rental of £924,640. Of the propriotors, 9085 (66 per cent.) held less than 1 acre, and 2478 (18 per cent.) between 1 and 10 acres. The owners of the largest holdings are —J. H. Arkwright, Hampton Court, Leominster, 10,559 acres; A. R. Boughton Knight, Downton Castle, 10,081; R. D. Harley, Brampton Bryan, 9869; Sir George H. Cornewall, Moccas, 6946; Lord Bateman, Shobdon Court, 6815; Earl Somers, Eastnor Castle, 6668; Lord Ashburton, 6583; Major Meysey Clive, Whiteld, 5799; Lady Emily Foley, Stoke Edith Park, 5660; Sir Henry Cotterell, Garnons, 5066; Sir Henry E. Scudamore Stanhope, Holm Lacy, 5039; Major Peploe, Garnstone, 4928.

In Herefordshire inland navigation was represented in the early part of the century by the Gloucester and Newent and Ledbury canal; but this has been bought up for railway purposos, and the canal from Leominster to Woofferton, and thence eastward to Tenbury and Stourport, has also ceasod to exist. Horeford is an important railway centre: the Hereford, Ross, and Gloucester line is now amalgamated with the Great Western; the Shrewsbury and Hereford railway traverses the county southward from Woofferton, *viâ* Leominster, to Hereford. The Worcester line from Hereford, *viâ* Malvern, connects the county town with Oxford and London by an alternative route of the Midland and Groat Western; and the west of the county is served by the Midland line from Hereford to Brecon, while the Hereford, Abergavenny, and Nowport line accommodates the south-west. Branch lines run from Eardisley to Kington and Presteign, from Ross to Monmouth, from Worcester to Bromyard, and from Leominster to Kington.

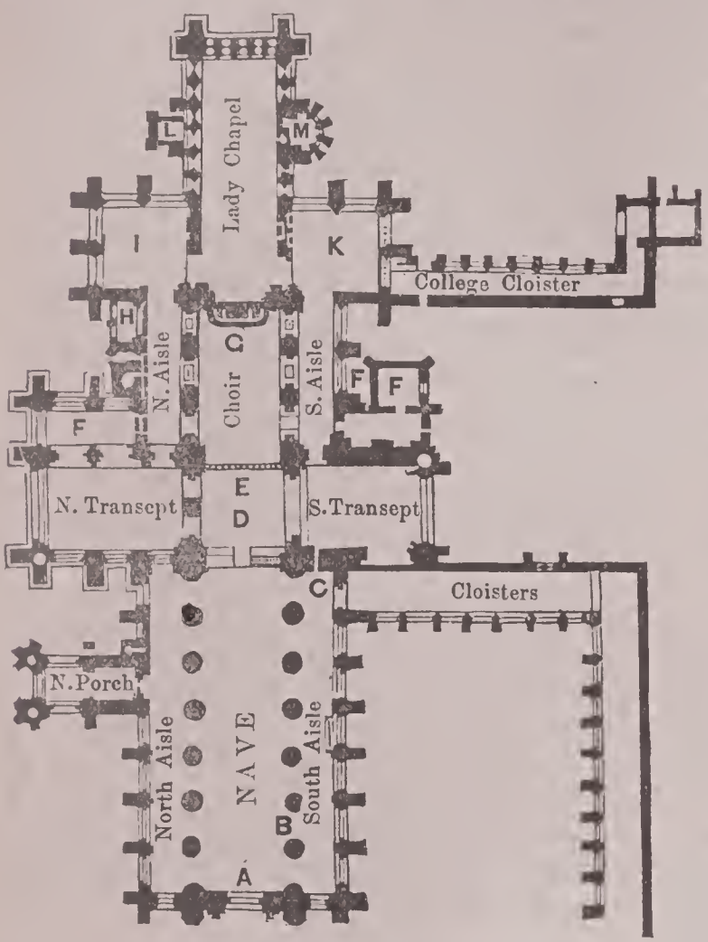
The latost statistics of public olementary schools show about 135 Church of England national or parochial schools, 6 board schools, 3 British and Foreign and 3 Roman Catholic schools in the county. Its population, which was 115,489 in 1851, had increased in 1871 to 125,370. Herefordshire is represented in parliament by 6 members—3 for the county, 2 for Hereford city, and 1 for the burgh of Leominster. Its towns, besides Horeford, are Ross, Leominster, Ledbury, Kington, and Bromyard; of these, Ross and Leominstor are the most considerable, though Kington, from its position on the Welsh border, drives a brisk trado. In Kington, Bromyard, Ledbury, and Ross, and such larger villages as Weobley and Orleton, survive many picturesquo timber and plaster houses of tho 15th and 16th centuries.

History.—The earliest known inhabitants of the county were the Silures, whose stout resistance to the Romans provoked the emperor Claudius to the war of extermination in which Ostorius Scapula took Caractacus prisoner. Coxwall Knoll, Caer Caradoc, and other heights contest the claim to have been the final standpoint against the Romans. Traces of tho Danes are found at Wigmoro; and in 912 they sailed up the Wye, and carried off from Archenfield the bishop of St. David's, who had to be redeemed with a large ransom. By the Normans the county was held on the tenure of repelling the Welsh, and for centuries the Marches of Wales were a debatable ground for Welsh and English. In the struggle between Maud and Stephen there was fighting in and around Herefordshire. When tho barons rose against Henry III. their hostilities affected this county, and it was the success of a plot of the earl of Gloucester, Roger Mortimer, and others to effect Prince Edward's escape out of De Montfort's hands that led to his flight to Wigmore, and the subsequent defeat of the barons at Evesham. In the Wars of the Roses a battle was fought on February 2, 1461, at Mortimer's Cross, near Kingsland, between Edward, earl of March (afterwards Edward IV.), and Jasper Tudor and James Butler, earls of Pembroke and Wiltshire, in behalf of Queen Margaret, which resulted in the victory of the Yorkists. The Marches were incorporated in the reign of Henry VIII. In the war between Charles I. and his parliament Herefordshiro suffered severely for its loyalty, and Horeford, Goodrich, and Ledbury endured sieges, all but the last ending in disaster to the king's party.

Antiquities.—The only pre-historic memorial in the county is the cromlech of Arthur's Stone on the hill above Bredwardine. A line of British entrenchments stretches from the Severn and from Malvern, where an earthwork is still known as the "Herefordshire Beacon," to Wapley, Croft Ambrey, and Coxwall Knoll, in the north of the county. A branch of the Watling Street road from Uriconium and South Shropshire crosses Horefordshire from Marlow to Longtown. Another Roman road camo direct from Gloucester (Glevum) to Ariconium or Weston-under-Penyard, and thence by a short route under Caplar Hill to Magna or Kenchester, but by a longer route to Monmouth, Usk, Abergavenny, and so through Magna to Shrewsbury. Offa's Dyko, the Saxon ruler's line of defence against the Welsh, is still traceable at Moorhampton, near Lyonshall, and beyond Kington. Offa's traditional palace, the scene of his murdor of Ethelbert, was at Sutton Walls, a little north of Hereford. Tho ruins of several Norman castles still exist at Wigmore, Clifford, Goodrich, and Brampton Bryan. Among the most interesting churches of that period are one or two remarkable structures of rare Irish Norman architecture, viz., Kilpeck, Moccas, and the arches of old Shobdon church; besides the Cistercian church of Abbey Dore, and the fine old churches of Ledbury and Leominster.

HEREFORD, the capital city of the above county, is situated on the left bank of the Wye, which is crossed there by a bridge of six arches. The see of Hereford was detached from Lichfield in 673, Putta being its first bishop. The removal of murdered Ethelbert's body from Marden to Hereford led to the foundation of a superior church, reconstructed by Bishop Athelstan, and burnt by the Welsh in 1055. Recommenced in 1079 by the first Norman bishop, Robert of Lorraine, it was carried on by Bishop Reynelm, and completed in 1148 by Bishop R. de Betun. The lady chapel, clerestory of the choir, and north transept date between 1226 and 1269, while successive additions and reconstructions have extended over 450 years. In 1786 the great western tower fell and carried with it the west front and the first bay of the nave, since which date there have been two modern restorations, in 1842 and 1863. The total length of the cathedral outside is 342 feet, inside 327 feet 5 inches, the nave being 158 feet 6 inches, the choir from screen to reredos 75 feet 6 inches, and the lady chapel 93 feet 5 inches. The breadth of the nave (span of roof) is 31 feet 4 inches, the nave and aisles, internally, 73 feet 4 inches, and the central transept 146 feet 2 inches. The height of choir is 62 feet 6 inches, of nave 64 feet, of lantern 96 feet, of tower to top of the leads 140 feet 6 inches, and to the top of the pinnacles 165 feet. The pillars and arches of the nave, the north and south arches of the choir, and the triforium are Norman in their architecture, as is also the font; the lady chapel, the clerestory, and stone vaulting, Early English. The north transept is of the date of Bishop Aqua-

blanca (1245–68), the south-east transept of Late Decorated. As the late Sir Gilbert Scott pointed out at Hereford to the Archæological Institute, but for the fall of the western tower, the consequent curtailment of the nave, and other solecisms, few cathedrals could offer so complete a field of progressive architectural study from Early Norman to latest Perpendicular. The cathedral can boast some fine monuments, notably St. Thomas of Cantilupe's shrine in the north transept, and Bishop Aquablanca's tomb. The "Mappa Mundi," compiled in 1300 or thereabouts by a monk of Lincoln, one of the largest and most curious of all the old maps, is preserved in the south choir aisle. The bishop's palace overlooks the Wye on the south of the cathedral, and to the left of it lies the castle green, the site of the historic castle, which is utterly effaced. One only of the six gates of the old walls is still to be seen, but there are ruins of the



Plan of Hereford Cathedral.

A. West Door.	E. Choir Screen.	I. N.E. Transept.
B. Font.	F. Vestries.	K. S. E. Transept.
C. Door to Cloisters.	G. Altar. [try.	L. Entrance to Crypt.
D. Central Tower.	H. Bp.Stanbery's Chan-	M. Audley Chapel.

Black Friars' Monastery in Widemarsh, and a mile out of Hereford on the Brecon Road, the White Cross, erected in 1347 by Bishop Charlton, and restored by Archdeacon Lord Saye and Sele, commemorates the departure of the Black Plague. For its loyalty and sufferings in the civil war Charles I. gave the city its motto "Invictæ fidelitatis præmium." It was incorporated in 1189 by Richard I., and is governed by a municipal council, consisting of a mayor, 6 aldermen, and 18 councillors. It has no manufactures. Its population at the census of 1901 numbered 21,382, or an increase of more than a third in twenty years; its area was 4969 acres. Its public buildings are the shire hall in St. Peter's Street, in the Grecian Doric style, with a statue of Sir George Cornewall Lewis in front of it; the corn-exchange (1858), the Rankin free library and Woolhope Club museum in Broad Street, and the Herefordshire middle-class college. The most noteworthy churches are All Saints and St. Peter's.

For the bibliography of the city and county of Hereford, see Duncumb's *Collections for a History*; Robinson's *Castles, Manors and Mansions*, 2 vols., 1869 and 1873; Webb's *History of the Civil War in Herefordshire*, 1879; Havergal's *Fasti Herefordenses*; *Quarterly Review*, art. "Herefordshire," July, 1879; and the *Woolhope Transactions*. (J. DA.)

HERENCIA, a town of Spain in the province of Ciudad Real, New Castile, is situated in a fertile, hilly region, near the junction of the rivers Giguela and Valdespino, about 80 miles south of Madrid. Soapmaking is the chief industry; coarse cloth, wax, and chocolate are also manufactured. Wheat, barley, vines, and olives are grown in the neighborhood, where also there is excellent pasturage. Population about 5,900.

HERERELAND, or DAMARALAND, a region of South-Western Africa, stretching north from the Kuisip to the Cunene, so called from the native race known to the Namaqua as Herero and to the Cape colonists as Damara (Damra, or Dama). The north-west portion is also known as Kaokoland. Since 1885 a part of German S.W. Africa.

According to the treaty of Okahandya, by which, in 1876, the country came in some sort under British protection,[1] the boundary line is fixed as coinciding in the south with the line of latitude passing through Rehoboth or Annis (a mission station in 17° 5′ E. long. and about 165 miles from the coast), thence in a straight line to Otyimbinde (Tunobis or Riet Fontein), in 20° 53′ E. long. and 22° 5′ S. lat., thence northwards to Otyiondarmie, and finally from that place westwards along the Omuramba Ovambo to the Cunene. The territory thus defined has an estimated area of 100,000 square miles; and of this about 35,000 square miles were marked out as a British reservation, bounded by a line drawn from Rehoboth to Otyimbinde, thence north-west to Otyituo, about 19° E. long. and 20° S. lat., thence west to Otyahevita, and south to the neighborhood of Mount Erongo. According to Palgrave the total population of Hereroland is 121,150, of whom 85,000 are Herero proper, 30,000 Hill Damara, 3000 Bushmen, 1500 Namaqua, 1500 Bastards, and 150 Europeans. In a paper in *Petermann's Mittheilungen*, 1878, based on information from the Rhenish missionaries, the total is given as 184,000, of whom 110,000 are Herero (80,000 Ova Herero and 30,000 Ova-mbanderu), 50,000 Hill Damara, 2500 Namaqua, 2000 Bastards, 20,000 Bushmen, and 300 whites.

Hereroland has a coast-line of 460 miles, but the only point where it offers shelter and access to ships is Walfish Bay, a safe but comparatively shallow harbor formed by Pelican Point immediately to the south of the mouth of the Kuisip. The country consists of three distinct physical regions—first, a long and narrow coast district backed by a very regular line of hills, of which the highest point appears to be Mount Messum or Dourissa; secondly, a broad mountainous tract, containing in the south such peaks as Omatako, 8800 feet, Ombotozu (Diambotodzu), 7300, Etyo, 4000, and far in the north Etendeka, 4000; and thirdly, a steppe region which stretches away into the Kalahari desert. The rivers of Hereroland, of which the most important, passing from south to north, are the Tsoachaub, the Eisib or Omaruru, the Ugab, and the Huab, are mere wadies, which only at intervals succeed in bringing water as far as the sea. Except in the half-dry river-beds, the coast district is almost destitute of vegetation, the only edible fruit being the *nara*, which grows on the sand-downs, and is, according to Anderson, eaten by oxen, mice, men, ostriches, and lions. In the mountainous tract there are places of considerable fertility; large trees, as sycamores, etc., grow along the river-beds, and euphorbias, tamarisks, and a variety of strong-spined bushes prevail. In a few favored spots wheat can be cultivated, and from a single grain as many as 150 stalks may be produced. The coast range and many of the mountains, such as Okonyonyo and Amatako, are composed of granite and gneiss, broken by intrusive quartz and porphyry; further east limestone formations, both Carboniferous and Oolitic, are predominant; and these again give place to sandstone strata, which are weathered into table-shaped eminences. The granite and gneiss are being disintegrated with great rapidity. Both iron and copper are said to occur in considerable abundance, though the mineral exploitation of the country has had no satisfactory result. About 25 mineral springs, both hot and cold, are known to exist among the mountains.

An interesting sketch of the climate was contributed by Dr. A. von Danckelmann to the *Zeitschr. der österr. Gesellsch. für*

[1] See *Damara and Namaqua Land: Report of W. Coates Palgrave, Esq., special commissioner to the tribes north of the Orange River, of his mission to Damaraland and Great Namaqualand in 1876*, Cape Town, 1877.

Meteor., 1878. Owing, it would appear, to the cold current in the neighboring sea, the coast region is almost rainless; though occasionally, in the rainy season of the interior, storm-clouds with thunder and lightning come from the east, and from September to March south-west winds laden with heavy mist blow almost without interruption. In the interior the year is divided into a regular dry and wet season, the former lasting from May to November. From September onwards the air is so clear that the planet Venus can be distinguished at midday, and every object looks so distinct that it is almost impossible to calculate distances correctly. Even during the rainy season the nights are usually cloudless. Not unfrequently before the beginning of the rains "sand-spouts," or, as they are called by the natives, Kumb'anhara or "rain-beggars," drive across the country. No support is afforded by the observations in Hereroland to the theory of the periodicity of African rain in accordance with the changes of the sun spots; but there would seem to be a gradual decrease of atmospheric precipitation. From September to December the east wind usually blows in the morning, but it passes round to the north-west in the forenoon. From December to April the east is decidedly predominant. Snow is extremely rare, but night frosts occur several times a year, and ice has been found inch thick. In the dry season the daily range of the thermometer is from 32° or 36° Fahr. to 75° or 79°; in the rainy season from 86° or 95° to 68° or 82°.

The Herero are the dominant race. They are well-formed, of good stature, and of regular features. Their complexion is usually dark but not black; but there is sufficient variety to lead them to classify themselves into the Ovathorondu or "red folks" and the Ovatherandu or "dark folks." Their scanty clothing consists mainly of skins and leather thongs, and both their garments and their bodies are thickly smeared with ochre and grease. The women's head-dress is a curious three-eared helmet. Assegais, bows and arrows, and knobsticks or kieries are the native weapons, but guns and even breechloaders are growing not uncommon. The whole race is in the pastoral stage, and some of the chiefs possess very extensive property in cattle. The various olans or "uandas" have each its own totem; and thus to one man it is a sin to partake of the flesh of a red cow and to another a one-horned sheep is equally sacred. By their language (Otyiherero) the Herero belong to the great Bantu family. For our acquaintance with it we are mainly indebted to the Rhenish missionaries, and more particularly to Dr. Hahn, who published *Grundzüge einer Grammatik der Herero*, Berlin, 1857. A spelling book (Cape Town, 1848) appears to be the earliest work printed in the tongue.

The Herero would seem to have come from the north, and they probably first appeared to the south of the Cunene about 150 years ago, to the dismay of the Hill Damara (Houquoin, Ihaukoin, Ovazoratu, or Ghoudamoup), a peculiar race who now occupy the fastnesses of the country, and speak the Nama or Hottentot language with a foreign accent, though there is no tradition of their having used any other. The Herero were subjugated by Jonker Afrikaner, and for a time were scattered among the Namaqua tribes, but about 1865 they recovered their independence. They are still unfriendly to the Hill Damara, who steal their cattle, and they are beginning to hunt down the Bushmen. A single tribe of the Namaqua, which sided with them in their war of liberty, is still settled near Mount Erongo.

Besides the works already mentioned, and the travels of Baines, Galton, and Anderson, see Hahn, "Die Ova-Herero," in *Zeitsch. für Erdkunde*, Berlin, 1868 and 1869, and "Reise im Lande der Herero," in Petermann's *Mittheilungen*, 1873.

HERESY is the English equivalent of the Greek word *αἵρεσις*, which has had a somewhat varied ecclesiastical use. The first employment of the word in the New Testament is to denote a sect or school of opinion among the Jews. We read of the heresy of the Sadducees (*αἵρεσις τῶν Σαδδουκαίων*, Acts v. 17), the heresy of the Pharisees (*αἵρεσις τῶν Φαρισαίων* Acts xv. 5), and St. Paul speaking to Agrippa says, "After the straitest heresy of our religion I lived a Pharisee" (*κατὰ τὴν ἀκριβεστάτην αἵρεσιν τῆς ἡμετέρας θρησκείας*, etc., Acts xxvi. 5). Christianity itself was in the beginning looked upon as one of those sects or schools of Jewish opinion, and the "heresy" of the Nazarenes (Acts xxiv. 5) is spoken of as well as the heresy of the Pharisees (*cf.* Acts xxiv. 14, Acts xxviii. 22). This use of the term is plainly borrowed from classical Greek, where *αἵρεσις* frequently means a school of Roman jurists or a school of philosophy (*cf.* Cic., *Epis. ad Fam.* xv. 16; Diog. Laert., *Procem.*, 13). In the New Testament the word is used in another sense which is purely ecclesiastical. Thus in Titus iii. 10 the apostle says: "A man who is an *heretic* after the first and second admonition reject;" in 2 Pet. ii. 1 the church is warned against false teachers, "who privily shall bring in damnable *heresies*, even denying the Lord that bought them," and these heretics and false teachers are evidently the same as those of whom Paul, in the Epistle to the Galatians, says that they are to be anathematized. They are men who in the name of Christ preach such doctrines as tend to frustrate the grace of Christ, who preach "another gospel" (Gal. i. 8, 9); they are compared to the false prophets of the Old Testament Scriptures; they cause divisions and schisms in the church (1 Cor. xi. 18, 19); and the heresies they are guilty of are classed along with grave moral offences (Gal. v. 20). It is this second New Testament use of the word which was taken over into ecclesiastical terminology, and it is in this sense that the early Christian writers speak of heresy and heretics. This early ecclesiastical use has continued down to the present, save that in earlier times schism was generally included under heresy, the names and the things not being separated by definition. It is interesting, however, to notice that the earlier New Testament use of the word seems to have lingered on. Tertullian (*Apolog.* c. 1) calls the church a *sect*, which is the Latin equivalent for *heresy*, and in the same way Constantine called the church (Eusebius, *H. E.*, x. 5, §§ 21–22) *ἡ αἵρεσις ἡ καθολική, ἡ ἁγιωτάτη αἵρεσις*.

Heresy means a grave error in matters of faith, but it is much more than a theological or ecclesiastical term. From the days of the emperor Theodosius at the latest, the Christian religion has been intimately connected with law, and heresy is a legal term, with a definite meaning attaching to it; a heresy was a crime with punishment annexed, and therefore was capable of legal definition. It was an offence in canon law, and it was also for long an offence according to civil law. The theological meaning, and the definitions according to canon law and according to civil law respectively, are all different from each other and must be separately explained.

1. *The Theological Sense of the Term.*—The early Christian writers say a great deal about heresy, but commonly refrain from telling what it is. They describe heresies, but they only denounce heresy. It is vain to look for a definition of it in Irenæus's *Against Heresies*, in Hippolytus's *Refutation of all Heresies*, in Tertullian's *Prescription against Heretics*. It is possible, indeed, to collect from these one or two leading tests of heresy, but no definition is to be found. The common features of heresy are too well known to call for specific enumeration. We can gather from Irenæus that heretics are those who reject Scripture, who refuse to accept the "doctrina tradita," who deny the authority of the clergy who have come in regular succession from the apostles, who keep aloof from the Catholic Church, the sole depositary of apostolic doctrine (*Against Heresies*, iii. 2–4). Tertullian, in his usual succinct manner, calls every man a heretic who does not at once accept the "Regula Fidei," and he refuses to argue with such a man even though the heretic proceeds to adduce arguments from Scripture. "A controversy over Scripture with heretics can clearly produce no other effect than to help to upset either the stomach or the brain" (*Præscr. adv. Hær.*, 16). In the Eastern Church, after the period of the œcumenical councils, Tertullian's test was the touchstone of heresy. The church had her rule of faith expanded into the Nicæo-Constantinopolitan creed, with the various explanations added in the symbols of the remaining œcumenical councils, and a heretic was one who denied this creed in whole or in part. In the Western Church, on the other hand, theologians were accustomed to define heresy in a vague way. Thus Jerome calls heresy "perversum dogma;" a heretic, with him, is one who interprets Scripture in other fashion than according to the witness of the Spirit of God; and Augustine summarily defines heresy to be the invention or retention of new and false opinions. But whatever the definition, the rough and ready test was always nonconformity to the "formula fidei præscripta ab ecclesia Romana." Instead of definition the Eastern Church simply points to the creed and the œcumenical councils, the Western Church to the rule of faith enjoined by Rome.

These meagre definitions, extracted from the writings of early theologians, all of them going back in the last resort to the recognized creed of the church for the time being, imply, in spite of their vagueness, that there is a certain essential kernel of doctrine in Christianity, which cannot be denied or challenged without involving the destruction of Christianity itself, and they all point the way to a fuller description of what is meant by heresy in the theological sense of the word. Heresy is a doctrine which, with the appearance of Christian doctrine, is really contradictory to

the essential nature of Christianity, and, if persisted in, would in the end make Christianity something very different from what it really is. In order, therefore, to say what heresy is, it is necessary to know what the essential nature of Christianity is, and therefore heresy is generally described by reference to the fundamental nature of Christianity, while the real nature of Christian doctrine is commonly brought out by contrasting it with heresy.

When we look at the matter historically we see that Christianity has always taken the shape of a community thinking and acting for the most part together, and that it has always implied a common life, common work, common ideas. Christianity appears in history as a community whose common work is to confess and to adore God because of what He has done for His people in salvation. This twofold work of confession and worship has manifested itself in a double organization,—an organization of thought and an organization of work,—doctrine and polity. There may be the church without a creed, and the heart-church without the *congregatio;* but that is not the way in which Christianity has taken actual historical shape. It is possible to conceive the entrance of a heterogeneous element into this organization on either side. A heterogeneous element, something really foreign to it, may become organized with the church's doctrine, or may have become incorporated in the church's polity, and whenever this happens there is a doctrine, apparently Christian, which is really subversive of Christianity, there is a polity which, apparently Christian, is really opposed to the real life of the *congregatio.* This possibility is the historical root of the origin both of heresy and of schism; for heresy is just a heterogeneous element imbedded in the organized dogmatic of the church, and schism is a foreign element which has found its way into church polity. This description, however, is somewhat misleading, because it may happen that an element which seems heterogeneous is not really so, but is on the contrary a true part of the organization. Heresy is not only apparently but really foreign to the system in which it has become incorporated. Its nature is different, and its source is different. Mere apparent incongruity, therefore, does not prove heresy. A doctrine must be seen to be really contradictory to the fundamental facts of Christianity, and to have come from a different source, before it can be called a heresy. It has frequently happened, accordingly, that doctrines have been judged heretical which a better acquaintance with the nature of Christianity would have pronounced orthodox.

Christianity, under the many forms which it assumes, has always implied the reconciliation of God and man through the person and work of Christ. It implies that Jesus Christ the Saviour has so brought it about that He has established a new kingdom of God which will last, in which men have communion with God through His Spirit. Christianity is complete when the kingdom of God is fully established. "Thy kingdom come" is its aspiration. It therefore implies a moral separation between God and man—a separation which is overcome by the work of Christ the Mediator. The idea of reconciliation is the central thing in Christianity, the essential part in its description. God, man unable to approach God until reconciliation has been made, Christ the Mediator, who reconciles, and his people brought again into communion with God,—all Christian doctrine rings the changes on these four fundamental ideas. Whatever contradicts or tends to destroy these, or their relations to each other, is incompatible with Christianity. Whenever any of these four ideas,—God, man, Christ, and the kingdom of God —are so misread as to introduce notions incompatible with the relations in which they stand to each other in Christianity, then heresy enters. Theology therefore (and Protestant theology only carries the idea somewhat further) has usually recognized four kinds of heresy, corresponding to the four fundamental ideas on which Christian doctrine rests. The nature and character of God and of His relation to the universe and to man may be so misread as to make reconciliation an impossible thing, and so also may the nature of Christ, the nature of man, and the nature of the results of Christ's work among men. Hence arise heresies about God, about the person of Christ, about the nature of man, and about the results of Christ's work,—all of them being doctrines which are incompatible with the idea of reconciliation.

I. Reconciliation implies that man has been separated by sin from God, and that God can overcome this separation. All descriptions of God, of His nature, character, and works, which contradict this fact may give rise to heresies. Thus God cannot overcome the separation if it he impossible for Him to project Himself heyond Himself for salvation. The nature of the Godhead may be so described as to contradict the idea of reconciliation, as *e. g.*, in the Arian heresy. Again, all descriptions of God's relations to the universe which imply that the universe and all things are not absolutely dependent on him, which imply that His gracious purpose can be thwarted, contradict the idea of reconciliation, and so may give rise to heresies, *e. g.*, the Gnostic doctrine that matter is independent of God. Misstatements ahout God's relation to Himself and ahout His relation to the universe give rise to two different kinds of heresy.

II. Reconciliation implies a real mediator who can accomplish the reconciliation on both its sides, and so heresies may arise ahout the nature of Christ. The Saviour may he so described that there is no real mediation, and no real reconciliation. These errors may arise in two ways, as one or other side of the mediator is described. The Saviour may he represented so that He has no real relation to God on the one hand or to man on the other. He may he described in such a way that there is no solidarity hetween Him and God, as *e. g.*, in the Ehionite heresy; or He may be described in such a way that there is no solidarity between Him and man, as in the Docetist heresy. Misstatements ahout the relation of Christ to God and the relation of Christ to man give rise to two different kinds of heresy.

III. Reconciliation implies that man is so separated from God hy sin that there is real need for salvation, and yet not so separated that he cannot he brought into communion with God again; and the nature of man, and especially the presence of sin in man, may he so described as to set aside these requirements. The fact of sin and its presence in man may he so explained away as to leave little ground for the necessity of reconciliation, *e. g.*, in the Pelagian heresy. Again, on the other hand, the fact and presence of sin may he so described that there is no capacity in man for salvation; it may be alleged that sin belongs to the essential nature of man and cannot be removed, *e. g.*, in the Manichæan heresy. These two misstatements about the connection hetween man and sin give rise to two kinds of heresy.

IV. The results of the reconciliation effected hy Christ may also he misrepresented in two ways. The separation between man and God, which is the formal occasion of the reconciliation, was caused hy sin; and the distance hetween God and man is a moral one. It is not such a separation as might arise from the difference hetween the divine and the human nature, or from the inevitahle distance hetween Creator and creature. And so reconciliation has for its effect, not mere ahsorption into God, hut the restoration of moral communion hetween God and His people. The intercourse was broken hy sin, and the result of reconciliation must be moral; it must take effect in a change of will, in the creation of a life of new ohedience. False ideas arise when this is misrepresented, and these misrepresentations can arise in two ways:—when it is said that the action of divine grace impregnates the nature in a magical way, instead of taking effect on the will in a moral fashion, *e. g.*, the magical idea of sacramental efficacy; or when it is said that the result of the reconciliation is to raise man above the necessity of living a moral life and of conforming to the laws of morality, *e. g.*, the Antinomian heresy.

Thus theology finds at least eight separate kinds of heresy, arising from the entrance of foreign elements into the four fundamental ideas of Christianity. All heresies may be reduced to one or other of these eight classes. In point of fact, however, most heresies which have actually arisen cannot be said to belong purely to any one of them. The class only denotes the type; for one error is apt to bring others in its train, and so most heresies are mixed, and do not in all respects conform to their type.

Theologians, however, have not rested content with the mere theoretical or genetic description of heresy and heretics, and have commonly borrowed distinctions first laid down by jurists in canon law to distinguish more narrowly the characteristic marks of heresy. Thus a false doctrine to be a heresy must be an *intellectual* error, it must be held *voluntarily*, it must contradict a doctrine *already defined* by the formula of the church, it must be held *pertinaciously*, and the heretic must be professedly *within the church;* but these distinctions belong properly to the legal aspect of heresy, and must be referred to again.

Many theologians, Schleiermacher among others, have attempted to describe the actual origin of heresies, and a common mode of explanation is as follows. Heresies arise in that province of theology called dogmatic, and commonly appear during the definition of some important part of dogmatic theology. Dogmatic theology is the rationale of

the spiritual events and forces which have called Christianity into being. In the attempt made by the church to understand these events and forces which have called it into being, its attention has commonly been confined to the more outstanding portions. The history of dogmatic shows us that from time to time the church has endeavored to master one doctrine, not the whole round of doctrines; it has endeavored to make distinct single points, instead of working at the various relations of all the doctrines to each other. This very natural mode of work has the one disadvantage that it concentrates attention on isolated portions of doctrine rather than on the whole mass, and between the consecutive portions there are gaps. The mind of man, however, like nature, abhors a vacuum, and summarily fills these vacua up with material usually drawn from the prevailing philosophical or scientific theories of the day. These summary explanations or theories may or may not be in accordance with the spirit of Christianity, and when they are not they become a fruitful source of heresies. One of the best illustrations of this is the introduction into theology of the Aristotelian doctrine of *τὸ ἑκούσιον*, which gave the church the Pelagian heresy along with some others.

So much for the general theological conception of heresy, of its nature, divisions, and sources; but before proceeding to describe the use of the term in canon law, it should be observed that the theological does not always correspond with the ecclesiastical meaning of the word. It is generally acknowledged that Holy Scripture is the source of doctrine, and that for the due understanding thereof the enlightening guidance of the Holy Spirit is required: though, of course, the precise meaning of this statement varies in different systems of theology. Holy Scripture and the witness of the Spirit of God are thus the touchstone of heresy. In the Roman Catholic and Greek Churches, however, it is held that the enlightening guidance of the Holy Spirit in this respect is restrained within the limits of certain ecclesiastical machinery (the œcumenical council, the pope *ex cathedra*, etc.), which are the only channels through which the Spirit comes to the church, and hence the creed of the church rather than Scripture is the real touchstone of heresy. Protestant theologians, on the other hand, do not believe either that the guidance of the Spirit is always present within this ecclesiastical machinery or that it is given in this way only, and so they make a distinction between mere ecclesiastical and real theological heresies. Ecclesiastical heresies arise when a fundamental statement made in the creed or confession is contradicted. But it may happen, since creeds and councils may err, that the error is not in the contradiction but in the creed, and therefore there is always an appeal from the creed to the Scripture. The ecclesiastical idea of heresy has always the theological idea behind it, and may at any time be corrected by it. Roman Catholic and Greek theologians, on the other hand, do not admit any going behind the record; they do not allow any appeal from the creed to Scripture. According to their ideas the creed is the infallible digest of Scripture, and therefore heresy is to be tested by the creed and not by Scripture—that is, the ecclesiastical and theological ideas of heresy are exactly the same.

2. *Heresy according to Canon Law.*—Canon law was the ecclesiastical law of mediæval Europe, and is still the law of the Roman Catholic Church, and its description of heresy and of heretics is almost more important than the theological in the investigation of the matter from the historical side. Canon law regards heresy from the practical side of ecclesiastical procedure and legal enactment. Its view is much narrower than the theological, but much more precise. Orthodoxy is the doctrine maintained by the infallible Roman Church and assented to by all its faithful members; heresy is dissent from the articles of faith established by the Roman pontiffs and by the councils of the Roman Church. Canon law also is mainly concerned with heresy in order to punish it, and therefore is obliged to treat the whole subject with severe legal accuracy of statement. It proceeds from strict definitions. Perhaps the commonest definition is the following:—heresy is "error intellectus voluntarius contra aliquam propositionem catholicam cum pertinacia assertus ab eo qui baptismum accepit." Jurists are accustomed to expand this general definition in a variety of qualifying statements. (*a*) All heresy is error, but every error is not a heresy. It is an error according to canon law to take usury; it is heresy to say that to take usury is not a sin, but taking usury is no heresy. Heresy is intellectual error. It is intellectual error believed to be truth, and that in spite of predominant opinion. Canonists distinguish between members of the Roman Church who refuse, *e. g.*, to accept the "filioque" clause in the creed, and members of the Greek Church who make the same refusal. The refusal is in both cases an error, but it is a heresy only in the Roman Church, for there only the predominant opinion is against the error. (*b*) An error also only becomes heresy when it is held voluntarily. To be a heretic a man must stick to his error, although he knows that it has been condemned by the church. A heretic not only errs, but knows that he errs, and wishes to err. (*c*) Nor is every voluntary error a heresy; the heretic must contradict a doctrine which has been clearly stated in the creed and has become part of the defined faith of the church. (*d*) Nor is an erroneous opinion voluntarily professed in opposition to the creed of the church heresy, unless the heretic persists in it. Pertinacity, all canonists insist, is an essential element in heresy, and unless it is present no process for heresy can legally proceed. (*e*) And lastly, a heretic must be a member of the church. He must have been baptized. Neither a Jew, a Mahometan, nor a heathen can be a heretic. They may be unbelievers, they may hold erroneous opinions, but their opinions are not heresies.

From the first qualification, that heresy is an intellectual error, canonists deduce the ground of their enactments against the suspicion of heresy and against those suspected. Canon law uniformly proceeds on the idea that heresy is not merely an error but a crime. It is a crime, however, which belongs to the invisible part of man, to his intellect. It is not something done with his hands or his feet which witnesses can see, and they argue that direct proof is therefore almost impossible, and that the commission of the crime must almost always be proved from suspicions. This suspicion of heresy occupies a very large space in the dissertations of canonists, and the weakness of their position has made them bring in a very great number of reasons which they seem to think strengthen it (see especially Dandinus, *De suspect. de hæresibus*). They carefully define the degrees of suspicion with the conduct appropriate to each: where the suspicion is only "light," the suspected are simply to be watched; where it is "vehement," they are to be denounced; where it is "violent," they are to be treated as heretics. Canonists have carefully analyzed and arranged what are reasonable grounds of suspicion. Pope Innocent III. declared that to lead a solitary life, to refuse to accommodate one's self to the prevailing manners of society, and to frequent unauthorized religious meetings were abundant grounds of suspicion; while later canonists were accustomed to give lists of deeds which made the doers suspect:—a priest who did not celebrate mass, a layman who was seen in clerical robes, those who favored heretics, received them as guests, gave them safe conduct, tolerated them, trusted them, defended them, fought under them, or read their books, were all to be suspect. The canonist rules for suspicion became a sort of inquisitor's *vade mecum*, and when really practised produced a reign of terror.

Since canon law regarded heresy with such horror and detestation, it is not surprising that it gives many directions, which have the force of legal enactments, whereby men may avoid the dangers of heresy. Pope Alexander IV. prohibited laymen from arguing about matters of faith. The council of Toledo (1129), anxious to put down the Albigenses, ordained that every man above fourteen and every woman above twelve years of age should solemnly swear to abjure every heresy and to maintain in its completeness the Catholic faith. Pope Pius IV. ordered the laity to abstain from reading the Scriptures in the vulgar tongue. The promiscuous reading of books was forbidden, and an index of prohibited books believed to be dangerous to faith or morals was formed.

Canon law regards heresy as a crime, and while it recognizes that the power of the church is spiritual, and that the church visits offences with spiritual punishments such as excommunication, it proceeds on the idea that the state should assist the church in suppressing heresy, and visit heretics with civil pains and penalties, including torture and capital punishment; but this side of the history of heresy belongs as much to civil as to canon law. The church, however, did what it could against heretics. The

council of Laodicea (can. 6–9) prohibited them from attending service, though from subsequent acts this could not have been enforced. They were not allowed to give evidence in an ecclesiastical court; a father was prohibited from allowing his son or daughter to marry a heretic; social intercourse with them was prohibited, etc.

3. *Heresy according to Civil Law.*—Civil law treats heresy in a still simpler fashion. The legal idea seems to have been that, since the state approved of one creed and gave it public recognition, to profess any other creed was in some sense civil disaffection or a kind of treason, and manifested lack of loyalty. This notion, however, was supplemented by another and much deeper one in the public law of the mediæval empire. According to the ideas of the earlier mediæval jurists, civil government and ecclesiastical government were equally and in the same sense ordinances of God; and this thought found expression in the twin conceptions of world-king and world-priest, emperor and pope, who were God's vicars, and ruled in His name over church and state. God was the king of the world; the emperor was His vicar, and treason, therefore, included treason against God, or heresy, as well as treason against the emperor. This idea lingered long, and indeed still lingers, and complicates the simpler civil notion of heresy. For all practical purposes, however, the deeper thought may be discarded. In civil law, heresy is pertinacious dissent from the creed approved of for the time being. For example, the Lutheran creed, the *Confessio Augustana*, was heresy in all parts of Germany up to the peace of Augsburg, when it was recognized as a creed which might be professed. It then became orthodox in the civil sense of the term, in the same way that the Roman Catholic creed was orthodox, while the Calvinist creed, still unrecognized, was heresy.

Civil punishment followed religious offences as early as the time of Constantine, who enacted severe penalties against the Donatists, and ordained that all possessing Arian books should burn them on the pain of death. Laws against the reading of heretical books became very frequent during and after the 4th century. Arcadius made the reading of books written by the Eunomians a capital offence. Theodosius and Valentinian proscribed Nestorian books, and Valentinian and Marcian the books of Eutyches and Nestorius. The custom became so common that the condemnation of any heresy by the church was followed by the proscription of the writings of members of the sect. The *Codex Theodosianus*, bk. xvi. tit. 5, "De hæreticis," enumerates a great variety of laws against heresy with penalties more or less severe. They had the practical effect of declaring heretics outlaws, who could not hold offices of dignity or value, receive or bequeath money, enforce contracts, etc. In some cases death was the punishment for heresy. Justinian made it impossible for any heretic to bear witness in the civil courts of the land. This legislation may all be traced back to the action of Theodosius, who imposed the Nicene creed upon all his subjects, and made it a law of the land. It continued in force during the Middle Ages, and in consequence heretics who could not accept the Nicene creed were outlaws also. This perhaps explains the curious fact that almost all the mediæval heretics were also revolutionists. During the Middle Ages, especially from the time of Innocent III. onwards, civil interference in cases of heresy was much increased. In the early church the power of discipline belonged to the presbytery, and was afterwards usurped by the bishops, who continued to exercise it in matters of heresy until Innocent III. appointed the Inquisition to deal with heretics. So long as the empire was not Christian, the civil law had nothing to do with the punishment of erroneous opinions, but as soon as Christianity became the authorized religion of the state, the old pagan idea that the state has power to punish *religiones novas et illicitas* was revived. The state, either instructed by the church or, as in the Theodosian code, without instruction, visited with civil pains and penalties all such opinions. This came to a height when the Inquisition was established; and civil courts and national assemblies one after another decreed that whatever penalties were imposed by the Inquisition should be imposed by the state, or else handed over all cases of heresy to the Inquisition to be dealt with as matters deserving the infliction of civil penalties, fines, imprisonment, torture, and death. There is no sadder page in the history of the church than her alliance with the state for the purpose of torturing men out of opinions different from her own. Since the Reformation the persecuting spirit, although tenacious of life, has been gradually dying out.

Principal Heresies.—Early Christian theologians wrote a great many books against heretics in which they enumerated the various heresies which had sprung up in the church up to their own time. St. Augustine tells us (*Ep.* 222) that Philastrius, bishop of Brescia, had discovered 28 heresies among the Jews before the coming of Christ, and 128 in the Christian Church afterwards; and many other orthodox writers have given very long lists of these erroneous opinions. It was natural that the early centuries of the Christian era, especially the first five, should be somewhat prolific in heresies, because that was the very period when the church was occupied in defining the principal doctrines of Christianity. A history of heresies must spend most time upon the early centuries. The first dogmatic work of the church was to define the nature of Christ, who occupied the central place in its thought, and it had to steer its way between two opposite views, both of which interfered with the full dogmatic expression of the nature of the Mediator. On the one hand, many of the Jewish converts never rose to the height of the Christian idea of the person of Christ, and it is evident that these must have been very numerous from the emphasis with which it is insisted that Christians should *θεολογεῖν τὸν υἱόν*. These Jewish converts preferred to regard the Saviour as the last of the prophets, one who bore the same relation to God and to man as the prophets did. They shrank from the idea of the incarnation; they seemed to feel no need for the divine Saviour. This theory was of course accompanied by other views about the nature of Christianity, but the main element was opposition to the Christian doctrine of the real divinity of Christ, God who has become man. This Ebionite heresy has been maintained by men who wish to call themselves Christians since these early days, and has taken a great variety of shapes; but whether it is held by Jew or Unitarian, there is the same outline of opinion and the same steadfast repugnance to the doctrine of the incarnation. On the other hand, the philosophic doctrine of the repugnance between matter and spirit, the idea, which runs through all Greek philosophy, that matter is the source of evil, induced many of the early Gentile converts to Christianity to think of the incarnation as a metaphor rather than as a fact. Christ, they thought, did not take, but only seemed to take, a human body. These Docetists, as they were called, had a whole series of successors in the early church. When Christian theology advanced step by step in the definition of the doctrine of the person of Christ, it was this old idea of the repugnance between the divine spirit and human nature embodied that lay at the root of the Apollinarian, Eutychian, and Monophysite heresies. Apollinaris denied that the Theanthropos had a "reasonable" soul; he denied the full humanity of the Saviour. Eutyches denied that the Theanthropos had a human nature; and the Monophysites in their various theories, held strongly by the same idea. All these theories, however different in form and expression, denied the full and true humanity of Christ, and so contradicted the church's yearning for a Saviour truly man as well as truly God. These heresies, along with the Nestorian, were all finally condemned at the council of Chalcedon, the fourth œcumenical.

But long before the church had definitely set forth the doctrine of the person of Christ, its attention was turned to the doctrine of the essential nature of the Godhead. At first this doctrine was scarcely considered apart from Christology. It is impossible to separate the history of the doctrine of the Trinity from the doctrine of the person of Christ; for long the two separate problems were inextricably mixed. At length it became evident to the mind of the church that there were two doctrines, and Christian theology turned aside to discuss, and if possible settle, the doctrine of the essential nature of the Godhead before it proceeded to exhaust the doctrine of the person of Christ. For the real problem in the Arian controversy was not the divinity of the Mediator but the nature of God. Is God to be thought of as a Trinity or as a Unity? what is the relation of the Second Person in the Trinity to the First Person? The real gain to Christian theology which came from the discussions in the Arian controversy was to thrust out the Greek conception of Deity as the Absolute who cannot be described save by negations, and to put in its stead a Christian conception which shows that there are

motions within the Deity which, however incomprehensible, enable us to know that God may be in sympathy with men, and that all things may live, move, and have their being in Him.

The philosophical idea that matter is the source of evil, that matter has always some stubborn element in it by which it can defy the ideal, gave rise to a whole series of ancient and mediæval heresies. The Gnostics in all their various sects distinguished between God and the Creator. The good God, they held, could not defile Himself by contact with matter, and therefore could not be the God of creation and providence. Christian theology, on the other hand, has always confessed God to be the Almighty Maker of heaven and earth, and all things seen and unseen, and the necessity for such a doctrine of creation consists in the fact that the Christian consciousness demands the absence of any thing that might come in between God and the furtherance of His plan of salvation. It demands that all things be thought of as dependent on God, in order that He may be able to make all things work together for the good of His people; and so it has strenuously asserted the doctrines of creation and providence in opposition to an independent matter and the reign of fate. The Gnostic ideas were repeated by the Manichæans and by several mediæval sects, such as the Paulicians and Messalians, and, in the Eastern Church, by the Bogomili.

The Pelagian and Manichæan heresies principally concern the Christian doctrine of man and of the presence of sin in man, and contradict the church's creed, because they do away with the Christian doctrine of reconciliation. Pelagianism, it was held, denied the need of God's grace by insisting that man was free from indwelling sin at the beginning of his career, and followed good, when he did follow it, by the power of his own will; while Manichæism, by asserting that sin belonged to the essential nature of man, seemed to paralyze the whole divine action in reconciliation. It was held by the orthodox opponents of Pelagius that his opinions really implied that there was no real need for the Saviour and the salvation which Christianity describes, and that semi-Pelagianism, although much nearer orthodox doctrine, very inadequately comprehended that sinfulness in man which rendered reconciliation indispensable ere there could be a restoration of communion with God.

The Antinomian and various kinds of mystical theories about the Christian life all proceed upon a view of the effects of Christ's work which is at variance with fundamental Christian ideas. Christian doctrine teaches that men reconciled to God will strive to live a life of new obedience to Him, and it holds that this life of new obedience comes under the same moral laws as the ordinary life of man. But many Christian sects have professed theories about this life of new obedience which seem to imply that it is not under the laws of ordinary morality, that Christian freedom means license to do what ordinary morals forbid. The Epistles to the Corinthians seem to say that such theories were held in the apostolic church, and were denounced by the apostles; many of the Gnostic and Manichæan sects undoubtedly professed them. The same views occur again and again in mediæval heresy, and were held by many of the enthusiastic sectaries in Reformation times and later. The Brethren of the Free Spirit in the 13th and 14th century, the Anabaptists during the Reformation period, and some of the followers of Molinos are examples. The mystical theories which so largely entered into the mediæval church, and which have continually clung to the skirts of Christianity, have in many instances proceeded on the principle that the new life is implanted in man in a physical way, and magical ideas of the means of grace have been very destructive to the moral theory of the Christian life.

The history of the mediæval heretical sects is by far too complicated to be entered on here. Many of them did no more than protest against the hierarchical constitution of the church of the Middle Ages. Most of them only sought room to carry out to the full their ideas of a true "Imitatio Christi," but it is also certain that a good many Gnostic and Antinomian tenets were held. The Friends of God, the Fratricelli, the Beghards, were all mystics, but their mysticism was of a very harmless description; while the Brethren of the Common Life were worthy forerunners of the pietists of the 18th century (see MYSTICS).

The heretics of the Reformation Church scarcely call for separate remark. The Zwickau prophets and the Anabaptists held opinions at variance with the ordinary notions of what is meant by the Christian life. Schwenkfeld, the Quietists, the followers of Madame Bourignon, all revived types of mysticism which had appeared long before; and the Quakers had their forerunners in mediæval times. Many of these sects, though called heretical, seem to have arisen simply from the desire to live purer and more spiritual lives than the church organization of their times permitted, and in order to do so were led to lay stress upon the idea of personal guidance by the Spirit of God, and on the necessity of the "house and heart church" in opposition to the external church life of their time, on the need of personal as opposed to official religion.

In this article Christian heresy alone has been described. Heresy, however, arises wherever there is doctrine, and there are Mahometan and Buddhist heresies and sects as well as Christian.

The best history of sects and heresies from the sympathetic side is Gottfried Arnold's *Unparteiische Kirchen- und Ketzer-Historie*, 1699–1700 (best ed. that of Schaffhausen, 1740). A very good list of writers on heresy, ancient and mediæval, is given in Burton's *Bampton Lectures on Heresies of the Apostolic Age*, 1829. The various Trinitarian and Christological heresies may be studied in Dorner's *History of the Doctrine of the Person of Christ*, 1845–56, Eng. tr., 1861–62; the Gnostic and Manichæan heresies in the works of Mansel, Matter, and Beausobre; the mediæval heresies in Hahn's *Geschichte der Ketzer im Mittelalter*, 1846–50, and Preger's *Geschichte der deutschen Mystik*, 1875; Quietism in Heppe's *Geschichte der quietistischen Mystik*, 1875; the Pietist sects in Palmer's *Gemeinschaften und Secten Würtembergs*, 1875; the Reformation and 17th century heresies and sects in the *Anabaptisticum et enthusiasticum Pantheon und Geistliches Rüst-Haus*, 1702; Böhmer's *Jus Ecclesiasticum Protestantium*, 1714–23, and Van Espen's *Jus Ecclesiasticum*, 1702, detail at great length the relations of heresy to canon and civil law. On the question of the baptism of heretics see Smith and Cheetham's *Dict. of Eccl. Antiquities*, "Baptism of Iteration;" and on that of the readmission of heretics into the church, compare Martene, *De Ritibus*, and Morinus, *De Pœnitentia*. (T. M. L.)

Heresy according to the Law of England.—The highest point reached by the ecclesiastical power in England was in the Act *De hæretico comburendo* (2 Henry IV. c. 15). Some have supposed that a writ of that name is as old as the common law, but its execution might be arrested by a pardon from the crown. The Act of Henry IV. enabled the diocesan alone, without the co-operation of a synod, to pronounce sentence of heresy, and required the sheriff to execute it by burning the offender, without waiting for the consent of the crown.[1] A large number of penal statutes were enacted in the following reigns, and the statute 1 Eliz. c. 1 is regarded by lawyers as limiting for the first time the description of heresy to tenets declared heretical either by the canonical Scripture or by the first four general councils, or such as should thereafter be so declared by parliament with the assent of convocation. The writ was abolished by 29 Car. II. c. 9, which reserved to the ecclesiastical courts their jurisdiction over heresy and similar offences, and their power of awarding punishments not extending to death. Heresy became henceforward a purely ecclesiastical offence, although disabling laws of various kinds continued to be enforced against Jews, Catholics, and other dissenters. The temporal courts have no knowledge of any offence known as heresy, although incidentally (*e. g.*, in questions of copyright) they have refused protection to persons promulgating irreligious or blasphemous opinions. As an ecclesiastical offence it would at this moment be almost impossible to say what opinion, in the case of a layman at least, would be deemed heretical. Apparently, if a proper case could be made out, an ecclesiastical court might still sentence a layman to excommunication for heresy, but by no other means could his opinions be brought under censure. The last case on the subject (Jenkins *v.* Cook, *Law Reports*, 1 Probate Division 80) leaves the matter in the same uncertainty. In that case a clergyman refused the communion to a parishioner who denied the personality of the devil. The judicial committee held that the rights of the parishioners are expressly defined in the statute of 1 Edw. VI. c. 1, and, without admitting that the canons of the church, which are not binding on the laity, could specify a lawful cause for rejection, held that no lawful cause within the meaning of either the canons or the rubric had been shown. It was maintained at the bar that the denial of the most fundamental doctrines of Christianity would not be a lawful cause for such rejection, but the judgment only queries whether a denial of the personality of the devil or eternal punishment is consistent with membership of the church. The right of every layman to the offices of the church is established by statute without reference to opinions, and it is not possible to say what opinions, if any, would operate to disqualify him.

The case of clergymen is entirely different. The statute 13

[1] Stephen's *Commentaries*, bk. iv. c. 7.

Eliz. c. 12, § 2, enacts that "if any person ecclesiastical, or which shall have an ecclesiastical living, shall advisedly maintain or affirm any doctrine directly contrary or repugnant to any of the said articles, and by conventicle before the bishop of the diocese, or the ordinary, or before the queen's highness's commissioners in matters ecclesiastical, shall persist therein or not revoke his error, or after such revocation eftsoons affirm such untrue doctrine," he shall be deprived of his ecclesiastical promotions. The Act it will be observed applies only to clergymen, and the punishment is strictly limited to deprivation of benefice. The judicial committee of the privy council, as the last court of appeal, has on several occasions pronounced judgments by which the scope of the Act has been confined to its narrowest legal effect. The court will construe the Articles of Religion and formularies according to the *legal rules for the interpretation of statutes and written instruments*. No rule of doctrine is to be ascribed to the church which is not distinctly and expressly stated or plainly involved in the *written law of the Church*, and where there is no rule, a clergyman may express his opinion without fear of penal consequences. In the *Essays and Reviews* cases (Williams *v.* the Bishop of Salisbury, and Wilson *v.* Fendall) it was held to be not penal for a clergyman to speak of merit by transfer as a "fiction," or to express a hope of the ultimate pardon of the wicked, or to affirm that any part of the Old or New Testament, however unconnected with religious faith or moral duty, was not written under the inspiration of the Holy Spirit. In the case of Noble *v.* Voysey in 1871, the committee held that it was not bound to affix a meaning to articles of really dubious import, as it would have been in cases affecting property. At the same time any manifest contradiction of the Articles, or any obvious evasion of them, would subject the offender to the penalties of deprivation. In some of the cases the question has been raised how far the doctrine of the church could be ascertained by reference to the opinions generally expressed by divines belonging to its communion. Such opinions, it would seem, might be taken into account as showing the extent of liberty which had been in practice, claimed and exercised on the interpretation of the articles, but would certainly not be allowed to increase their stringency. It is not the business of the court to pronounce upon the absolute truth or falsehood of any given opinion, but simply to say whether it is formally consistent with the legal doctrines of the Church of England. Whether convocation has any jurisdiction in cases of heresy is a question which has occasioned some difference of opinion among lawyers. Hale, as quoted by Phillimore, says that before the time of Richard II., that is, before any Acts of Parliament were made about heretics, it is without question that in a convocation of the clergy or provincial synod "they might and frequently did here in England proceed to the sentencing of heretics." But later writers, while adhering to the statement that convocation might declare opinions to be heretical, doubted whether it could proceed to punish the offender, even when he was a clerk in orders. Phillimore states that there is no longer any doubt, even apart from the effect of the Clergy Discipline Act, 3 and 4 Vict. c. 86, that convocation has no power to condemn clergymen for heresy. The supposed right of convocation to stamp heretical opinions with its disapproval was recently exercised on a somewhat memorable occasion. In 1864 the convocation of the province of Canterbury, having taken the opinion of two of the most eminent lawyers of the day (Sir Hugh Cairns and Mr. Rolt), passed judgment upon the volume entitled *Essays and Reviews*. The judgment purported to "synodically condemn the said volume as containing teaching contrary to the doctrine received by the United Church of England and Ireland, in common with the whole Catholic Church of Christ." These proceedings were challenged in the House of Lords by Lord Houghton, and the lord chancellor (Westbury), speaking on behalf of the Government, stated that if there was any "synodical judgment" it would be a violation of the law, subjecting those concerned in it to the penalties of a *præmunire*, but that the sentence in question was "simply nothing, literally no sentence at all." It is thus at least doubtful whether convocation has a right even to express an opinion unless specially authorized to do so by the crown, and it is certain that it cannot do anything more. Heresy or no heresy, in the last resort, like all other ecclesiastical questions, is decided by the judicial committee of the council.

The English lawyers, following the Roman law, distinguish between heresy and apostasy. The latter offence is dealt with by an Act which still stands on the statute book, although it has long been virtually obsolete—the 9 and 10 Will. III. c. 35. If any person *who has been educated in or has professed the Christian religion* shall, by writing, printing, teaching, or advised speaking, assert or maintain that there are more Gods than one, or shall deny any of the persons of the Holy Trinity to be God, or shall deny the Christian religion to be true or the Holy Scriptures of the Old and New Testament to be of divine authority, he shall for the first offence be declared incapable of holding any ecclesiastical, civil, or military office or employment, and for the second incapable of bringing any action, or of being guardian, executor, legatee, or grantee, and shall suffer three years' imprisonment without bail. Unitarians were saved from these atrocious penalties by a later Act (53 Geo. III. c. 160), which permits Christians to deny any of the persons in the Trinity without penal consequences. (E. R.)

HERFORD, a town of Prussia, capital of a circle in the government district of Minden, province of Westphalia, is situated in a beautiful and fruitful district at the confluence of the Werra and Aa, and on the Minden and Cologne railway, 19 miles south-west of Minden. It possesses five evangelical churches, among which may be mentioned the Münsterkirche, a Romanesque building with a Gothic apse of the 15th century; the Marienkirche, in the Gothic style; and the Johanniskirche, with a tower 280 feet high. The other principal buildings are the Catholic church, the synagogue, the gymnasium founded in 1540, the agricultural school, and the theatre. The industries include cotton and flax spinning, and the manufacture of linen cloth, furniture, sugar, tobacco, and leather. The population of the town in 1905 was 28,832.

Herford owes its origin to a nunnery which is said to have been founded in 832, and was confirmed by Louis the Pious in 839. From the emperor Frederick I. the abbess obtained princely rank and a seat in the imperial diet. The foundation was secularized in 1803. Herford was a member of the Hansa League. In 1631 it became a free imperial town, but in 1647 it was subjugated by the elector of Brandenburg. It came into the possession of Westphalia in 1807, and in 1813 into that of Prussia.

HERIOT. See COPYHOLD.

HERIOT, GEORGE (1563–1623), the founder of Heriot's Hospital, Edinburgh, was descended from an old family of some consideration in the county of Haddington; and his father, a goldsmith in Edinburgh, for some time represented the city in the Scottish parliament. George was born in 1563, and after receiving a good education was apprenticed to his father's trade. In 1586 he married the daughter of a deceased Edinburgh merchant, and with the assistance of her patrimony set up in business on his own account. At first he occupied a small "buith" at the north-east corner of St. Giles's Church, and afterwards a more pretentious shop at the west end of the building. To the business of a goldsmith he joined that of a money-lender, and in 1597 he had acquired such a reputation that he was appointed goldsmith to Queen Anne, consort of James VI. In 1601 he became jeweller to the king, and on the removal of the court to London, he followed his royal master thither, and occupied a shop opposite the Exchange. Heriot was largely indebted for his fortune to the extravagance of the queen, and to the imitation of this extravagance by the nobility. Latterly he had such an extensive business as a jeweller that on one occasion a Government proclamation was issued calling upon all the magistrates of the kingdom to aid him in securing the workmen he required. He died in London, 10th February, 1623. In 1608, having some time previously lost his first wife, he married Alison Primrose, daughter of James Primrose, grandfather of the first earl of Rosebery, but she died in 1612; by neither marriage had he any issue. The surplus of his estate, after deducting legacies to his nearest relations and some of his more intimate friends, was bequeathed to found a hospital for the education of freemen's sons of the town of Edinburgh; and its value afterwards increased so greatly as to supply funds for the erection of several Heriot foundation schools in different parts of the city. For a notice of Heriot's Hospital, see EDINBURGH, vol. vii. p. 578.

Heriot takes a leading part in Scott's novel, *The Fortunes of Nigel* (see also the Introduction). A *History of Heriot's Hospital, with a Memoir of the Founder*, by William Steven, D.D., appeared in 1827, 2d ed. 1859.

HERISAU, the largest town in the Swiss half-canton of Appenzell-ausser-Rhoden, is situated at the confluence of the Glatt and Brühlbach, 7 miles north-west of Appenzell, and about 2550 feet above sea-level. The town is irregularly built, and extends over a large area. The church-tower, in which the archives are kept, is referred to the 7th century. Herisau has a public library, an arsenal, a new townhouse, and a hospital, and is the seat of the cantonal council and of a district court of justice. The manufactures comprise muslin, cotton, and silk. Christianity was introduced at Herisau (a name during the Middle Ages Latinized as Augia Domini) about the beginning of the 7th century

The nobles of Herisau were its first superiors, but their power passed in 1390 into the hands of the abbots of St. Gall, from whose somewhat oppressive rule the people bought themselves free in 1463. The population in 1900 was 13,501. In the neighborhood beautiful walks lead to the interesting ruins of the castles of Rosenberg and Rosenburg. The baths and goat's-whey cure of Heinrichsbad are about a mile to the north-east.

HERISTAL. See HERSTAL.

HERITABLE JURISDICTIONS, in the law of Scotland, were grants of jurisdiction made to a man and his heirs. They were a usual accompaniment to feudal tenures, and the power which they conferred on great families, being recognized as a source of danger to the state, led to frequent attempts being made by statute to restrict them, both before and after the Union. They were all abolished by the Act 20 Geo. II. c. 43, which enacts (§ 1) that all heritable jurisdictions of justiciary, and all regalities and heritable baileries, and all heritable constabularies, other than the office of high constable of Scotland, and all stewartries, being parts only of shires and counties, and all sheriffships and deputy-sheriffships of districts, being parts only of shires and counties, belonging to or possessed by any subject or subjects, shall be taken away and totally dissolved and extinguished. At the same time, constabularies and other jurisdictions having been recognized as rights of property by the Treaty of Union, the Act provides that compensation shall be awarded to all persons lawfully possessed of such jurisdictions, and the sum of £150,000 was afterwards voted by parliament to pay the claims for compensation for loss of jurisdiction, as settled by a report of the Court of Session (see Erskine's *Institutes*, by Nicholson, p. 92).

HERLEN, FRITZ, of Nördlingen, was an artist of the early Swabian school, who tempered the rudeness of his native art with some of the delicacy of the masters of Bruges. The date and place of his birth are unknown, but his name is on the roll of the tax-gatherers of Ulm in 1449; and in 1467 he was made citizen and town painter at Nördlingen, "because of his acquaintance with Flemish methods of painting." One of the first of his acknowledged productions is a shrine on one of the altars of the church of Rothenburg on the Tauber, the wings of which were finished in 1466, with seven scenes from the lives of Christ and the Virgin Mary. In the town-hall of Rothenburg is a Madonna and St. Catherine of 1467; and in the choir of Nördlingen cathedral a triptych of 1488, representing the Nativity and Christ amidst the Doctors, at the side of a votive Madonna attended by St. Joseph and St. Margaret as patrons of a family. In each of these works the painter's name certifies the picture, and the manner is truly that of an artist "acquainted with Flemish methods." We are not told under whom Herlen labored in the Netherlands, but he probably took the same course as Schongauer and Hans Holbein the elder, who studied in the school of Van der Weyden. His altarpiece at Rothenburg contains groups and figures, as well as forms of action and drapery, which seem copied from those of Van der Weyden's or Memling's disciples, and the votive Madonna of 1488, whilst characterized by similar features, only displays such further changes as may be accounted for by the master's constant later contact with contemporaries in Swabia. Herlen had none of the genius of Schongauer. He failed to acquire the delicacy even of the second-rate men who handed down to Matsys the traditions of the 15th century; but his example was certainly favorable to the development of art in Swabia. By general consent critics have assigned to him a large altarpiece, with scenes from the gospels and figures of St. Florian and St. Floriana, and a Crucifixion, the principal figure of which is carved in high relief on the surface of a large panel in the church of Dinkelsbühl. A Crucifixion, with eight scenes from the New Testament, is shown as his in the cathedral, a Christ in Judgment, with Mary and John, and the Resurrection of Souls in the town-hall of Nördlingen. A small Epiphany, once in the convent of the Minorites of Ulm, is in the Holzschuher collection at Augsburg, a Madonna and Circumcision in the National Museum at Munich. Herlen's epitaph, preserved by Rathgeber, states that he died on the 12th of October, 1491, and was buried at Nördlingen.

HERMANN, the popular modern name in Germany for the ancient German hero Arminius. See GERMANY, vol. x. p. 426.

HERMANN, commonly distinguished as Hermannus Contractus, *i. e.*, Hermann or Herman the Lame, an old German chronicler and scholar, was born in 1013, a son of the Swabian Count Wolverad (Wolfrat) of Vehreningen (Veringen or Voringen), and died in 1054, at the family residence of Aleshusen near Biberach. Educated at the monastery of Reichenau, and afterwards admitted a member of the fraternity, he added greatly to that reputation for learning which the establishment had maintained from the time of Abbot Berno. Besides the ordinary studies of the monastic scholar, he devoted himself to mathematics, astronomy, and music, and constructed watches and instruments of various kinds.

His chief work is a *Chronicon ab urbe condita ad annum 1054*, which in its earlier portion consists of a compilation from previous chronicles, but between 1044 and 1054 furnishes important and original material for the history of Henry III. The first edition, from a MS. no longer extant, was printed by Sichard at Basel in 1529, and reissued in 1530; another edition appeared at St. Blaise in 1590 under the supervision of Ussermann; and a third, from a Reichenau MS., forms part of vol. v. of Pertz's *Monumenta Germaniæ historica*. A German translation of the last is contributed by Robbe to *Die Geschichtsschreiber der deutschen Vorzeit*. The separate lives of Conrad II. and Henry III., often ascribed to Hermann, appear to have perished. His treatises *De mensura astrolabii* and *De utilitatibus astrolabii* (to be found, on the authority of Salzsburg MSS., in Pez, *Thesaurus anecdotorum novissimus*, iii.) being the first contributions of moment furnished by a European to this subject, Hermann was for a time considered the inventor of the astrolabe. A didactic poem from his pen, *De octo vitiis principalibus*, is printed in Haupt's *Zeitschrift für deutsches Alterthum* (vol. xiii.); and he is sometimes credited with the composition of the Latin hymns *Veni Sancte Spiritus*, *Salve Regina*, and *Alma Redemptoris*.

HERMANN, FRIEDRICH BENEDICT WILHELM VON (1795–1868), one of the most distinguished of modern writers on political economy, was born on 5th December, 1795, at Dinkelsbühl in Bavaria. After finishing his primary education he was for some time employed in a draughtsman's office. He then resumed his studies, partly at the gymnasium in his native town, partly at the universities of Erlangen and Würzburg. His attention seems principally to have been given to mathematics and political economy. In 1817 he took up a private school at Nuremberg, where he remained for four years. After filling an appointment as teacher of mathematics at the gymnasium of Erlangen, he became in 1823 privat-docent at the university in that town. His inaugural dissertation was on the notions of political economy among the Romans (*Dissertatio exhibens sententias Romanorum ad œconomiam politicam pertinentes*, Erlangen, 1823). He probably did not remain long at Erlangen, for a year or two after this date we find him acting as professor of mathematics at the gymnasium and polytechnic school in Nuremberg, where he continued till 1827. During his stay there he published an elementary treatise on arithmetic and algebra (*Lehrbuch der Arith. u. Algeb.*, 1826), and made a journey to France to inspect the organization and conduct of technical schools in that country. The results of his investigation were published in 1826 and 1828 (*Ueber technische Unterrichts-Anstalten*). Soon after his return from France he was made professor extraordinarius of political science at the university of Munich, and in 1833 he was advanced to the rank of ordinary professor in the same subject. In 1832 appeared the first edition of his great work on political economy, *Staatswirthschaftliche Untersuchungen* (Economical Researches). In 1835 he was made member of the Royal Bavarian Academy of Sciences.

From this time onwards Hermann's life was one of great and varied practical activity. From the year 1836 he acted as inspector of technical instruction in Bavaria, and made frequent journeys to Berlin and Paris in order to study the methods there pursued. In the state service of Bavaria, to which he devoted himself, he rose gradually but rapidly. In 1837 he was placed on the council for superintendence of church and school work; in 1839 he was entrusted with the direction of the bureau of statistics; in 1845 he was one of the councillors for the interior; in 1848 he sat as member for Munich in the national assembly at Frankfort. In this assembly Hermann, with Heckscher and Sommaruga, was mainly instrumental in organizing the so-called "Great German" party, and was selected as one of the representatives of their views at Vienna. Warmly supporting the customs union (Zollverein), he acted in 1851 as one of its

commissioners at the great industrial exhibition at London, and published an elaborate report on the woollen goods. Three years later he was president of the committee of judges at the similar exhibition at Munich, and the report of its proceedings was drawn up by him. In 1855 he became councillor of state (Staatsrath im ordentlichen Dienst), the highest honor in the service to which he could attain.

It is hardly surprising that in the midst of such varied and weighty practical occupations Hermann did not find time for carrying on systematically his work in the pure science of economics. Yet the long series of reviews, mainly of works on economical subjects, published in the *Münchener Gelehrte Anzeigen* from 1835 to 1847, attest his unabated industry and constant interest in the subject on its theoretical side, while his more elaborate papers in Rau's *Archiv der politischen Oekonomie* and in the *Augsburger Allgemeine Zeitung* show the wide extent of his practical knowledge. As head of the bureau of statistics he published a series of annual reports (*Beiträge zur Statistik des Königreichs Bayern*, Heft 1–17, 1850–1867) which are of very high value, especially as regards the growth of population. His only complete work in economic science, the *Researches*, had gone out of print a very few years after the book was published, but not until near the close of his life did Hermann find an opportunity of undertaking a revision of it. Upon this task he was engaged at the time of his death, 23d November, 1868, and he had recast, enlarged, and amended nearly two-thirds of the volume. The second edition, prepared from his MS., and including those parts of the first edition which had not been revised or superseded, was published in 1870 by his friends Dr. Helferich and Dr. Mayr. There have since been several reprints.

Although the *Staatswirthschaftliche Untersuchungen* is not a systematic treatise on political economy, it must nevertheless be regarded as in many respects the most important contribution to the science since the *Wealth of Nations*. It cannot, indeed, be said to contain principles which are in themselves novel or original; Hermann's merits are not so much those of a discoverer as of a most acute and subtle critic. Like Ricardo he excels in abstract analysis, in resolution of complex phenomena into their simpler elements, but he has a more firm hold than Ricardo ever seems to have possessed of the true nature of these elementary facts, and a remarkable power of precisely stating and comprehensively combining them. The peculiar value of the *Researches* consists in the strict analysis to which the primary notions of economics are subjected, in the general conception of the method and plan of the science which emerges from this analysis, and in the masterly way in which fundamental principles are carried out in the detailed problems of the science. Only in the fashion indicated by Hermann can we hope to render clear the position of a pure theory of economic facts as an indispensable and independent branch of social science. The historic method of inquiry, fatal to much that has been regarded as distinctive of the abstract or English school of political economy, harmonizes perfectly with the theory of the elementary facts from which economical development takes its start, as stated by Hermann and those Continental writers who have followed him.

The *Researches*, in the 2d edition, consists of ten separate essays, of which the first, on the fundamental notions of economics ("Grundlegung," pp. 1–77), the fifth (pp. 143–389, on "Production"), the sixth (pp. 390–459, on "Price"), the eighth (pp. 448–581, on "Profit"), and the ninth (pp. 582–598 on "Revenue") are of the greatest importance. In the "Grundlegung," a clear and lucid description is given of the simple phenomena, in family, community, and state, upon which economical inquiries are founded. Human wants and the satisfaction to be obtained for them by labor exercised on natural agents are recognized as the primitive facts. But in the satisfaction of wants there are two aspects, the technical and the economical. Technically we consider solely the process by which commodities of a quality suited to satisfy want are obtained. Economically we have always to estimate the ratio between the effort expended and the result obtained. An "economy" is a distribution of forces so that the result, satisfaction, may be obtained with least expenditure of effort, with least loss of utility. The influence of this economical principle, the institutions to which it gives rise, the conditions under which it is possible, and the circumstances which affect, modify, or counteract it, are traced with reference to the individual, the family, the community, and the state or nation. The increasing complexity of the phenomena does not alter the nature of the principle which lies at the basis of them, and it is the business of economic theory to analyze these phenomena under guidance of the general principle. Economics is therefore defined by Hermann as the "quantitative theory of goods;" and, though he is sparing in the use of symbols, his method of treatment is throughout mathematical. Deserving of attention is the manner in which he points out the influence of collective feeling and collective wants as giving rise to special institutions (government, defence) in the community. To this first fundamental essay the three succeeding papers ("Wants," "Goods," "Economy," pp. 78–142) are appendices. The treatment of these, the classifications given, the detailed discussion of particular points, *e. g.*, the productivity of labor, and the distinction drawn between economical estimates from the individual or the collective point of view, make up a solid contribution to the science.

The fifth essay is an elaborate treatise on the theory of production, treating the agents of production—free goods, labor, and capital—separately, then the interests of the several parties engaged, and the changes due to variations in the cost of producing. Under "Labor" is given the most complete and systematic discussion of separation of employments. Capital is defined so as to include land, but careful reference is made to the distinctive peculiarities of this form of wealth. Especially remarkable is Hermann's treatment of what he calls *Nutz-capital* (*i. e.*, service-capital), with regard to which he accepts almost entirely the view of J. B. Say. Under fixed capital a very elaborate treatment of the nature and economic influence of machines is given, while the handling of changes in the cost of production, both here and in the essay on "Profit," is acute and luminous.

The sixth essay analyzes the forces which underlie supply and demand. These are stated to be:—(*a*) on the side of the purchaser—(1) his desire for the commodity in question, or its utility to him, (2) his means, (3) the competition of sellers; (*b*) on the side of the seller—(1) cost of production, (2) competition of the buyers, (3) the value of the medium of exchange. The same considerations are shown to hold good in the case of the price of labor, though unfortunately the seventh essay, on "Wages," is incomplete. The eighth essay, on "Profit," discusses very elaborately the rate of return on the various species of capital and the circumstances that determine it, distinguishes interest from profit in general, and marks as a special form the profit of the *entrepreneur* (*Unternehmergewinn*). This last he regards as distinct from wages of superintendence, and from insurance for risk. The ninth and tenth essays, on "Revenue" and "Consumption," are perhaps specially interesting from the clear mode in which the theory, afterwards called that of the wages fund, is rejected, and from the precision with which the diverse points of view for estimating net revenue are discriminated.

This brief analysis is sufficient to show the high value of Hermann's work as a contribution to pure economics. On practical questions, those of economic legislation, his opinions are only to be gathered with difficulty from the papers in the *Gelehrte Anzeigen*, and generally were expressed with such reference to special circumstances as to render doubtful their full import. It seems probable, however, that his views on protection were far from clear, and that he was somewhat under the sway of the dangerous principle that the best financial policy is encouragement of national industry. It is difficult, however, to speak definitely on this subject.

See Kautz, *Gesch. Entwicklung d. National- Oekonomik*, pp. 633–38; Roscher, *Gesch. d. Nat. Oekon. in Deutschland*, pp. 860–79. (R. AD.)

HERMANN, Johann Gottfried Jakob (1772–1848), classical editor and philologist, was born at Leipsic on November 28, 1772. Entering the university of his native city at the precocious age of fourteen, Hermann at first studied law, but his inclination to classical learning was too strong to be resisted, and accordingly, after a session spent at Jena in 1793–94, he became a lecturer on classical literature in Leipsic. In 1798 he was appointed professor extraordinarius of philosophy at the university there, and after refusing an invitation to proceed to Kiel as rector of a school, he was in 1803 chosen professor of eloquence. In 1809 he received the chair of poetry in addition. He died, senior of the university, on December 31, 1848.

Hermann devoted his early attention to the classical poetical metres, and published on that subject *De metris Græcorum et Romanorum poetarum*, in 1796; *Handbuch der Metrik*, in 1798; *Elementa doctrinæ metricæ*, in 1816, of which an *Epitome* appeared in 1818; and *De Metris Pindari* in 1817, attached to Heyne's edition of that author. Of his influential and valuable writings on Greek grammar the chief are *De emendenda ratione Græcæ grammaticæ*, 1801; *Notes and Excursus to Viger's "De præcipuis Græcæ dictionis idiotismis,"* 1802; and *De particula ἄν libri IV.*, 1831. His *Lexicon of Photius* appeared in 1808. His editions of the classics comprise several of the plays of Euripides (see vol. viii. p. 596); the *Clouds* of Aristophanes, 1799; *Trinummus* of Plautus, 1800; *Poetics* of Aristotle, 1802; *Hymns* of Orpheus, 1805; and the Homeric *Hymns*, 1816. In 1825 Hermann finished the edition of Sophocles begun by Erfurdt. His editions of Bion and Moschus were published posthumously in 1849, and of all the plays of Æschylus in 1852.

The *Opuscula*, a collection of Hermann's smaller writings in Latin, appeared in seven volumes between 1827 and 1877.

HERMANN, Karl Friedrich (1804–1856), one of the leading representatives of classical investigation in Germany, was born August 4, 1804, at Frankfort-on-the-Main. His early education was received partly at Frankfort and partly at Weilburg, and his university studies were carried on at Heidelberg and Leipsic. On his return from a tour in Italy he habilitated in 1826 as privat-docent in Heidelberg; in 1832 he was called to Marburg as professor ordinarius of classical literature; and in 1842 he was transferred to Göttingen to fill the chair left vacant by the death of Ottfried Müller. Both at Marburg and Göttingen he likewise held the office of director of the philological seminary. He died at Göttingen on the 8th of January, 1856. Hermann's scholarship took in a wide and ever-widening horizon; but his vision was clear and steady, and he knew well how to portray for other eyes the scenes that shaped themselves with new life before his own. Among his more important publications are the *Lehrbuch der griechischen Antiquitäten*, of which the first portion (Heidelberg, 1841) deals with political, the second (1846) with religious, and the third (1852) with domestic antiquities; the *Geschichte und System der Platonischen Philosophie* (Heidelberg, 1839); an edition of the Platonic Dialogues (6 vols., Leipsic, 1851–52); and *Culturgeschichte der Griechen und Römer* (Göttingen, 1857–58, 2 vols.), published after his death by G. Schmidt. A collection of *Abhandlungen und Beiträge zur class. Literatur und Alterthumskunde* appeared in 1849, but the great mass of his essays and brochures, which deal with a vast variety of archæological, artistic, critical, and philosophical subjects, are still unarranged. See Lechner, *Zur Erinnerung an K. F. Hermann* (Berlin, 1864.)

HERMANNSTADT (Hungarian *Nagy-Szeben*, Latin *Cibinium*), chief town of an Hungarian county of the same name, is advantageously situated on the Szeben, an affluent of the Aluta, about 72 miles S. E. of Kolozsvár (Klausenburg), and is the terminus of the Kapus and Nagy-Szeben branch line of railway, in 45° 48′ N. lat. and 24° 9′ E. long. It is the see of a Greek Orthodox bishop, the meeting place of the Lutheran consistory for the Transylvanian circle, and the head-quarters both of the honvéd (or "defence-militia") and of the regular infantry and artillery of the district; and it also possesses royal courts of law and assizes, and offices of finance, assay, state survey, and engineering. Hermannstadt has a somewhat mediæval appearance, the streets being often narrow, and the houses built in the old German style. Of the squares the most striking is the large quadrangular market-place. The public buildings comprise Roman and Greek Catholic, Greek Orthodox, Calvinist, and Lutheran churches, a royal law academy, both Roman Catholic and Lutheran gymnasia, a Greek Orthodox seminary for priests, a hospital for the insane, foundling and orphan homes, Franciscan and Ursulan retreats, a house of correction, civil and military hospitals, county and town halls, the infantry and large new artillery barracks, the town theatre, the "Transylvania" assurance office, the "Albina" bank, and, above all, the Bruckenthal palace with its fine museum and library. Among the industrial establishments are factories for the preparation of soap, candles, soda, sulphuric acid, bone-dust, paper, cloth, linen, leather, caps, boots, combs, and building materials. There are also printing houses, tanneries, and rope-walks, several distilleries, and a large brewery. A brisk trade is carried on both at the regular weekly markets and at the special fairs. The civil population in 1900 was 29,577, of whom about two-thirds were of German (Saxon) and the remainder of Roumanian and Magyar extraction.

The German name of the town is traceable to Hermann, a citizen of Nuremberg, who about the middle of the 12th century established a colony on the spot. In the 13th century it bore the name of *Villa Hermanni*. Under the last monarchs of the native Magyar dynasty Hermannstadt enjoyed exceptional privileges, and soon became a thriving centre of trade, its commerce with the East rising to considerable importance. In the course of the 15th and 16th centuries it was several times besieged by the Turks. In 1610 it suffered at the hands of the Transylvanian prince Gabriel Báthori. At the beginning of 1849 it was the scene of several engagements between the Austrians and Hungarians, and later in the year it was several times taken and retaken by the Russians and Hungarians, the latter being eventually forced to yield to overwhelming numbers, August 6.

HERMAS. See Apostolic Fathers, vol. ii. p. 173.

HERMENEUTICS, Biblical, is that branch of theological science which treats of the principles of Scripture interpretation. Variously described as the theory of the discovery and communication of the thoughts of Holy Scripture (Lange), the science of attaining clearness both in comprehending and in explaining the sense of the Biblical authors (Ernesti), the methodological preparation for the interpreter and for exegesis (Doedes), the science of the removal of differences between us and the sacred writers (Immer), it has for its task to determine the laws of valid exegetical practice. Schleiermacher and Klausen have limited it to the doctrine of what the interpreter has to observe in order to put *himself* in possession of the mind of Scripture. The former defines it as a discipline which looks simply to the reader's own apprehension, not to the conveyance of the meaning ascertained to others; which latter is to be regarded, he thinks, as but a particular division of the art of speaking and writing. It has been generally taken, however, to have respect to the communication as well as the acquisition of the thoughts of the Biblical writers. This larger definition, which is as ancient at least as Augustine's statement of the two things "quibus nititur omnis tractatio Scripturæ, modus inveniendi quæ intelligenda sunt et modus proferendi quæ intellecta sunt" (*De Doctr. Christ.*, i. 1), has been formally accepted or practically acted on by most modern authorities. It is consonant with the currency of the terms ἑρμηνεύω, ἑρμηνεύς, ἑρμηνευτής (connected it may be with *Hermes*, but not derived from that, such use of a deity's name being probably unexampled).[1] These in the classics express both expounding (Pindar, *O.*, 2, 153) and interpreting or translating a foreign language to others (Xen., *Anab.*, i. 2, 17; Herod., ii. 125); while in the New Testament ἑρμηνεύειν means to translate (John i. 39, 43) and διερμηνεύειν to expound, interpret, or translate (Luke xxiv. 27, 1 Cor. xii. 30, Acts ix. 36). The definition is in harmony too with the Protestant idea of exegesis as an art which brings the contents of Scripture to the general understanding, and the Protestant conception of the direct approach of God's word to man's heart by Scripture. As the theory of the interpretative art hermeneutics is usually taken to be an historical science, forming a subdivision of historical theology. Where, however, a fourfold, instead of a threefold, distribution of theological science is adopted, it is assigned to literary theology. It presupposes such disciplines as textual criticism and Biblical introduction, while it may exercise a reflex influence on some of the discussions with which these are conversant. Although practice precedes theory, and only through the use of the art of interpretation can the principles of interpretation be reached, as it is out of Scripture itself that the laws of Scriptural exposition must be drawn, theoretically this science precedes exegesis and forms an indispensable preparation for Biblical theology. Much which it has been the custom to embrace within it belongs really to general hermeneutics. The limits properly assignable to it are comparatively narrow, its immediate object being to decide how the laws of general hermeneutics are related to the particular records known as Scripture. The propriety of a special Biblical hermeneutic is established so far as Scripture is proved to be more than an ordinary literature. The Christian who comes to the Bible with the conviction that it is the record of divine communications, and with the experience that it is the medium through which God has spoken to him and led him into new relations to Himself, has to ask whether the principles of ordinary hermeneutics have to be modified or supplemented when applied to these books. Neither the Christian recognition of the spiritual character of Scripture nor the Protestant assertion of the right of private judgment, the perspicuity of Scripture, and the laity's direct interest in the Bible, warrants the extreme position assumed among some sects, that a scholarly interpretation and, therefore, a science of hermeneutics are superfluous. Being a literary record composed in languages which demand the exegetical *praxis* of translation, and produced under circumstances, by writers, and for readers widely removed in date and character from our present acquaintance, Scripture requires a scientific process for its exposition, and the laws of that process must be verified. The peculiar value which attaches to it as a holy literature makes this the more needful, the exceptional position assigned it rendering its interpretation opener to the invasion of prepossession and private religious ideas.

[1] See article Hermes, and compare Curtius, *Greek Etymology*, § 350.

The exclusive authority ascribed to these books by the Protestant, who accepts them as the only rule of faith and life, gives him a special interest in hermeneutics. The concrete and historical form in which their spiritual teaching appears, the figurative, typical, and symbolical terms so largely used in them, the numerous presuppositions on which their statements of religious truth and fact proceed, suggest the necessity of such a discipline. The qualities of Scripture which render its appeal to the common understanding distinct and immediate are arguments for scientific intelligence in educing from its declarations nothing more and nothing less than their exact intention. The interpreter's function being, not to develop some meaning which the words might bear to present students or which the first readers may have seen in them, but simply to ascertain with precision and completeness the ideas which the writers themselves meant to convey, it may be said with Schleiermacher that in a certain sense the interpreter has to educe more than the author introduced. The former has to bring out into clearness much that influenced the latter half-unconsciously in his composition, and to give objective expression to much that underlies his definite statements. Hence the special need for a scientific hermeneutic in the case of a book like the Bible, in which there is so much that is implicit. The vast variety of results reached in crucial passages, and the wide diversities of method which have been pursued among individual exegetes and in exegetical schools, make the propriety and utility of such a science the more apparent.

Since Christopher Wolle (*Hermeneutica Novi Fœderis acroamatico-dogmatica certissimis defecatæ philosophiæ principiis corroborata eximiisque omnium Theologiæ Christianæ partium usibus inserviens*, Leipsic, 1736) the hermeneutics of the New Testament, for the sake of convenience or on grounds of scientific distinction, has often been separated from the hermeneutics of the Old Testament. The scientific union or disjunction of these disciplines depends on the view entertained of the mutual relations of the Hebrew Scriptures and the Christian. Where the Bible is seen to constitute an organic whole, the hermeneutical principles applicable to the two Testaments are treated in connection. It then becomes one great object of the science to grasp the differences which are discovered within the unity of Scripture, and exhibit what account has to be taken of these in the art of interpretation. A distinct position, however, naturally belongs to Jewish hermeneutics, which dealt with the Hebrew Scriptures as at once the entire written revelation of God, and the repertory of the highest wisdom on all subjects of human inquiry. The results of the scientific study of the Old Testament, which was carried on with vast activity from Ezra's time by numerous scribes and in great schools and colleges (Jerusalem, Tiberias, Sura, Pumbeditha, Nahardea, etc.), are seen in the Talmudical writings, the *Mishna* giving authoritative enlargements and explanations of the law, and the *Gemara*, in its twofold form of *Jerusalem Talmud* edited at Tiberias, and *Babylonian Talmud* proceeding from Sura, containing further commentaries, fantastic definitions, and explanations of prior explanations (see TALMUD). The most ancient Jewish interpretation of Scripture the *Midrash* ("study," "investigation"), which assumed a fixed character during the period of the second temple and gradually formed a literature, ran out into two great branches, logical or legal exposition, and practical or homiletical exposition. The former, designated "Halacha" ("rule by which to walk," "binding precept"), brought the law to bear upon points of religious or general interest on which there was no explicit declaration. It confined itself chiefly to the Pentateuch, extracting from it by numerous exegetical expedients a body of "Halachoth" or sopheric precepts (*cf.* Matt. xv. 2, Mark vii. 3), which were held authoritative. These, after a long period of oral transmission, gradually assumed written form, and passed finally through a process of compilation, classification, and redaction which extended perhaps from about two centuries before to two centuries after Christ. The latter, styled "Hagada" ("opinion," "free exposition"), was meant for edification, traversed the entire Old Testament, and occupied itself with the application of Scripture to the purposes of practical instruction in all manner of subjects, ethical, political, metaphysical, theosophic, as well as religious. Its expositions were conveyed in forms, symbolical, poetic, parabolic, such as were most likely to arrest attention, and, though of no binding authority, it made itself so attractive to the people that it was often known as "the Midrash" distinctively. The hermeneutical laws followed in these two lines of exposition are sufficiently well known. Eliezer ben Jose, the Galilæan, a distinguished rabbi of the 2d century of our era, has embodied the results of a final redaction of the principles of the Hagadic exegesis in a series of thirty-two rules. Some of these are sound, dealing, *e. g.*, with the use of brachylogy, repetition, parable, the reconciliation of two discrepant texts by a third, etc. Many of them are wholly fantastic, prescribing how explanations are to be sought by reducing the letters of a word to their numerical value, by the transposition of letters, by the substitution of another word of the same numerical value for one which yields no worthy sense, by studying the introduction of superfluous particles, etc. Such principles held a much smaller place in the Halachic exegesis, which, as it aimed at something higher than applications of Scripture, could indulge in fewer freedoms in certain directions, so far as it was true to its idea. In the fixing of the Halachic hermeneutics Hillel I. (died 8 or 10 A. D.) occupies a conspicuous place. He reduced the traditional legal erudition of the Jews, with its bewildering multiplicity of laws, from the 600 or 700 sections over which it is said previously to have spread, to six capital "Sedarim" or orders, forming a manageable basis on which his successors 'Akiba, Simon III., and Jehudah I. could work on to the final codification of the *Mishna*. He was also the first to formulate definite rules by which the rabbinical development of the law should proceed. These canons of interpretation were seven in number, afterwards increased by Rabbi Ismael to thirteen by the addition of seven new rules and the omission of the sixth, and looked to the construction of Biblical warrant for precepts which it was wished to prove implicit in the law. These "Middoth" were instructions to reason (1) *a minori ad majus*, (2) *ex analogia*, (3) by derivation of a principal proposition from a single passage, (4) by derivation of a principal proposition from two passages, (5) by limitation of the general through the particular, (6) by explanation of one passage through another, (7) by the use of the context. The idea that the Old Testament, preeminently the law, held hidden in it the highest wisdom on all subjects, was naturally inimical to the rights of the literal sense. The rabbinical hermeneutics drew inevitable distinctions between the proper or innate sense (מַשְׁמָע), which again was described as either verbal (פְּשַׁט) or figurative (סוֹד), and the derivative or studied sense (מִדְרָשׁ, דְּרָשָׁה), which was to be sought either by inference (דְּרוּשׁ) or by artificial conjunction (רֶמֶז). The natural sense, however, though practically robbed of its dues, was not professedly ignored. This regard for it, which was never wholly disowned, ultimately took shape in the improved rabbinical hermeneutics of the Middle Ages. In the writings of such rabbis as Saadias Gaon, Jarchi, Rashi, Kimchi, Maimonides, Abarbanel (a line of expositors extending from the 10th to the 16th century), we find, alongside the traditional rules and explanations, a scientific recognition of the interpreter's duty to give the literal sense as well as a practical application of the principles of grammatical and historical exegesis to the Old Testament.

The hermeneutics developed among the Hellenistic Jews had marked characteristics of its own. These interpreters, departing from the exclusiveness of rabbinical devotion to the Old Testament revelation, and from the pure Hebraism of native Jews, brought to the study of the sacred books a range of ideas derived from Hellenic culture. They had to devise a hermeneutical procedure which would harmonize their new ethnic learning with the traditional estimate of the Jewish Scriptures. To the theosophic Hellenist, and specially to the Alexandrian Jew, acceptance of the plain sense was often an impossibility. A reconciliation was sought by the use of allegorical interpretation. This method was also pursued by the Rabbinical exegetes. It is embraced in the Halachic hermeneutics, and is seen in the distinctions drawn by Palestinian Jews between the body and the soul of texts. But while the allegorical interpretation of native Jews, in consonance with their purer estimate of the Hebrew revelation, moved in the direction of the typical, that of the Hellenists became rather mystical. The coryphæus in this hermeneutical practice was Philo (born perhaps about 20 B. C.), although he had predecessors in Aristobulus (180 B. C.), Josephus, and others. He devoted himself mainly to the exposition of the Pentateuch, with the view of explaining the realism and anthropomorphism

of the Old Testament in a way to suit the philosophy of the time. Wishful to retain the Alexandrian Jew's regard for Moses as the supremely inspired prophet of God and the oracle of all mysteries along with adherence to the current Platonism and theosophy, he supposed that the Mosaic writings contained a twofold mode of teaching, a popular representation of God and divine things and a spiritual. It was the task of wisdom to penetrate through the envelope of the literal history to the secret sense which it shielded. The verbal sense was acknowledged, but held to be for the illiterate. The outstanding facts in the records of the creation, the deluge, the careers of the patriarchs and Moses, were accepted in an historic sense, but the details of all these narratives were spiritualized. Sometimes the figurative meaning was made the only meaning, but in other cases the objective meaning was allowed to be the intended meaning. The hermeneutical rule, however, was to rise by allegory from the superficial anthropomorphic sense (*τὸ ψυχικόν*) to the higher or spiritual sense (*τὸ πνευματικόν*). The simple histories were symbols of abstract truths. To the enlightened they were so many modes of soul (*τρόποι ψυχῆς*)—Adam the figure of the sensuous nature, Rebecca of patience, Leah of despised virtue, Egypt an emblem of the body, and Canaan of piety.

Two later chapters in the history of Jewish hermeneutics deserve notice. On the one hand the rabbinical procedure was decisively departed from by the Karaites, among whom Japhet ben Heli, of Bussorah, belonging to the close of the 10th century, and Aaron ben Joseph, of the 13th century, are notable. In their case interpretation again sought the *via media* between bald literalism and arbitrary spiritualizing. It was prosecuted on the principles of renouncing the quest after a variety of senses, abiding by the natural sense, accepting metaphor where the figurative was intended, and conserving the religious interest. On the other hand an extraordinary development was given to the rabbinical hermeneutics by the Kabbalists of the Middle Ages, who used the devices of artificial interpretation in order to find an Old Testament basis for their mixed Neo-Platonist, Gnostic, and Sabæan culture. The Kabbala ("what has been received," "tradition," see KABBALA) had its roots in the ancient doctrine of numbers, for which the Jews were probably indebted to the Chaldæans. The use of the numerical power of letters as a key to mysteries, which the Palestinian Jews had early favored and which formed a not inconsiderable element in the Hagadic exposition, expanded into a vast system of fantastic Hebrew Gnosticism in the 8th century of the Christian era. The written Word was regarded as a depository of secret doctrine and absolute truth which could be entered only by the initiated. The mysteries hidden in its letters required for their discovery processes of exchange, more or less intricate, between literal and numerical values. By the combinations and permutations of letters, the interchange of words of equal numerical value, and similar artifices, new meanings were extracted where the proper sense seemed poor, and acceptable meanings found where offence was felt. Where the text, *e. g.*, states (Numbers xii. 1) that Moses married an Ethiopian woman, the veiled sense was shown to be that he married a woman of *beautiful countenance*, and the offence against the law was thus removed. For the letters of כּוּשִׁית added together make the sum 736, the letter in the expression יְפַת מַרְאֶה, "beautiful of countenance," yield the same sum; and the enlightened are able to read the latter idea in the former appellative. Distinct titles came to be applied to different branches of the art. The process of reaching hidden truths by the numerical equivalence of letters (as when from the circumstance that א occurs six times in the first and last verses of the Old Testament it is inferred that the world is to last 6000 years) was styled "Gematria." The process of forming new words out of the several letters of some solemn term, or one new word by combining the first letters of several words (as when the answer מִילָה, "circumcision," is discovered in the question in Deut. xxx. 12, "Who shall go up for us to heaven?" by bringing together the letters with which the several words in the query commence), was called "Notarikon." The use of the anagram or permutation (as when by transposition of מַלְאָכְ into מִיכָאֵל it is ascertained that "mine angel" of Exod. xxiii. 23 was the angel Michael) was known as "Temurah." The hermeneutical practice of the Kabbalists increased in subtlety as the theosophic system itself grew. Rules were elaborated for exchanging the powers of letters, reading them in a variety of orders, and otherwise conjuring with the literal sense.

The course which Biblical hermeneutics has run outside the purely Jewish pale has been not less changeful or remarkable. The New Testament writings show at large how the apostles and first followers of Christ viewed, interpreted, and quoted the Old Testament. They give little in the shape of formal hermeneutical principles, but allow much to be inferred from usage and example. Conclusions as to authoritative canons of interpretation, so far as these are drawn from New Testament employments of Old Testament Scripture, are weighted with the question whether or how far currency is followed. It is affirmed on the one hand that Paul, *e. g.*, in his hermeneutics, was a pure rabbinist, while on the other the equally extreme position is held that his training is in no way reflected in his use of the Hebrew Scriptures. The citation of the Old Testament in the New, which forms a question by itself and one of great intricacy, takes a variety of modes. Passages are reproduced as direct prophecies of the Messiah and His kingdom (Acts ii. 34, Heb. i. 13), as mediate references to the same through partial realizations of their idea (Heb. ii. 6–9, 12, 13), as illustrations or applications of principles common to both economies (Rom. x. 6–8, 1 Tim. v. 18), as apt expressions, without the character of explicit quotation, in which New Testament statements naturally embody themselves (1 Pet. i. 24). The proper and immediate sense is adhered to. The application of typology and symbolism (Heb. viii. 5, ix. 9) is at the same time exemplified, and the existence of secondary or higher meanings in allegorical or other forms (Gal iv. 24, Eph. v. 32) is to a certain extent recognized. The typical relation of the Old Testament to the New is everywhere presented. It is exhibited both in the histories and in the institutions, and is developed alike in ethical, didactic, and prophetic significance (1 Cor. x. 6, 11, Rom. vi. 17, v. 14). The Hebrew revelation is interpreted as a divine preparation for the Christian and as a continuous prophecy bearing onwards towards Christ (Acts ii. 25). Its official personages and its saints, its ordinances and its events, are real though imperfect exhibitions of Messiah and the Messianic kingdom. Even its minor occurrences and incidental utterances are anticipations or expressions of the purposes of Jehovah realized in the Christian dispensation (Matt. ii. 15, Heb. iv. 7, Eph. iv 8–12). How far Biblical hermeneutics within the Christian Church has gathered its principles from Scripture itself, and what use it has made of the New Testament *praxis* will appear from its history. It will be enough here to deal with the capital ideas to which the various conflicting methods seem capable of being reduced. We indicate which of these prevailed on the whole in important schools and periods, without attempting a chronological statement or detailing the exact relations of each great name to this subject. It is not to be supposed, however, that any single mode was exclusively dominant at any one time, or that the interpreters whose names are connected with some particular procedure held by that only. On the contrary, in the long-continued absence of a definite settlement of principles the best writers swayed remarkably from method to method, and men who are largely identified with vicious modes exhibit at the same time admirable examples of the opposite. It may be said that three great hermeneutical tendencies have been followed. These may be conveniently designated the subjective, the dependent, the historical.

1. The first, which we have distinguished as the *Subjective* tendency, embraces all those widely diverse schemes which agree in passing beyond the objective intention of the words and seeking veiled or underlying meanings. To this belong the different forms of the allegorical method, by which is meant the imposition of a sense not designed by the writer. It is the adding of a meaning foreign to the intention, rather than the substitution of an improper for the proper sense. The first Christian interpreters were under special temptations in this direction. The idea of the need of exceptional principles of exposition in order to reach the deep significance of divine communications had a great hold of the ancient mind, Greek, Roman, Oriental, and Hebrew. The spell of this idea and the powerful influence of the Rabbinical tradition, acting on the Christian conviction that the Bible is a divine message, readily induced the notion that the ordinary laws of interpretation are inade-

quate, and that Scripture is honored when the natural or "lower" sense is made the stepping-stone to a "higher" sense for which special processes are required. Early Christian literature, although its mysticism may sometimes be otherwise explained, adheres decidedly to this idea. The apostolic fathers and the Apologists, while not entire strangers to sound spiritual interpretation, are addicted to the allegorical. The *Epistle of Barnabas* confirms faith and perfects γνῶσις by spiritualizing the details of such narratives as that of the two goats in Leviticus xvi. The *Shepherd of Hermas* contains various examples. Clement of Rome gives the figurative application of the scarlet line suspended from Rahab's window, which is adopted by so many of the fathers. In this connection great interest belongs to Justin Martyr, who exhibits acquaintance with several of the distinct senses which were subsequently formulated. Embracing Christianity as the only certain philosophy, and carrying much of his old Platonism with him into his new faith, he dealt with the Scriptures very much as he dealt with the classics. The histories of the Old Testament (he seldom expounds the New) were a drapery covering broad spiritual truths. As the piling of Pelion and Ossa was a Greek version of the building of the tower of Babel, so Jacob's marriage with Leah and Rachel denoted Jehovah's revelation in the Jewish Church and the Christian. Every particular in prophetic passages like Gen. xlix. 9–12 had a mystical reference to Christ and His salvation, His passion being signified by the washing of the garments in wine, the Jews by the ass, the Gentiles by the colt.

The allegorical method, which offers itself as a natural expedient for harmonizing difficulties between religious faith and philosophical feeling, and which had been freely applied to Homer by Plato, found a most congenial home in Alexandria, where Philo's influence was strong. It became a recognized principle with the entire catechetical school, firmly rooted in the distinction which there prevailed between πίστις and γνῶσις. Clement of Alexandria, who seems to have been the first to bring the New Testament no less than the Old under its scope, finds a parabolic meaning in all Scripture, and affirms that the literal sense carries us simply to the elementary stage of Christian knowledge called faith, while it is only through the allegorical or mystical interpretation that we can reach that higher wisdom which implies insight into the essence, reason, and real relations of faith's objects. He speaks of a "tradition of the church," an "ecclesiastical canon," or "canon of the truth," which gives the key to the true understanding of Scripture, and is identified with the γνῶσις or spiritual apprehension of divine mysteries as that was first communicated by Christ to the apostles in oral form, and by them transmitted to their successors. This canon is described as "the consent and harmony of the law and the prophets with the covenant delivered during the Lord's presence." In accordance with this Clement discovers in the Mosaic law three senses in addition to the natural. The terms in which the precepts are expressed are images of other things, rules for the direction of life, and predictions of the future. The high priest's robe is an emblem of the world of sense; the bells upon it are a symbol of the acceptable year of the Lord. The decalogue itself is spiritualized, the fifth commandment being taken to refer to the Heavenly Father, and that divine Wisdom which is the mother of the just.[1]

A position of commanding importance must be claimed for Origen, whose genius secured wide and long-continued acceptance for his greatest extravagances. Exact grammatical exegesis is by no means alien to his homilies and commentaries, and many of his strangest uses of Scripture may be viewed as practical applications rather than scholarly expositions. Fanciful modes, however, are so predominant that he has been generally regarded as the chief allegorist of the Christian Church. Yet the disservice thus done by his example cannot cloud the lustre of his merits in Biblical studies. His Platonism, his adhesion to the Alexandrian idea of γνῶσις, his wish to defend and elucidate the Christian religion by reason and philosophy, his exaggerated notion of inspiration, combined to commend a mystical style of interpretation. In terms of the Platonic division of man into body, soul, and spirit, he held that Scripture had a threefold sense, σωματικός, ψυχικός, πνευματικός. The first, or obvious, sense was meant for the edification of the simple. The second, which was to be sought for under the letter, and embodied the soul of Scripture, exhibited the bearing of the word upon the practical needs of the moral life, and addressed itself to the more advanced. The third, which lay still deeper, and imparted the spirit of Scripture, disclosed pure unmixed truth, exercised the speculative powers, and was intended only for the perfect, such as are described in 1 Cor. ii. 6, 7. He has been sometimes credited with the promulgation of the fourfold distinction afterwards so current, especially in the Latin Church, and expressed in the couplet (given, *e. g.*, by Lyra):—

> Litera gesta docet, quid credas allegoria,
> Moralis quid agas, quo tendas anagogia.

Such terms, however, as tropological, mystical, allegorical, pneumatic, anagogical, are rather interchangeable with him. The literal sense, too, is so far from being dispensed with that he has even been regarded (*e. g.*, by Ernesti) as the first who secured for it its primary value, particularly in New Testament exegesis. But, while he maintains that the spirit and the letter are generally to be taken together, and admits that no small portion of the contents of Scripture (*e. g.*, the decalogue, precepts of universal obligation, even many of the narratives) may not be allegorized, his practice is greatly in the direction of esteeming the literal sense only as the protecting shell of secret treasure. Wherever the letter yields a meaning which seems to him unworthy, or opposed to reason and possibility, a mystical sense is discovered. He stumbles at the record of creation when it introduces the sun after the third day, at many of the Mosaic ordinances, at the realism of Christ's temptation. He finds mysteries or figures of spiritual things in Eden, Abraham's wives, Rebecca's visit to the well, the waterpots at Cana, and many other narratives. The later type of Alexandrian hermeneutics is seen in Cyril, who, without wholly abandoning the literal sense, carries typical interpretation into unqualified allegorical extremes in dogmatic and polemic interests.

The Western Church exhibited the same tendency, not only in the marked artificialities of such teachers as Hippolytus, Hilary, and Ambrose, but in the eminent instance of Augustine. Though not the first to attempt a statement of hermeneutical canons (having before him, for instance, the seven rules of Tichonius, which he states and criticises at length), he constructed more of a system in this line of inquiry as in some others. Many of the principles which are enunciated in different parts of his writings, and most definitely in his *De Doctrina Christiana*, are of permanent value. He conceives the object of interpretation to be the discovery of the thoughts of the writer exactly as he meant to express them. He shows that the real sense is often not to be got by insisting merely on expressions as they stand by themselves; that they must be compared with the immediate context; with similar passages elsewhere, and with the essentials of Christian doctrine; that faith and the aids of the Holy Spirit cannot supersede the use of science; that a reverent and sympathetic mind is indispensable. But along with such rules as these he propounds others which served as grounds for his allegorical procedure. He affirms, *e. g.*, that whatever cannot clearly be seen to bear upon honesty of morals or the truth of faith must be taken figuratively. He speaks of several different modes of interpretation,—the historical, the ætiological, the analogical, the allegorical. He usually practises the first and the last of these. His profound spiritual experience gave him a truer insight than his canons indicated into many parts of Scripture, and above all into the Pauline epistles. Yet over most even of the New Testament he allows the allegorical fancy to range freely. His influence perpetuated the reign of the allegorical method for many centuries throughout the Western Church. In Gregory the Great, the Venerable Bede, Hrabanus Maurus, Hugo de S. Caro, and many others, we see it steadily extending rather than merely maintaining its sway, until in Bonaventura we find the current four senses —historical, tropological, allegorical, anagogical—enlarged to seven by the addition of the symbolical, synecdochical, and hyperbolical.

2. The second great hermeneutical tendency, which we call the *Dependent*, has an equally instructive history. It is easy to understand how extreme allegorizing would lead to a counter movement, and how this would be helped by the exigencies of dealing with heretics who were themselves

[1] See especially *Strom.*, vi. p. 676–89; also Baur, *Die Christliche Gnosis*, and Kaye, *Some Account of the Writings and Opinions of Clement of Alexandria.*

advocates of γνῶσις. The appeal soon came to be made to a rule of faith which may at first have meant nothing more than the harmony of Scripture teaching, but which was speedily identified with something outside Scripture, with the contents of doctrinal summaries, or with the verdict of exegetical tradition. The East and the West gave way alike to this bias, but the West first and most positively. In both we find early mention of an ecclesiastical canon or norm of truth. In the Church of the East, indeed, that took originally the form of an authoritative γνῶσις or private exposition of the esoteric meaning of Scripture handed down by careful tradition from Christ and the apostles, while in the Church of the West it was rather the voice of the church itself, and that soon the voice as formulated. Both churches, however, more or less distinctly recognized an ecclesiastical tradition represented in compends of doctrine which were used for catechetical and other purposes, and an interpretative tradition embodied in the expositions of influential doctors. Thus hermeneutical independence was sacrificed. In Irenæus and Tertullian we see how a very natural reaction took this direction. The necessity of meeting errorists who were greater adepts in arbitrary spiritualizing than any whom the church could present led them to protest against the practice. They saw the propriety of looking to Scripture itself for hermenentical guidance, and of rescuing it from the despotism of a mystical philosophy which threatened the life of its cardinal doctrines. They adopted a simpler reading of its message, and so far they deserve the name of pioneers in real historical interpretation. But, as appears in their gross chiliastic expositions, their literalism was carried to excess. It came into conflict with the deeper declarations of Scripture, and this conflict they were tempted to compose by a relapse into fanciful methods. It created difficulties in their controversy with Gnostic opponents, and these they thought to remove by a final appeal to an authoritative tradition fixing the sense in which the sacred books which both parties used as witnesses to their doctrine were to be understood. This was to be found in its integrity in those ancient churches which had enjoyed direct apostolic teaching, and, as Irenæus conceived, in some special way in that of Rome. Gradually the idea of a normative analogy of faith discovered within Scripture was externalized, and the standard of interpretation was looked for in ecclesiastical symbols and the formal decisions of the heads of the church. In this process, which issued in the Tridentine definition of the ultimate determination of the interpretation of Scripture as resident in the church, and the more recent declaration of the infallibility of the pope as the voice of the church, Vincent of Lerins claims particular notice. In his *Commonitorium*, for which we are indebted to the Semi-Pelagian controversy, he lays down rules for the attainment of certitude in belief. Faith is to be settled by two things, the authority of Scripture and the tradition of the church. The former is a perfect and adequate foundation. Yet the caprices of interpretation require it to be supplemented by the latter. The sense of Scripture is the sense in which the church understands it, and this tradition of the Catholic Church, which is to be accepted as the canon of hermeneutics, is defined as "quod ubique, quod semper, quod ab omnibus creditum est." This treatise, still retained in singular honor by large sections of the Christian Church, exhibits the hermeneutics which had been winning acceptance since the times of Irenæus and Cyprian, and by which the Latin communion was led to bind itself. The result of the deference paid to the fathers in both churches, and especially in the West, was the renunciation of independent exegesis and the production of compilations of patristic comments. These σειραί or *Catenæ* epitomized the interpretations of most of the great expositors, particularly Origen, Chrysostom, Jerome, and Augustine, and were on the whole more successfully executed in the Greek Church than in the Latin. They were in use by the end of the 5th or beginning of the 6th century. Andreas of Cæsarea, who belongs to the former period, or Olympiodorus, whose date is about the beginning of the 7th century, has sometimes been recognized as the earliest epitomizer; but the position is to be assigned rather to Procopius of Gaza, who comes between these two. For many centuries the most eminent divines took part in the preparation of *Catenæ*, such as Cassiodorus (also a literalist), Bede (already cited as an allegorist), Alcuin, Hrabanus Maurus (often honored as the most learned interpreter of the 8th and 9th centuries), Haymo, Remigius, Sedulius, Theophylact, Œcumenius, Paschasius Radbertus, and Aquinas. The *Catena aurea* of Aquinas on the gospels was of great value. Redactions of the *Catenæ* were also made in course of time. These were the *Glossæ* which were known as *marginales* or *extrinsecæ* when the comments were given on the margin, and *interlineares* or *intrinsecæ* when these were introduced in the text. The most influential glossa of the second class was that of Anselm of Laon, who belongs to the end of the 11th and the beginning of the 12th century. Of the former the most important was the *Glossa ordinaria* of Walafrid Strabo, which was esteemed the chief exegetical manual for some six centuries. Throughout the Middle Ages, full as these were of theological activity, dogmatic and polemic, hermeneutics became more and more a tradition. The less the Bible was studied in a free spirit, the more it became the subject of strained panegyric. Aquinas, indeed, though his practice was often in conflict with his theory, could still speak of the literal sense as that on which all the senses of Scripture are founded, and of argument as to be drawn only from that one literal sense and not from those senses which are expressed according to allegory (*Summa*, i. 1, art. 10). But at last independence was so completely resigned that John Gerson, the illustrious chancellor of Paris, was only the exponent of the prevalent opinion, when he declared that those who did not take the literal sense as the church defined it ought to be dealt with not by curious reasonings but by statutory penalties.

3. But alongside these two hermeneutical tendencies there can be traced from the earliest times, however obscurely or fitfully, a third which we term the *Historical*. Men like Irenæus, Origen, Augustine, etc., were not wholly incapacitated for the exercise of a better method by their allegorical or dogmatic bias. There has been a line of interpreters, slender enough as that line has been at times, who have recognized it to be the exegete's object to discover the one sense intended by the writer himself, who have allowed allegory therefore only where the writings themselves indicated their mystical design, and who have laid the first importance on the grammatical sense and on the capacity of transporting oneself into the writer's position. Even Alexandria presents in the great Athanasius and in Isidore notable instances of interpreters who, though given to occasional spiritualizing, proceed on the principle of the αὐτάρκεια of Scripture (this specially in the case of Athanasius), and on the necessity of considering the occasion of each writing. But in direct antithesis to the allegorizing school of Alexandria stood the school of Antioch, which was grammatical and historical, with a tendency to an extreme literalism which yielded in not a few cases a jejune and unspiritual exegesis. Theophilus and Julius Africanus may claim a place in this order. But the acknowledged representatives of the Antiochene school are Lucian of Samosata, who is sometimes reckoned its real founder, Diodorus of Tarsus, Theodore of Mopsuestia, and above all John Chrysostom and Theodoret of the Syrian Cyrrhus. The last two, while not less careful of the objective sense, surpassed the others in spiritual insight. Chrysostom abounds in sound hermeneutical statements which strike a happy mean between Alexandrian arbitrariness and the unethical superficiality into which extreme Antiochene interpretation sank. He withstands the imposition of foreign senses as a practice dishonoring to the Word of God, and yet shows how much there is that must be taken otherwise than as it stands. He insists upon the importance of ascertaining the "scope" of a writing in order to a correct judgment of its separate declarations, on the necessity of the revelation of the Spirit, on the respect due to the harmony of Scripture with itself. He lays it down as a general principle that, when allegory is employed, the Bible also gives its interpretation as a check upon the unbridled desire of those who wish to allegorize (*Hom. in Genes.* v.). Theodoret exhibits a kindred sobriety, and, though occasionally guilty of seeking a secondary sense where the obvious sense seems too bald, ranks deservedly among the very best of ancient exegetes. Principles similar to the Antiochene prevailed for a long period also in the schools of Edessa and Nisibis. The objective tendency found representatives, too, in men like Basil of Cæsarea, Gregory of Nazianzus, Gregory of Nyssa (although he was less decidedly historical, and strongly advocated a non-literal reading of Canticles in particular), Pelagius, and the laborious Jerome. This last-named orna-

ment of the Latin Church, although he too often drifted into fanciful and even puerile interpretations, was strongly opposed both to the allegorists and the extreme literalists. Against the former he affirmed that the grammatical and historical sense must be held the fundamental thing. Against the latter he insisted that the figurative interpretation is not necessarily equivalent to the allegorical, and that the gospel is to be sought not in the words but in the sense of Scripture, not in the surface but in the marrow, not in the leaves of discourses but in the root of the idea (*Comm. in Habac.* iii. 14; *in Epist. ad Galat.* i. 11). In the unproductive centuries which followed, this purer hermeneutical tendency appears occasionally in such instances as those of Druthmar, "the grammarian;" Œcumenius, bishop of the Thessalian Tricca, who belongs to the 10th century; Theophylact, bishop of Achrida in Bulgaria, "the last of the fathers;" Rupert of Deutz and Euthymius Zigabenus, who carry us into the 12th century.

A great impetus was given to independent hermeneutics by the Humanists and the precursors of the Reformation. An eminent position is occupied by Nicolaus de Lyra, to whose *Postillæ*, or brief commentaries on the whole Bible, Luther and the Reformers owed a debt expressed in the familiar distich, "Si Lyra non lyrasset, Lutherus non saltasset." The current fourfold division of the sense of Scripture still appeared in his writings, but for the most part only as a theoretic division. He allowed occasional spiritualizing, but that mostly in the form of professed practical application of the proper sense. He declared anew the necessity of adhering to the plain objective meaning, likening the mystical interpretation which departs from the solid basis of the literal sense to a building which deviates from its foundation and inclines to its fall. On the side of grammar and philology the reaction was helped by Laurentius Valla and other Humanists, although the services of Reuchlin in particular, great as they were in the assertion of exegetical freedom and in the restoration of linguistic science, were impaired by cabbalistic predilections (*cf.* specially his *De verbo mirifico*). On the religious side, something was achieved by men like Wycliffe, Huss, Wessel, who all perceived the primary importance of the grammatical method, and Faber Stapulensis (Lefèvre d'Étaples), who affirmed the sufficiency of the Word, and practised an independent, non-dogmatic exegesis. It is matter of course that Erasmus should claim special notice in this connection. In this consummate scholar and versatile genius, who continued and vastly excelled all that had been attempted by Valla and others, and whose guidance the Reformers were wise enough to follow, notwithstanding the frequent deficiencies of his exegesis in depth and spiritual insight, we come at length upon a master hand that marks a great epoch. Indecision clings indeed to his utterances on some subjects. He speaks with caution on the infallibility of the church and the church's head, although he lets us see that he rejects it. He admits the existence of occasional inaccuracies in the Scriptures. But he declares that these are so far from being disadvantageous to the gospel that they are turned by the Spirit into a help to faith. He adds at the same time that if the authority of the entire Scripture should be supposed to be impaired by the presence of the smallest error in it, it is more than probable that none of the copies now used by the Catholic Church is so perfect as to be free from the intrusion of all mistakes, accidental or intentional (*cf. Annot. in Matt.* ii. 6). But his clear enunciation of the interpreter's independence and the inquirer's obligation to become bound by the authority of no one (*In Luc.* ii. 35), his advocacy of the translation and free circulation of the Scriptures, his repudiation of any other sense than what was meant to be conveyed, his sagacity in dealing with the figurative sections of both Testaments, his recognition of the need of a "pia curiositas" and a "curiosa pietas" in the exposition of the divine word (*cf.* Pref. to *Paraph. in Evang.*), his practice of the true exegetical art in his *Paraphrases* and *Annotations*, contributed powerfully to the diffusion of better hermeneutical ideas.

The mightiest impetus was given by the Reformers. They were the heirs of what was best in the ancient school of Antioch and in the Humanistic revival. But they added to the philology, the grammar, the history, and the independence which were illustrated in these the spiritual insight and the personal religious interest which were so often wanting. The process by which they won their own way to a freer faith lifted them above tradition, mysticism, and unspiritual literalism. Their profound religious experiences, intensified by the forces at work in an unexampled mental upheaval, made the Bible a new thing to them. It came to them as God's message, and they received it as the only rule of faith and life. It spoke immediately to their souls, and they saw it was to be interpreted by itself. They found it a message conveyed in historical form, and recognized the need of the appliances of language and history in order to read it. They perceived it to be a spiritual message, and discovered that the full reception of it could come only by spiritual enlightenment. Believing it to be a message meant for all, they held it perspicuous to the general intelligence of the prayerful in all that concerns faith and morals, and affirmed, with Melanchthon, "unam et certam et simplicem sententiam ubique quærendam esse juxta præcepta grammaticæ, dialecticæ, et rhetoricæ." Each of the great Reformers did something to advance this truer hermeneutical movement. Luther, Zwingli, and Calvin were alike imbued with the historic sense, Luther excelling in spiritual genius and a bold originality which carried him at times to extremes in the independence of his treatment of Scripture, Zwingli in an incisive perception which inclined strangely at times to subjective interpretations, Calvin in a union of qualities which distinguished him as the foremost exegete of the Reformation. Profoundly reverencing Scripture as God's word, submitting to it as authoritative, yet not binding himself to any theory of its inspiration which would preclude the possibility of circumstantial inaccuracies (*cf.* on Matt. xxvii. 9, Acts vii. 16), the Reformer of Geneva excelled all in freedom from arbitrary exposition, in reading the Biblical statements in the light of historical occasion and intention, in laying the foundations of a truer typology, and in exhibiting with its Christward testimony the historical basis of Messianic prophecy. The coryphæi of Protestant exegesis were aided by Beza, Bucer, Bullinger, Œcolampadius, and others. At length the hermeneuties of the Reformation found symbolical expression in the Protestant definitions of the exclusive sufficiency of Scripture, its perspicuity under the use of the ordinary means and with the teaching of the Holy Spirit, its possession of a sense which is one and not manifold, and its interpretation by itself. In the *Clavis Scripturæ Sacræ* of M. Flacius Illyricus it was cast for the first time into systematic form, and dealt with theoretically.

With the Reformation objective exegesis may be said to have been firmly established. The conditions were also laid for further hermeneutical progress. Since then the principles of true grammatico-historical interpretation have been gradually coming to be better understood and more successfully applied. This has not been the case, however, without frequent relapses. In various schools there have been revivals of old errors. There has been a return to the subjective tendency, *e. g.*, in the "moral interpretation" of Kant, as well as in various forms of rationalistic and Socinian exegesis. In accordance with his ideas of the empiric and local order of an historical faith, and his definition of morality as the essence of religion, Kant held that the judgments of the pure reason must be the test of religious truth, and that the literal sense, when it seems to convey a meaning adverse to morality, inconsistent with reason, or unworthy of God, must have a new meaning found for it. His hermeneutics, therefore, did not profess to rest with the sense intended by the writer, but reckoned it legitimate to adopt any possible sense which should be conformable to the interests of perfect morality. To the same tendency belong the "psychological interpretation" of Paulus and Eichhorn, and the mythical interpretation of Weisse and Strauss. Of these the former proposed to hermeneutics the task of distinguishing the realities from the inexact impressions formed of facts by the sacred writers, while the latter sought principles by which the idea might be disentangled from the narrative vesture which it had woven for itself. Pietism, too, although its leaders, Spener and Francke, were of a better spirit, degenerated through its straining after "edifying" interpretation into mystic and chiliastic license. The dependent tendency, again, formulated in the symbolical definitions on the subject of the Vulgate as the basis of exegesis, the church as the authoritative interpreter, and the pope as the infallible exponent of the church in official declarations on faith and morals,

has become so firmly seated in the Roman Catholic communion that the interpreter's attitude to the church is capable of being compared by a Catholic author to that of a diplomatist acting in the spirit and interest of his prince.[1] It is followed, too, by that section of the English Church which defers to primitive tradition or the consent of the fathers of the first four centuries. Even among those who adhere to the Protestant positions there has been partial reaction in both directions. The subjective tendency has reasserted itself, *e. g.*, in the artificial typology of the Cocceian school, although Cocceius himself rather deserves the credit of making Protestant theology, after it had entered its scholastic period, again more Biblical, and of enforcing the importance of a literal, contextual interpretation. The dependent tendency has reappeared where the "analogy of faith," instead of being kept to the original idea of the general contents of Scripture as gathered from the lucid passages and used for a help to the understanding of the obscurer, has been identified with the creeds and employed as an external standard of interpretation.

But with partial retrogression there has been an advance on the whole in Protestant hermeneutics. To this interpreters of very different schools have contributed. Among these are to be mentioned Sal. Glassius, the author of the *Philologia Sacra*, Hugo Grotius, Abr. Calov, G. Calixtus, J. J. Rambach, whose *Institutiones Hermeneuticæ Sacræ* exercised a salutary influence, notwithstanding his inclination to the pietist principle of "emphasis" in interpretation; J. A. Bengel, in whose *Gnomon* a happy union was effected between pietism and science; and J. S. Semler, who did much for the expansion of historical interpretation, notwithstanding the injurious results of his theory of accommodation. Of still greater importance are J. A. Ernesti, to whose celebrated *Institutio Interpretis Nova Testamenti* last century was indebted for the scientific presentation of the soundest hermeneutical principles on the philological side; Friedr. Schleiermacher, whose *Hermeneutik* abounds in fertile suggestions, and brings out for the first time the necessity of recognizing a specifically Christian element in the language of the New Testament; and F. Lücke, who illustrates the just combination of the strictest scientific method with the primary qualification of spiritual sympathy with the Word in the true interpreter. Extensions of hermeneutical method have been attempted, in the form of defining a special "psychological" (Stäudlin), "theological" (Klausen, Landerer), or "dogmatic" (Doedes) interpretation, or in the form of proposing new modes of interpretation, such as the "æsthetical" of Pareau, the "pneumatical" of Beck, the "panharmonic" of Germar. But whatever is valid in these schemes comes within the ordinary grammatico-historical method. Properly understood, the historical side of that method covers all that concerns the transportation of the exegete, not only into the times and circumstances of the composition of the books, but also into the position and personality of the authors. It embraces therefore that subjective quality which, however variously designated as the religious preparation, sympathy with the writers and their message, spiritual tact, or the illumination of the Holy Spirit, has been recognized by the best interpreters to be a primary and essential requisite. The development of these principles has been greatly helped by the grammatical studies of men like Gesenius, Ewald, Olshausen, and Böttcher in Hebrew, and Winer and Buttmann in Greek; by the literary, historical, critical, and theological investigations of Herder, Baur, Rothe, Hofmann, and many others; and above all by the exegetical practice of scientific expositors such as De Wette, Bleek, Hupfeld, Lücke, Meyer, Godet, Ellicott, Lightfoot, and Delitzsch. Results are thus being gathered which will issue in new enlargements of hermeneutical method. A clearer insight is being gained into the genius of the languages, which has already rescued New Testament Greek from purist and Hebraist extremes, and into the nature of typology, the laws of prophecy, the relation of the two Testaments to each other, the historical delivery and development of their contents, the unity (so distinguishable from uniformity) which animates their different sections. In these directions there is the promise of further progress in hermeneutics. More exact inquiry into the presuppositions which underlie the Biblical doctrines will also tell upon the laws of interpretation. Differences in hermeneutical method, however, run up finally into differences of conception on the origin of the sacred literature, its intention, and the spirit which animates it. Uncertainty of view on the subject of what Scripture is and what its inspiration covers, as seen in the symbols of the churches and in the widely divergent positions affirmed by representative theologians of different schools (*cf., e. g.* those expounded respectively by Chemnitz, Beck, Schleiermacher, Martensen, Hodge, Ewald, Rothe, Hofmann), exercises a disturbing influence. More determinate conclusions on the definition of Scripture, such as can be the result only of completer historical investigation into the rise and object of the several books, must yet be reached before a thorough adjustment is possible between the religious interest and the scientific in Biblical hermeneutics.

[1] Loehnis, *Grundzüge der biblischen Hermeneutik und Kritik*, p. 151, Giessen, 1839.

Literature.—On the history generally:—Buddæus, *Isagoge hist. theol.*, etc., 1730; Hartmann, *Die enge Verbindung des A. T. mit dem N. T.*, 1831, J. G. Rosenmüller, *Historia interp. libr. sacr. in eccles. Christ.*, 5 vols., 1795–1814, G W. Meyer, *Geschichte der Schrifterklärung seit der Wiederherstellung der Wissenschaften*, 5 vols., 1802–8; L. Diestel, *Geschichte des alten Testaments in der christ. Kirche*, 1869; also the notices in Reuss's *Geschichte der heil. Schriften N. Test.*; the Introductions to the Old Testament by Keil and Bleek, and De Wette's *Lehrbuch der historisch-kritischen Einleitung in das Alte und Neue Testament* (edited by Schrader), 1869; and the sketches in Klausen's *Hermeneutik des N. T.* (German edition, Leipsic), 1841; J. L. Lutz's *Biblische Hermeneutik*, 1861, S. Davidson's *Sacred Hermeneutics*, 1843. On the Rabbinical Hermeneutics:—Surenhusius, Βίβλος καταλλαγῆς, 1713; Zunz, *Die gottesdienstl. Vorträge d. Juden*, 1832; Pressel's article "Rabbinismus," in Herzog's *Real-Encyclopädie*; Hirschfeld, *Der Geist der talmudischen Auslegung der Bibel* (Erster Theil, "Halachische Exegese," 1840), and *Der Geist der ersten Schriftauslegungen, oder die hagadische Exegese*, 1847; Frankel, *Vorstudien zu der Septuaginta*, 1841; E. Deutsch, *Literary Remains*, 1874; and the sections in Jost's *Geschichte des Judenthums und seiner Secten*, Grätz's *Geschichte der Juden*, Derenbourg's *Histoire de la Palestine*, Hausrath's *Neutestamentliche Zeitgeschichte*, Schürer's *Lehrbuch der Neutestamentlichen Zeitgeschichte*, and Gfrörer's *Jahrhundert des Heils*. On the Kabbala also.—Delitzsch, *Zur Geschichte der Jüdischen Poesie*, 1836, Jellinek, *Moses ben Schem Tob de Leon und sein Verhältniss zum Zohar*, 1851; Ginsburg, *The Kabbalah, its Doctrines, Development, and Literature*, 1865. On the Alexandrian School.—Gfrörer, *Philo und die alexandrinische Theosophie*, 1831; Keim, *Geschichte Jesu von Nazara*, vol. i., Siegfried, *Philo von Alexandria als Ausleger des A. T*, 1875; Frankel, *Ueber den Einfluss der palästinischen Exegese auf die alexandrinische Hermeneutik*, 1851, and *Ueber palästinische und alexandrinische Schriftforschung*, 1854; the monographs by Kaye on Clement and Thomasius, and Redepenning on Origen; C. R. Hagenbach, *Obs. circa Origenis methodum interp.*, 1823; J. J. Bochinger, *De Origenis allegorica S. S. interpretatione*, 1829. On the Antiochene School:—Hergenröther, *Die Antioch. Schule und ihre Bedeutung auf exeg. Gebiete*, 1866; Kihn, *Die Bedeutung der Antioch. Schule auf dem exeget. Gebiete*, 1867; Specht, *Der exeg. Standpunkt des Theodor von Mopsuestia und Theodoret von Kyros in der Auslegung mess. Weissag.*, 1871, also the monographs on Chrysostom by Neander, Meyer, Förster, and Stephens. Of the treatises referred to above, the following are of special importance:—M. Flacius, *Clavis S. Scripturæ* (by Musæus), 1674; Rambach, *Institutiones Hermeneuticæ*, 1723; Ernesti, *Institutio interpr. N. T.* (in English by Terrot, 1843); Schleiermacher, *Hermeneutik und Kritik mit besond. Beziehung auf das N. T.* (by Lücke), 1838; Fr. Lücke, *Grundriss der Neutest. Hermeneutik*, 1817. In addition these also deserve notice:—S. F. N. Morus, *Super Hermeneutica N. T. acroases academ.*, 1797–1802; Olshausen, *Ein Wort über tiefern Schriftsinn*, 1824; Kuenen, *Critices et Hermeneutices librorum Novi Fœderis lineamenta*, 1858; Döpke, *Hermeneutik der Neutest. Schriftsteller*, 1829; Wilke, *Die Hermeneutik des N. T. systematisch dargestellt*, 1843–44; Immer, *Hermeneutik des N. T.*, 1873, English edition by Newman, Andover, 1877; Cellerier, *Manuel d'Hermeneutique biblique*, 1852; Doedes, *Manual of Hermeneutics*, 1867; Lange, *Grundriss der bibl. Hermeneutik*, 1878. On the Hermeneutics of the Roman Catholic Church, in addition to Loehnis, there may be mentioned—J. Jahn, *Enchiridion Hermeneuticæ generalis tabularum Vet. et N. T.*, 1812; Ranolder, *Herm. bibl. gen. principia rationalia*, 1839; Kohlgruber, *Herm. bibl. gener.*, 1850; Güntner, *Herm. bibl. gener.*, 1851; Setwin, *Herm. bibl. institutiones*, 1872; Reithmayr, *Lehrbuch der bibl. Herm.*, 1874; Friedlieb, *Prolegomena zur bibl. Hermen.*, 1868; Wilke, *Bibl. Hermen.*, 1853. Important discussions of sections of the subject are found in Seyffarth, *Ueber Begriff, Anordnung, und Umfang der Herm. des N. T.*, 1824; J. C. K. von Hofmann, *Vermischte Aufsätze*, 1878; John Keble, *Primitive Tradition recognized in Holy Scripture*, 1837, and *On the Mysticism attributed to the Early Fathers of the Church*, 1868; Merx, *Eine Rede vom Auslegen ins besondre des Alten Tests.*, 1879. (S. D. F. S.)

HERMES is the name of a Greek god (corresponding to the Roman Mercury) whose origin and real character are perhaps more difficult to define than is the case with any other Greek deity here it is possible only to give an outline of one definite theory, and refer the reader to the works quoted at the end. He was not a god worshipped by the pure Doric or Ionic races, but is found in most places where Æolian, Achæan, and Pelasgic tribes can be traced. If we begin with the rudest races, summed up generally under the title of Pelasgic, we find Hermes often connected with the mysterious Cabiri. These deities, in the accounts we have, vary in number and sex, being sometimes two, sometimes three or four. We may conclude that originally they were a pair, male and female, whom we may compare with Uranus and Gæa, or with Cronus and Rhea. Often the female is doubled, as mother and daughter, resembling the relation of Demeter and Persephone; while the male also is transformed either into twin brothers, or into a father and his son by one of the female deities. Certainly the male deity seems sometimes to be regarded as Hermes, sometimes as Hephæstus (see HEPHÆSTUS), while in other places the two are associated. Hermes and Hephæstus are perhaps local varieties of one type, which after having acquired distinct individuality in their separate homes were brought beside each other by subsequent intercourse. Hence we may understand how the epithet ἄγγελος and the office of messenger between gods and men, which in the *Rig Veda* belong to Agni, the fire, are in Greek mythology attached to Hermes. This Pelasgic Hermes is an ithyphallic deity, the god of fertility and reproductive power, and bestower of riches in flocks and herds. Corresponding to this religious conception we have in mythology such epithets as ἐριούνιος, ἀκάκητα, etc.; and in the hymn to Aphrodite (written perhaps in Æolis in the 9th century B.C.), Hermes and the Sileni (Latin *Silvani*) are the companions of the mountain nymphs. So in Arcadia, one of the chief seats of his worship, where on Cyllene his birthplace was shown, he was by Penelope the father of Pan. Penelope, the "torch-eyed" (Ahrens in *Philol.*, 1879, p. 205), is a form of Athene, Odysseus of Hermes; and Hermes and Athene are associated as Hephæstus with Athene in Attica. In the very mixed Attic people, it is not surprising to find the worship of Hermes widespread; it is sometimes said to have been introduced into Samothrace. In Athens Hermes is the god of social life and intercourse in general, of streets and doorways, and of the palæstra. He is worshipped as ἀγοραῖος and προπύλαιος; and Hermæ, pillars supporting a bearded head and furnished with a phallus, stood all over the city. In Bœotia also we find Hermes, especially at Tanagra, where Hermes the champion, and Hermes κριοφόρος, the averter of diseases, were worshipped. The Doric god Apollo, with the titles Agyieus and Paion, corresponds most closely to these last aspects of Hermes. As god of social intercourse he easily grows into the impersonation of cleverness, and at last into the patron of thieves. If we pass from religion to mythology, where we find all the successive ways of expressing views of nature preserved to us side by side, we find an immense variety of traditions. The most common subject in these tales is the struggle between darkness and light. When it is said that Hermes stole the oxen of Apollo, and after killing two of them nailed their skins on a rock, we have one of a class of myths described at length by Kuhn (*Entwickelungsstufen der Mythologie*). The slain animal is the sun, who is killed every evening; and the hide, *i.e.*, the sky of night, is either hung up on the tree of heaven (as is the Golden Fleece) or fastened with the star-headed nails. Again, when Io, the moon, is watched by the hundred-eyed Argus (Sanskrit *rajas*, "darkness"), the star-studded sky, Hermes slays Argus with a stone, the same which Cadmus and Jason, use, viz., the rising sun. In both cases Hermes is the sun-god as hidden during the night away among the souls of the dead; hence the Chthonian character so frequently attached to him. The rod with which he lulls men to sleep is the same sceptre that the ruler of the dead, Yama or Rhadamanthus, Minos or Hades, always bears (Kuhn in *Zft.*, iv. p. 123); he is also the sender of dreams; we find him worshipped among the Chthonian deities at Cnidus, and on vases accompanied by the Chthonian dog. We are now able to understand a fact which is perhaps the most interesting point connected with Hermes. Kuhn first pointed out the identity of the Greek Ἑρμείας with the Sanskrit Sârameyas, and though the connection has been doubted by various writers, as Mannhardt (*Wald- und Feld-Kulte*, ii. pref.) and others, yet no valid objection has ever been offered on etymological grounds (see Benfey in *Abhandl. Gött. Ges.*, 1877). Amid the difficulties which still envelop the translation and the mythology of the Vedas, it is, however, even more difficult to discover the original character of the two Sârameyau and their mother Saramâ, than it is to determine the nature of Hermes. The two Sârameyau are mentioned twice in the *Rig Veda* (vii. 55; x. 14); they are two dogs, are said both to guard the way to the abode of the dead and refuse a passage to the impious, and also to act as the messengers of Yama, carrying away the souls when the time of death has arrived. Saramâ also seems to be regarded as the messenger or the dog of Indra; and Hermes appears regularly as the companion and helper of all the light-heroes on their adventures. One epithet of these dogs is Çarvara, spotted, which in its Greek form Cerberus (Benfey, *Vedica*, p. 149) is the name of the dog that guards the gate of the lower world. Now we find in Rome that two *lares præstites*, children of Mercury and Egeria, are said to guard dwellings and streets in the form of dogs; and in the German legend the dog who attends the wild huntsman Wuotan, *i.e.*, the sun hidden during the seven winter months, is closely related to the dwarfs or spirits of the dead, and is called by their name (Kuhn, *Westf. Sagen*, i. p. 69c). So Hermes, whom we have seen as king of the dead, is as ψυχοπομπός also the conductor of souls to their future home, we may therefore count the dog (or dogs) as ultimately identical in character with the king of the dead. Sonne (on Charis in Kuhn's *Zft.*, x.) has pointed out how these primitive conceptions commonly pass through the stage of animals before reaching that of gods; and in mythology we have the two stages preserved side by side as distinct beings. The Hindu Kubera, lord of the treasures of the lower world, who may be identified with Pluto or with Hermes, is styled "Lord of the hosts of the Sârameyas."

In this account there has been no room left for the idea of Hermes as connected with the wind. The sun, after he has set at night, is the same as the sun hidden during the dreary months of winter, who then rides abroad in the tempest. The wind is then easily conceived as his servant and messenger, and is often considered to carry away the souls of the dead (see HARPIES). From his connection with the wind, Hermes is represented with winged shoes. But with Roscher (*Hermes der Wind-Gott*) to see in Hermes simply the wind is to take a narrow view and to ignore the character of primitive Aryan thought.

In art, besides the Hermæ already described, Hermes is in the archaic time represented as a man with pointed beard, wearing a chlamys and the broad hat called petasus; his symbols are the staff (κηρύκειον) and the winged shoes (talaria). The ideal type of Hermes was probably modelled after the statue by Praxiteles in the Heraion at Olympia. This statue, which was recently discovered by the German expedition, represented the god leaning with his left arm on a rock and supporting on it the infant Bacchus. The right arm, which is lost, probably held the caduceus. The form shows a perfect combination of agility and strength.

See the works on mythology or religion by Welcker, Gerhard, Rinck, Stuhr, Schwenck, O. Müller, Eckermann, H. D. Müller, Lauer, Schwartz, Max Müller, Preller, Hartung, Braun, Maury, etc., also Lehrs, *Popularische Aufsätze;* Schömann, *Hesiod. Theog.;* Göttling in *Hermes*, xxix.; Mehlis, *Grundidee des Hermes, Myriantheus Açoins;* Haupt in *Zft. f. Alterth.*, 1842; Oestermann, *Hermes-Odysseus;* H. D Müller in *Philologus*, xiv.; Kuhn in Haupt's *Zft. f. d. Alterth.*, vi.; Von Hahn, *Sagwissensch. Studien;* Roscher, *Hermes.* As usual, the fullest list of ancient authorities is to be found in Jacobi, *Handwörterbuch der Mythologie* (W. M. RA.)

HERMES, GEORG (1775–1831), a distinguished Catholic theologian, born on 22d April, 1775, at Dreyerwald, in Westphalia, was educated at the gymnasium and university of Münster. His life presents no facts of importance. After completing his course of study at Münster, he acted for some time as lecturer at the gymnasium and then as professor at the university. In 1820 he was called, as professor of theology, to the university of Bonn, where he remained till his death on 26th May, 1831. Hermes was peculiarly adapted for the life and work of the professoriate. He had great gifts as a lecturer and teacher, and gathered round him at Bonn a devoted band of adherents. His works were *Untersuchungen über die innere Wahrheit des Christenthums*, Münster, 1805, and *Einleitung in die Christ-*

katholische Theologie, of which the first part, a philosophical introduction, was published in 1819, the second part, on positive theology, in 1829. The *Einleitung* was never completed. His *Christkatholische Dogmatik* was published, from his lectures, after his death by two of his scholars, Achterfeld and Braun, 3 vols. 1831–4.

The *Einleitung* is a remarkable work, both in itself and in its effect upon Catholic theology in Germany. Few works of modern times have excited a more keen and bitter controversy. Hermes himself was very largely under the influence of the Kantian and Fichtean ideas, and though in the philosophical portion of his *Einleitung* he criticises both these thinkers severely, rejects their doctrine of the moral law as the sole guarantee for the existence of God, and condemns their restricted view of the possibility and nature of revelation, enough remained of purely speculative material to render his system obnoxious to the Catholic Church. A very few years after his death, the contests between his followers and their opponents grew so embittered that reference of the dispute was made to the papal see. The judgment consequent upon a review of Hermes's writings, undertaken in Rome in 1833, was adverse, and on 25th September, 1835, a papal bull condemned both parts of the *Einleitung* and the first volume of the *Dogmatik*. Two months later the remaining volumes of the *Dogmatik* were likewise condemned. The controversy did not cease with this condemnation; but not till 1845 was there any systematic attempt on the part of Catholic theology to examine and refute the Hermesian doctrines. In that year was published anonymously by F. X. Werner the most complete survey of the principles of the works of Hermes as contrasted with the orthodox catholic faith (*Der Hermesianismus*, 1845). In 1847 the condemnation of 1835 was confirmed by Pius IX. A sufficient account of Hermes and the dispute raised by him will be found in K. Werner, *Geschichte der Katholischen Theologie*, 1866, pp. 405 *sqq.*

HERMES TRISMEGISTUS. The Egyptian Thoth, Tauut, or Tat (see vol. vii. p. 622), who was identified by the Greeks more or less completely with their own Hermes, is described in the hieroglyphics by various epithets, among which occurs that of "the great great" or twice great, with an added hieroglyphic (a kite) also signifying "great." To him as scribe of the gods, "Lord of the divine words," "Scribe of truth," was attributed the authorship of all the strictly sacred books generally called by Greek authors Hermetic. These, according to Clemens Alexandrinus, our sole ancient authority (*Strom.*, vi. p. 268 *sq.*), were forty-two in number, and were subdivided into six divisions, of which the first, containing the ten books "of the prophets," dealt with laws, deities, and the education of priests; the second, consisting of the ten books of the "stolistes," or official whose duty it was to dress and ornament the statues of the gods, treated of sacrifices and offerings, prayers, hymns, festive processions; the third, "of the hierogrammatist," also in ten books, was a repertory of hieroglyphical, cosmographical, geographical, and topographical information; the four books "of the horoscopus" were devoted to astronomy and astrology; the two books "of the chanter" contained respectively a collection of songs in honor of the gods and a description of the royal life and its duties; while the sixth and last division, consisting of the six books "of the pastophor," was medical. Of this canon, which according to the generally received opinion of Bunsen must have been closed at latest in the time of the Psammetichi but probably earlier, numerous small fragments are to be found in the works of Stobæus and other ancient writers. The now well-known *Book of the Dead*, according to Bunsen, originally had its place among the ten ceremonial books of the "stolistes," but this is denied by Lepsius; an ancient papyrus recently deciphered by Ebers is believed by that author to date from about the year 1500 B. C., and to have formed part of one of the books of the pastophor.

The epithet Trismegistus (ὁ τρισμέγιστος, or "superlatively" greatest), as applied to Hermes, is of comparatively late origin, and cannot be traced to any author earlier than the 2d Christian century. Most probably it arose out of the earlier forms μέγας καὶ μέγας or μέγιστος, derived by the Greeks from early Egyptian sources; but various other explanations of the appellation have been offered, such as that of the author of the *Chronicon Alexandrinum* (47 A. D.), who maintains that it was because Hermes, while maintaining the unity of God, had also asserted the existence of three supreme or greatest powers that he was called by the Egyptians Trismegistus.[1] This view, which is also adopted by Suidas, seems preferable at least to that met with in Nicolai's *History of Greek Literature*, according to which an apocryphal author named Hermes was called τρισμεγίστιος, simply in order to indicate that he had succeeded and outdone a certain Megistias of Smyrna in astrological, physiognomical, and alchemistic theories. The name of Hermes seems during the third and following centuries to have been regarded as a convenient pseudonym to place at the head of the numerous syncretistic writings in which it was sought to combine Neo-Platonic philosophy, Philonic Judaism, and cabbalistic theosophy, and so provide the world with some acceptable substitute for the Christianity which had even at that time begun to give indications of the ascendency it was destined afterwards to attain. Of these pseudepigraphic Hermetic writings some have come down to us in the original Greek; others survive in Latin or Arabic translations; but the majority appear to have perished. That which is best known and has been most frequently edited is the ποιμάνδρης *sive De Potestate et Sapientia Divina* (ποιμάνδρης being the Divine Intelligence ποιμὴν ἀνδρῶν), which consists of fifteen chapters treating of such subjects as the nature of God, the origin of the world, the creation and fall of man, and the divine illumination which is the sole means of his deliverance. The *Editio Princeps* appeared in Paris in 1554; and there has been a recent edition by Parthey (1854); the work has also been translated into German by Tiedemann (1781). Along with it are usually printed the certainly later ὅροι or *Definitions* of Asclepius, which have sometimes but erroneously been attributed to Apuleius. Other Hermetic writings which have been preserved, and which have been for the most part collected by Patricius in the *Nova de Universis Philosophia* (1593), are (in Greek) Ἰατρομαθηματικὰ πρὸς Ἄμμωνα Αἰγύπτιον, Περὶ κατακλίσεως νοσούντων περιγνωστικά, Ἐκ τῆς μαθηματικῆς ἐπιστήμης πρὸς Ἄμμωνα; (in Latin) *Aphorismi sive Centiloquium, Cyranides*; (in Arabic, but doubtless from a Greek original) an address to the human soul, which has been translated by Fleischer (*An die menschliche Seele*, 1870). The connection of the name of Hermes with alchemy will explain what is meant by hermetic sealing, and will account for the use of the phrase "hermetic medicine" by Paracelsus, as also for the so-called "hermetic freemasonry" of the Middle Ages.

See Ursinus, *De Zoroastre, Hermete*, etc., Nuremberg, 1661; Lenglet Dufresnoy, *L'Histoire de la Philosophie Hermétique*, Paris, 1742; Baumgarten-Crusius, *De librorum hermeticorum origine atque indole*, Jena, 1827; Hilger, *De Hermetis Trismegisti Poëmandro*, 1855; Ménard, *Hermès Trismégiste: Traduction complète, précédée d'une étude sur l'origine des livres hermétiques*, 1866; Pietschmann, *Hermes Trismegistus, nach Ægyptischen, Griechischen, und Orientalischen Ueberlieferungen*, 1875.

HERMESIANAX, an elegiac poet of the Alexandrian school, was born at Colophon, and flourished in the time of Philip and Alexander, or a little later. He was a friend and admirer—probably also a pupil—of the grammarian and poet Philetas, whom he outlived. His chief work was a poem in three books, which he, following the example of his countrymen Mimnermus and Antimachus, inscribed with the name of his mistress Leontium (said by some to be the same as the mistress of Epicurus). Of this poem a fragment of about one hundred lines has been preserved by Athenæus (xiii. 597); and it may serve as a specimen of the style of the school. Erotic in character, and plaintive in tone, it enumerates instances, mythological and historical, of the irresistible power of love, and redeems the monotony of its ground plan by its picturesque language, and by the alternate force and tenderness of its treatment. Hermesianax was exceedingly popular in his own times, and was highly esteemed even in the Augustan period. Propertius follows his example in dedicating the first book of his *Elegies* to his mistress Cynthia.

Many scholars have labored upon the text, but it is still in a very unsatisfactory condition. See Hermann, *Opuscula*, iv.; Schneidewin, *Delect. Poes. Eleg.*; Bergk, *De Hermesianactis Elegia*; the editions of Bailey (London, 1839), etc.

HERMOGENES, of Tarsus, Greek rhetorician, flourished in the reign of Marcus Aurelius. His precocious ability secured him a public appointment as teacher of his art

[1] Ἑρμῆς ἔφρασε τρεῖς μεγίστας δυνάμεις εἶναι, τὸ τοῦ ἀῤῥήτου καὶ δημιουργοῦ θεοῦ ὄνομα μίαν θεότητα εἶπεν εἶναι . . . διὸ καὶ ἐκλήθη ὑπὸ τῶν Αἰγυπτίων Τρισμέγιστος Ἑρμῆς

while as yet he was only a boy; but at the age of twenty-five his faculties gave way, and he spent the long remainder of his life in a state of intellectual impotency. In the nine or ten years, however, of his activity he composed a whole series of treatises on matters rhetorical, which became popular text-books, and the subject of subsequent commentaries. Of his Τέχνη ῥητορικὴ we still possess Περὶ τῶν στάσεων; Περὶ εὑρέσεων; Περὶ ἰδεῶν; Περὶ μεθόδου δεινότητος, and Προγυμνάσματα.

The last-mentioned was only known from Priscian's Latin translation till the publication by Heeren of the Greek original discovered at Turin (*Bibl. für alte Lit und Kunst*, Gött., 1791). Richard Volkmann, in *Animadversiones criticæ in nonnullos veterum de præexercitationibus rhetoricis locos* (Jauer, 1869), discusses the relation of the original to Priscian's translation, and treats them as sources of reciprocal emendation.

HERMON, the highest mountain in Syria (9150 feet above the Mediterranean), an outlier of the Antilebanon. The name חֶרְמוֹן, "separate," is perhaps due to its isolated position. The Sidonians called it Sirion, and the Amorites Shenir (Deut. iii. 9). It is probably the "high mountain" near Cæsarea Philippi where the Transfiguration occurred (Mark ix. 2). The modern name is *Jebel esh Sheikh*, or "chief mountain." It is also called *Jebel eth Thelj*, "snowy mountain." The ridge of Hermon, rising into a dome-shaped summit, is 20 miles long, extending north-east and south-west. The formation is a hard dark-gray crystalline limestone belonging to the Neocomian period, and full of fossils. The spurs consist in some cases of white chalk covering the limestone, and on the south there are several basaltic outbreaks. The mountain in spring is covered with snow, but in autumn there is occasionally none left, even in the ravines. To the height of 500 feet it is clothed with oaks and brush, while luxuriant vineyards abound. Above the snow limit the mountain is bare and covered with fine limestone shingles. The summit is a plateau from which three rocky knolls rise up, that on the west being the lowest, that on the south-east the highest. On the south slope of the latter are remains of the small temple or sacellum described by St. Jerome. A semicircular dwarf wall of good masonry runs round this peak, and a trench excavated in the rock may perhaps indicate the site of an altar. On the plateau is a cave about 25 feet square, with the entrance on the east. A rock column supports the roof, and a building once stood above. The view from Hermon is very extensive, embracing all Lebanon and the plains east of Damascus, with Palestine as far as Carmel and Tabor. On a clear day Jaffa may also be seen. Other small temples are found on the sides of Hermon, of which twelve in all have been explored. They face the east, and are dated by architects about 200 A.D. The most remarkable are those of *Deir el 'Ashaiyir*, *Hibbarîyeh*, *Hosn Niha*, and *Tell Thatha*. At the ruined town called Rukhleh on the northern slopes are remains of a temple, the stones of which have been built into a church. A large medallion 5 feet in diameter, with a head supposed to represent the sun-god, is built into the wall. Several Greek inscriptions occur among these ruins. Foxes, wolves, and the Syrian bear are commonly found on Hermon, with various kinds of game. In the 12th century Psalm lxxxix. 12 was supposed to indicate the proximity of Hermon to Tabor. The conical hill immediately south of Tabor was thus named Little Hermon, and is still so called by some of the inhabitants of the district.

HERMOSILLO, a town of Mexico, state of Sonora, is situated at the entrance to a valley of remarkable fertility near the river Sonora at its confluence with the Horcasitas, 40 miles south-west of Ures. Some of the principal houses are built of stone, but most of the dwellings are of adobe. The town possesses two churches, a prison, and a mint. Its rise and early prosperity were due to the discovery of gold mines in Sonora, but it now depends wholly on the fertility of the surrounding country, of which the principal products are cotton, wheat, grapes, and a great variety of fruits. The town is the commercial centre of Sonora. It has cotton manufactories, flour mills, and brandy distilleries, and carries on a considerable foreign trade by means of the port of Guaymas, which is 100 miles distant. The population is 10,613.

HERMSDORF, generally known as Niederhermsdorf, a town of Prussia, in the government district of Breslau and circle of Waldenburg. There are coal and iron mines and lime quarries in the vicinity, and in the town there is a large iron-work. The population in 1905 was 11,683.

HERMUPOLIS. See SYRA.

HERNIA (a Latin term commonly derived from ἔρνος a sprout, but this origin is doubtful) is the protrusion of any viscus from its normal cavity; for example, hernia cerebri is the name given to a protrusion of the brain substance, hernia pulmonum a protrusion of a portion of the lung. The word may here be restricted to its most usual meaning, a protrusion of part of the contents of the abdomen from their normal position in the abdominal cavity,—in common language a "rupture." A rupture may occur at any weak point in the abdominal wall. The common situations are the groin (inguinal hernia), the upper part of the thigh (femoral hernia), and the umbilicus or navel (umbilical hernia). The contents of a rupture may be any of the abdominal viscera, the more movable the viscus the more tendency there is to protrusion, and therefore we generally find that the small intestine and the omentum are most frequently displaced. The tumor may contain intestine alone (enterocele), omentum alone (epiplocele), or a combination of intestine and omentum (entero-epiplocele). The predisposing cause to rupture is any weakness of the abdominal wall due (1) to natural conformity, as in inguinal hernia, which descends along the inguinal canal, a canal in which the cord lies in the male and the round ligament in the female, or in femoral hernia, in which the hernia descends along the femoral canal along with and to the inner side of the femoral vessels, (2) to any cause which weakens the wall locally, as an abscess or wound (3) to general laxity of the tissues, as in weakly people, or after repeated pregnancies. This third cause only predisposes to hernia in so far as it may weaken an already weak part under the first and second heads. The exciting cause of hernia is generally some strain or over-exertion in any powerful effort, as lifting a heavy weight, jumping off a high wall, straining, as in difficult micturition or in consequence of constipation, or excessive coughing, as in chronic bronchitis. The pressure of the diaphragm above and the anterior abdominal wall in front acting on the abdominal viscera tends to cause their protrusion at the weakest point. Rupture is either congenital or acquired. A child may be born with a hernia in the inguinal or umbilical region, the result of an arrest of development in these parts, or the rupture may be acquired, first appearing perhaps in adult life, the result of one or other of the accidents referred to above. Ruptures are most frequent at the extremes of life. Men suffer more frequently than women, because they are more liable to those accidents, being frequently exposed to intermittent work, such as the lifting of heavy weights.

At first the rupture is small, and with more or less rapidity it gradually increases in size, it varies from the size of a small marble to that of a child's head or even larger. The swelling which appears is spoken of as consisting of three parts,—the coverings, sac, and contents. (1) The "coverings" are composed of the different structures which form the abdominal wall at the part where the rupture occurs. In femoral hernia the coverings are formed of the structures at the upper part of the thigh. These structures are stretched and may be thinned, in some cases they are condensed and matted together, the result of pressure, in others there is an increase in their thickness, the result of repeated attacks of inflammation. (2) The "sac" is composed of the peritoneum or membrane lining the abdominal cavity; in some very rare cases the sac is wanting. The neck of the sac is the term used to designate the narrowed portion where the peritoneum forming the sac becomes continuous with the general peritoneal cavity. Very frequently the neck of the sac is thickened, indurated, and adherent to surrounding parts, because here the tendency to local inflammatory action is most marked, the pressure being greatest at this point. (3) The "contents" have already been described. There are three distinct conditions in which we may find the contents of a hernial tumor: it may be either reducible, irreducible, or strangulated. A "reducible" hernia is one in which the contents can be pushed back into the abdomen. In some cases this is done with ease, in others it is a matter of great difficulty. At any moment a reducible hernia may become "irreducible," that is to say, its contents cannot be pushed back into the abdominal cavity. This may suddenly occur in consequence of an attack of constipation, or slowly, the irreduci-

bility being at first partial and gradually becoming more and more complete Generally this is due to an increase in the size of the omentum, accompanied by inflammatory induration. A "strangulated" hernia is one in which the circulation of the blood through the hernial contents is interfered with. The interference is at first slight, but very rapidly tends to become more pronounced. At first there is congestion; this congestion may go on to inflammation; if unrelieved, the inflammation will end in mortification. The rapidity with which the change from simple congestion to mortification takes place will depend on the tightness of the constricting cause; as a rule the more rapidly a hernia forms, in other words, the less time the surrounding tissues have to accommodate themselves to the protruding swelling, the greater the rapidity of the changes in the conditions of the contents. The constricting agent may be one or other of the structures which form the boundaries of the openings through which the hernia has travelled in its gradual course through the abdominal wall, or it may lie in the neck of the sac, which has become thickened in consequence of inflammation.

Reducible Hernia.—The symptoms of reducible hernia show themselves in a soft compressible tumor (elastic when it contains intestine, doughy when it contains omentum, a combination of elasticity and doughiness when both are present), its size increasing in the erect, and diminishing in the horizontal posture, whence as a rule it gives little trouble during the night, and becomes more troublesome in the daytime, more especially towards evening. There is a more or less distinct impulse on coughing, and when the intestinal contents are pushed back into the abdomen a gurgling sensation is perceptible by the fingers. Such a tumor may be met with in any part of the abdominal wall, but the chief situations are—(*a*) the inguinal region, in which the neck of the tumor lies immediately above Poupart's ligament (a cord-like ligamentous structure which can be felt stretching from the anterior superior spinous process of the ilium to the spine of the pubis immediately above the genital organs); (*b*) the femoral region in the upper part of the thigh, in which the neck of the sac lies immediately below the inner end of Poupart's ligament; (*c*) the umbilical region, in which the tumor appears at the navel. As the inguinal hernia increases in size it tends to pass into the scrotum in the male, into the labium in the female; while the femoral hernia, appearing first below Poupart, tends gradually as it increases in size to pass upwards superficial to Poupart's ligament.

The treatment of reducible hernia consists in pushing back the contents of the tumor into the abdomen, and applying a truss or elastic bandage in order to prevent the contents from again escaping. The younger the patient the more chance there is of the truss acting as a curative agent, as the natural tendency to contraction of the channel through which the hernia protrudes is greater. The truss is frequently laid aside at night, because in the horizontal posture the tendency of the contents to descend is greatly lessened. The truss or bandage should, however, be worn day and night. If, after the hernia is once returned, it is never again allowed to come down, there is a probability of a cure taking place; but if it is allowed to come down occasionally, as it may do, even during the night, in consequence of a cough or from turning suddenly in bed, the parts are stretched, and the contracting process which may have been going on for weeks is undone.

It is unnecessary to describe the multitudinous varieties of trusses. When a truss is ordered the surgeon has to see that it fits accurately, the necessary amount of pressure being obtained by means of a steel spring, to which a pad is attached. The pad should be so arranged as to press, not into the opening through which the hernia has come, but rather on its sides, so as to facilitate its contraction and permanent closure. The main pressure should be in the neighborhood of the neck of the sac; if the pad presses into the opening, the tendency is to keep the opening patent. The principle of the nipple-shaped pad, frequently ordered for umbilical hernia, is evil: a flat pad properly applied and held in position by an elastic bandage is the proper arrangement for restraining an umbilical hernia. No truss is to be applied until the hernia is completely reduced; it will only do harm by pressing on the contents of the unreduced hernia. In some herniæ, generally those of large size, it is found impossible to keep them up by means of a truss; in such cases an elastic bandage will sometimes effect the object, in others various operations have been recommended. They are spoken of as "the radical cure of hernia," in contradistinction to the so-called "palliative treatment by means of a truss." An attempt has been made above to show that a truss may radically cure a hernia. The principles involved in the operations described are (1) obliteration of the neck of the sac, (2) obliteration of the channel through which the hernia has descended, (3) obliteration of the sac itself, (4) plugging of the channel by invaginating the loose skin. The first and second are specially important, as in them the surgeon imitates nature's way of attempting to cure the tendency to hernial protrusion.

Irreducible Hernia.—Here the main symptom is a tumor in one or other of the situations already referred to, of long standing and generally of large size, in which the contents of the tumor, in whole or in part, cannot be pushed back into the abdomen. The irreducibility is due either to its large size or to changes which have taken place in the contents, either indurations or adhesions. Such a tumor is a constant source of danger: its contents are liable, from their exposed situation, to injury from external violence; it has a constant tendency to increase in size; it may at any time become strangulated, or the contents may inflame, and strangulation may occur secondarily to the inflammation. It is accompanied by dragging sensations referred to the abdomen, colic, dyspepsia, and constipation, which may in its turn lead to obstruction, that is to say, a stoppage of the passage of the contents of that portion of the intestinal canal which lies in the hernial tumor. When an irreducible hernia becomes painful and tender, a local peritonitis has occurred, which resembles in many of its symptoms a case of strangulation.

The treatment of irreducible hernia may be palliative: a bag truss may be worn to prevent the swelling from getting larger; the bowels must be kept open, and all irregularities of diet avoided. A person with such a hernia is in constant danger, and more than palliation is called for. An attempt should be made to reduce the hernia—(1) by laying the patient on his back, raising his buttocks, administering purgatives, and starving him (persevering attention to these points may so reduce the size of the contents that the hernia may be returned); or (2) by means of an elastic bandage carefully applied so as to press continuously on the tumor, and gradually press it back into the abdominal cavity. By this simple means large irreducible herniæ, which have withstood all attempts at reduction have been returned into the abdomen after elastic pressure has been carefully and continuously applied for a few days. (3) The surgeon may cut down on the hernia, under strict antiseptic precautions, open the sac, divide any omental adhesions, ligature and cut away indurated omentum, return the bowel, and then tie the neck of the sac. Such an operation is unjustifiable unless other means have been fairly tried and failed, and unless the hernia is giving rise to such symptoms that the usefulness of the patient is interfered with.

Strangulated Hernia.—In this the contents are constricted, and the flow of blood into the tumor and from the tumor is stopped. The symptoms are—nausea, vomiting first of bilious matter, after a time of fæcal matter, a twisting, burning pain generally referred to the umbilicus, intestinal obstruction, a quick wiry pulse, pain on pressure over the tumor and in the abdomen near the tumor, the abdomen tense and tympanitic, and no impulse on coughing, because the contents of the tumor are practically cut off from the general abdominal contents. The patient has an anxious expression. Sooner or later, from eight hours to eight days, if the strangulation is unrelieved, the tumor will become livid and emphysematous; mortification has occurred, and gangrene of the bowel at the neck of the sac will take place, followed by extravasation of the intestinal contents into the abdominal cavity; the patient becomes collapsed, and dies comatose.

The treatment of a strangulated hernia admits of no delay; delay is fatal. If the symptoms are not very acute, and if the case is seen early, attempts may be made by large enemata and by the application of cold to the tumor to reduce the congested condition and relieve the strangulation. But these attempts must not be persevered with for more than two or three hours. If the strangulation continues, then the patient should be told that his case is one which admits of no delay. Chloroform should be administered; another attempt to return the contents by pressure (termed "the taxis") should be made. If this has already been fairly tried, and if the symptoms indicate urgency, no prolonged attempts at taxis are justifiable, because the condition of the hernial contents may be such that they cannot bear the pressure. The taxis to be successful should be made in a direction opposite to the one in which the hernia has come down. The inguinal hernia should be pressed upwards, outwards, and backwards, the femoral hernia downwards, backwards, and upwards. The larger the hernia the greater is the chance of success. The slightest gurgle indicates that success is near. If taxis does not succeed then the surgeon must cut down on the tumor, carefully dividing the different coverings until he reaches the sac. The sac is then opened, the constriction divided, care being taken not to injure the bowel. The condition of the bowel is then examined, and if it is glistening however black it may be, it is returned into the abdomen. If it has lost its glistening aspect, if it is like "wet parchment," then the case is very doubtful. If in doubt, relieve the constriction and leave the bowel in the sac. Never open the bowel, however bad it looks; it may recover; and if it does not burst for some hours afterwards, the chances are that adhesions may

form at the neck of the sac and lessen the risk of extravasation into the abdominal cavity—a fæcal fistula will be the result. The omentum, if healthy, may be returned; or if congested and indurated, it may be ligatured and cut off. After the bowel is returned the wound is sewn up, and a pad and flannel bandage applied. A dose of opium should be given to prevent movement of the bowels. On the third day a dose of castor oil is administered if the bowels do not open naturally. A truss is applied after the wound is healed before the patient is allowed to get out of bed. Many complications which may occur cannot here be referred to Any one suffering from hernia should take great care to obtain an accurately fitting truss, and should remember that, whenever any symptoms resembling in any degree those of strangulation occur, any delay in the treatment is not only dangerous but may prove fatal. A medical man should at once be communicated with. He in his turn has to remember that when a patient asks his advice, complaining of symptoms resembling strangulation, he must examine all the situations where hernia may occur, because the hernial tumor may be so small that it has escaped the notice of the patient. Any assertion on the patient's part that he does not suffer from hernia must receive no weight. The surgeon must satisfy himself by ocular inspection and manual examination. If an operation is necessary he may with confidence say that the operation is not in itself a dangerous one, while, on the other hand, he can assure the patient that any delay is most certainly excessively dangerous. (J. C.)

HERNÖSAND, chief town and seat of the administration of the län of Wester Norrland on the east coast of Sweden, is built on the island of Hernö (connected with the mainland by bridges), about 3 miles south of the mouth of the Angerman river, and 230 miles north of Stockholm. It is the seat of a bishop, and possesses a fine church, erected in 1842–46. There are engine works, timber-yards, sawmills, and various manufactories in the town. The harbor is good. In 1878, 33 vessels, chiefly engaged in the timber trade, with a total burthen of 7698 tons, entered and cleared at the port. Tar is also exported, and there is an institution for pisciculture in the town. Hernösand was founded in 1584, and received its first town privileges from John III. in 1587. The population in 1900 was 7,890.

HERO AND LEANDER. Hero, the beautiful priestess of Venus at Sestos, was there seen by Leander, a youth of Abydos, at the celebration of the festival of Venus and Adonis. He became deeply enamored of her, and found that day an opportunity of declaring his passion, which she returned; and as her position rendered their marriage impossible, they agreed to carry on a clandestine intercourse. Nightly Hero placed a lamp in the top of the tower where she dwelt by the sea, and Leander, guided by it, swam the dangerous Hellespont. One stormy night the lamp was blown out, and Leander perished. On finding his body next morning on the shore, Hero flung herself into the waves.

Reference is made to this famous tale by Virgil (*Georg.*, iii. 258) and by Statius (*Theb.*, vi. 535). Ovid (*Her.*, xviii. and xix.) has composed an epistle from Leander to Hero, and one from Hero to Leander. But the story is best known from the work of Musæus (see MUSÆUS), which has been repeatedly translated into modern European languages. The *Hero and Leander* of Marlowe and Chapman is an imitation and expansion of the work of Musæus.

HEROD was the name of a family of Idumæan origin, which displaced the Asmoneans as the rulers of Judæa. The founder of the dynasty, and its most notable representative in every way, was Herod the Great, who was king of the Jews for about thirty-seven years, from 40 to 4 B. C. Herod's father was Antipater, who during the troubles which broke out in the family of Alexander Jannæus, attached himself to Hyrcanus, the weak-minded son of Alexander. In this way Antipater, though an Idumæan, soon became the most powerful man in Judæa, and in the Alexandrian war gave such effectual help to Julius Cæsar that the dictator made him procurator of Judæa, Hyrcanus being high priest (47 B. C.). The same year, at the age of twenty-five, Herod was appointed governor of Galilee by his father. He soon gave proof of the remarkable energy of his character in rooting out the banditti who infested his province; but his summary measures gave a handle to the enemies of his house at Jerusalem, and he was summoned before the sanhedrin. There he appeared, not in the garb of an accused person, but gorgeously attired, and attended by a guard of soldiers. He found it expedient, however, to withdraw from Jerusalem without awaiting the sentence. He retired to Syria, where he met with a gracious reception from Sextus Cæsar, who appointed him governor of Cœle Syria. Herod now marched with an army against Jerusalem, but at the persuasion of his father and brother was induced to depart without exacting vengeance on his enemies. After the death of Cæsar, the fortunes of Herod were affected by all the changes which befell the Roman state. When Cassius took the command in the East, and began to gather his strength for the final struggle which was decided at Philippi, Herod managed to win his favor by the readiness with which he raised his share of the heavy exactions imposed upon the East. About the same time his father was poisoned, and to Herod fell the task of avenging his death, as well as of supporting the interests of his house in Palestine. After Philippi he gained Antony over by large presents of money. He and his brother Phasael were appointed tetrarchs of Judæa. In 40 B. C. the Parthians appeared upon the scene, overran the whole of Syria, and placed on the throne of Judæa Antigonus, son of Aristobulus, and representative of the rival branch of the Asmonean house. Herod was completely overpowered; and, after placing his relatives in safety, so far as he could, he hastened to Rome to lay his case before Antony and Octavianus. He succeeded beyond his expectation, for, while he meant only to advocate the claims of Hyrcanus the Asmonean, the two heads of the state made him king of Judæa. Herod returned home without delay, and set about the task of winning the kingdom allotted to him. Owing chiefly to the slackness of the Roman generals who should have helped him, it was three years before he succeeded in taking Jerusalem (37 B. C.). Before that event he had married the beautiful Mariamne, a princess of the Asmonean house, a granddaughter both of Aristobulus and Hyrcanus. Herod's early measures were cruel; he put to death all the members of the sanhedrin except two, and spared no one that was likely to stand in his way. Aristobulus, the youthful brother of Mariamne, whom he had appointed high priest, he caused to be treacherously drowned because he was too popular with the patriotic party. On this occasion Alexandra, mother of Aristobulus, induced Cleopatra to take her part, and Herod had to appear before Antony to answer the charge of murdering the prince. Again Herod knew how to gain the Roman, and he returned home with confirmed power. During the war of Actium, Herod had the good fortune to be engaged in a war with the king of Arabia on Antony's behalf, and so escaped the risk of fighting against Octavianus. Yet he recognized the danger of his position as the friend of Antony, and faced it with his usual courage and foresight. Hastening to Rhodes (30 B. C.), he appeared in the presence of the conqueror, and avowing his loyalty to his friend Antony, proffered the same faithful service to Octavianus. Octavianus was gracious, and remained the constant friend and patron of Herod to the end. This was the last crisis of Herod's life; he was henceforward undisputed king of Judæa, and next to Agrippa the most trusted friend of Augustus. But while the friend of the great, and prosperous in all external relations, Nemesis pursued him in his family. When summoned to answer for himself before Antony, and again on his journey to Rhodes, he left the beautiful and beloved Mariamne in charge of one of his friends, but with the cruel injunction that she should be put to death should anything serious befall himself. On both occasions Mariamne discovered the secret, and, instead of regarding the command as a proof of his jealous love, abhorred it as another instance of the cruelty which had not spared so many of her nearest relatives. A horrible tragedy ensued: Mariamne openly expressed her disgust; and Herod, furious with rage, jealousy, and rejected love, ordered her death. The violence of his feelings threw him into a dangerous malady, and even drove him to the verge of insanity. His mind never recovered its healthy tone, and in later years the avenger again overtook him. In the mean time his government was marked by the greatest magnificence and apparent success. His turbulent subjects were kept tolerably quiet in spite of heavy taxes. He managed to gratify his love for Greek and Roman life; and yet he avoided wounding too deeply the susceptibilities of the Jews. The magnificent buildings which he raised were the most brilliant products of his reign. He rebuilt Samaria, calling it Sebaste, from the Greek name for Augustus. He converted the small town of Strato's Tower into a magnificent seaport with an artificial harbor, under the name of Cæsarea. These and other towns which he built were

furnished with temples, theatres, aqueducts, and all the other ornamental and useful appliances of Greek and Roman life. In the city of Jerusalem even he built a theatre, and an amphitheatre outside of it. A more patriotic work was the rebuilding of the temple (begun 20 B. C.), which had suffered greatly during the late troubles; it was on a very magnificent scale, and lasted nine years and a half, even then being unfinished. Equally necessary and equally significant of his relation to his subjects was the construction of strong fortresses in various parts of the country. The last years of Herod's life were darkened by the return of those family troubles which had previously overcast it. His two sons by Mariamne had been educated at Rome, and returned, 17 B. C., to Judæa. Their Asmonean descent, their youth, beauty, and accomplishments, and their too interesting history gained them the most enthusiastic popularity among the Jews. Their father himself was proud of them. But Pheroras and Salome, brother and sister of Herod, did all they could to sow jealousy and suspicion. Herod's mind was too painfully open to dark insinuations, and he recalled his eldest son Antipater to counterbalance the influence of the Asmonean princes. After the arrival of Antipater, who was a most unscrupulous plotter, there was no more peace or security at the court of Herod; things went from bad to worse, till after many years of the darkest intrigue and the bitterest domestic contention, the two sons of Mariamne were strangled at Sebaste. Soon after the clearest proof was discovered of a conspiracy which Antipater had formed with Pheroras against the life of Herod himself. The order for the death of Antipater was given by Herod from his death-bed. His health had long been failing; after the cruelest torments of both mind and body, he died 4 B. C. The birth of Christ took place in the same year as Herod's death, but this, as is well known, occurred four years before the date fixed as the beginning of the Christian era. The massacre of the little children at Bethlehem is not mentioned by Josephus among the horrors of Herod's last days. He was buried with great magnificence. His will, by which the greater part of his dominions was bequeathed to his sons by Malthace, a Samaritan, was confirmed by Augustus.

Herod's name is doubtless one of the most repulsive in history. He was a man of wonderful energy and sagacity. He saw clearly that Rome was the hinge on which everything turned, and that no policy could be successful which did not depend upon her leading men. His skill in understanding these men, in conciliating them, and making himself useful to them, was very great. Thus he made the successive masters of the world his willing friends, and out of all the crises of his fate emerged victorious. But his hands were red with the blood of his own household; when his position or his interests were touched no scruple could arrest him. All that can be said in his favor is that many of his cruel measures cost him unspeakable agony of mind, and that he was simply more expert than his rivals at the weapons which were in common use in the political life of the time.

The great source for the life of Herod is Josephus; but such writers as Strabo or Dion Cassius are of service in further illustrating it. Useful modern works are Hausrath, *Neutestamentliche Zeitgeschichte;* the work of the same name by Schürer; Ewald, *Geschichte des Volkes Israel*, vol. iv.; Keim, *Geschichte Jesu von Nazara*, vol. i.; and Milman's *History of the Jews*, vol. ii. (T. K.)

HEROD ANTIPAS, son of Herod the Great by the Samaritan Malthace, and full brother of Archelaus, received as his share of his father's dominions the provinces of Galilee and Peræa. Like his father, Antipas had a turn for architecture: he rebuilt and fortified the town of Sepphoris; he also fortified Betharamptha, and called it Julias after the wife of the emperor. Above all he founded the important town of Tiberias on the west shore of the Sea of Galilee, with institutions of a distinctly Greek character. Antipas is mentioned more than once in gospel history under the name of Herod. He it was who was called a "fox" by Christ. He is erroneously spoken of as a king in Mark vi. 14. It was to him that Jesus was sent by Pilate to be tried. But it is in connection with his wife Herodias that he is best known, and it was through her that his misfortunes arose. He was married first of all to a daughter of Aretas, the Arabian king; but, making the acquaintance of Herodias, the wife of his brother Philip (not the tetrarch), during a visit to Rome, he was fascinated by her and arranged to marry her. Meantime his Arabian wife discovered the plan and escaped to her father, who made war on Herod, and completely defeated his army. John the Baptist condemned his marriage with Herodias, and in consequence was put to death in the way described in the gospels and in Josephus. When Herodias's brother Agrippa was appointed king by Caligula, she was determined to see her husband attain to an equal eminence, and persuaded him, though naturally of a quiet and unambitious temperament, to make the journey to Rome to crave a crown from the emperor. Agrippa, however, managed to influence Caligula against him. Antipas was deprived of his dominions, and banished to Lyons, Herodias voluntarily sharing his exile.

HEROD PHILIP, son of Herod the Great by Cleopatra of Jerusalem, received the tetrarchate of Ituræa and other districts to the N. E. of the Jordan. He is a different person from the first husband of Herodias, also called Philip by St. Mark (vi. 17), and was married to Salome the daughter of Herodias. Philip is described as an excellent ruler, who loved peace, and was careful to maintain justice, and spent his time in his own territories. He was also a builder of cities, one of which was Cæsarea Philippi, and another was Bethsaida, which he called Julias. He died after a reign of thirty-seven years; and his dominions were incorporated in the province of Syria.

HERODIANS (Ἡρωδιανοί), a sect or party mentioned in Scripture as having on two occasions—once in Galilee, and again in Jerusalem—manifested an unfriendly disposition towards Jesus (Mark iii. 6; xii. 13; Matt. xxii. 6; *cf.* also Mark viii. 15). In each of these cases their name is coupled with that of the Pharisees. According to many interpreters the courtiers or soldiers of Herod Antipas ("Milites Herodis," Jerome; "Diener Herodis," Luther) are intended; but more probably the Herodians were a public political party, who distinguished themselves from the two great historical parties of post-exilian Judaism by the fact that they were and had been sincerely friendly to Herod the Great and to his dynasty (*cf.* such formations as "Cæsariani," "Pompeiani"). For the evidence which goes to show that neither the Pharisees nor the Sadducees as such could in consistency have been really thus friendly, reference may be made to Hausrath (especially his *Neu-Testamentliche Zeitgeschichte*, and article "Herodianer" in Schenkel's *Bibel-Lexicon*), and to Wellhausen (*Pharisäer u. Sadducäer*, 1873). It is possible that, to gain adherents, the Herodian party may have been in the habit of representing that the establishment of a Herodian dynasty would be favorable to the realization of the theocracy; and this in turn may suggest some explanation of Tertullian's (*De Præscr.*) palpably absurd allegation that the Herodians regarded Herod himself as the Messiah.

HERODIANUS, the author of a Greek history of the period extending from 180 to 238 A. D. Of his origin and condition in life very little is known. He was in Rome in 203, and seems to have held some public office. It has been conjectured that he was first "procurator Cæsaris" and afterwards "legatus" of the Sicilian provinces, and that, while fulfilling his official duties, he wrote at intervals the history which bears his name. It is entitled Ἡρωδιανοῦ τῆς μετὰ Μάρκον Βασιλείας ἱστοριῶν βιβλία ὀκτώ, and it narrates the events of the fifty-eight years that intervened between the death of Marcus Aurelius and the proclamation of Gordianus III. The narrative is of special value for the reigns of the emperors subsequent to Alexander Severus, with whom the work of Dion Cassius ends. As an historian Herodianus has prominent merits and defects. His work has the value that attaches to a record written by one chronicling the events of his own times, gifted with respectable powers of observation, indubitable candor, and independence of view. But he prefers the interest of style to the interest of truth, and is thus led into exaggerations and errors. The inner life and thought of Rome, the formidable barbarian pressure on her borders, are alike unheeded, that he may blazon his pages with the dazzling vicissitudes of the purple. Though the somewhat sober declamations which he introduces are apt to become tedious, his story is on the whole clear, graceful, and vivacious. The frequent antitheses and studied tricks of phrase savor of the rhetorical schools. Imitations of Thucydides and Latinisms are frequent. Yet in the main his style retains an original cast, a genuine unborrowed beauty, and contrasts favorably with the thin, affected Atticism of the period. Extensive use has been made of Herodianus by later chroniclers. His

history was first translated into Latin in the end of the 15th century, by the famous Angelo Poliziano.

HERODIANUS, ÆLIUS, a famous grammarian of antiquity, called by Priscian "maximus auctor artis grammaticæ." He was the son of the grammarian Apollonius, was born at Alexandria, and resided at Rome. He was patronized by the emperor Marcus Aurelius (161–180 A. D.), to whom he dedicated his great treatise on prosody. This was a work in twenty books, called Καθολικὴ Προσῳδία, which included also an account of the etymological part of grammar. An epitome of it has been preserved. Abstracts of a treatise on difficult words and peculiar forms, called Ἐπιμερισμοί, are also extant. Besides these, Herodianus wrote various other treatises, but of the large number of titles quoted, some are probably merely names for parts of larger works. Only one of them has come down complete —a treatise on monosyllables (περὶ μονήρους λέξεως). Numerous quotations, however, and considerable fragments still exist.

Fabricius (*Bibl. Græc.* vi. 278 *sqq.*) enumerates his works and the passages where they are quoted. Lenz (*Herodiani technici reliquiæ*, Lips. 1867–70) has collected and thoroughly edited all the remains.

HERODOTUS, according to the best authorities, was born in or about the year 484 B. C. He was a native of Halicarnassus, a city which belonged originally to the Doric Hexapolis, situated towards the south-western corner of Asia Minor, but which from a date considerably anterior to the birth of Herodotus had been excluded from the confederacy, and was an isolated Greek town, dependent upon the Persians. Herodotus was thus born a Persian subject, and such he continued until he was thirty or five-and-thirty years of age. At the time of his birth, Halicarnassus was under the rule of a queen called Artemisia, who had been allowed by the Persians to succeed to the sovereignty of her husband, and was mistress, not only of Halicarnassus, but also of Cos, Nisyrus, and Calydna. The year of her death is unknown, but she left her crown to her son Pisindelis (born about 493 B. C.), who was succeeded upon the throne by his son Lygdamis about the time that Herodotus grew to manhood. The family of Herodotus belonged to the upper rank of the citizens. His father was named Lyxes, and his mother Rhæo, or Dryo. He had a brother Theodore. and an uncle or cousin called Panyasis, who was an epic poet, and a personage of so much importance that the tyrant Lygdamis, suspecting him of treasonable projects, put him to death. It is likely that Herodotus derived from this near relative that love of letters which led him at an early age to the careful study of the existing Greek literature, and determined him ultimately to engage in the composition of his great work. It is probable also that he shared his relative's political opinions, and was either exiled from Halicarnassus, or quitted it voluntarily, at the time of his execution.

Of the education of Herodotus no more can be said than that it was thoroughly Greek, and embraced no doubt the three subjects essential to a Greek liberal education—grammar, gymnastic training, and music. There is no reason to suppose that he went beyond the walls of his native city for instruction in this, the ordinary, curriculum, or that he enjoyed any special advantages in respect of these early studies. They would be regarded as completed when he attained the age of eighteen, and took rank among the "ephebi" or "eirenes" of his native city. Under ordinary circumstances a Greek of this age began at once his duties as a citizen, and found in the excitement of political life sufficient employment for his growing energies. But when a city was ruled by a despot or tyrant, this outlet was wanting, no political life worthy of the name existed; and youths of spirit, more especially those of superior abilities, had to cast about for some other field in which to distinguish themselves. Herodotus may thus have had his thoughts turned to literature as furnishing a not unsatisfactory career, and may well have been encouraged in his choice by the example of Panyasis, who, whether his cousin or his uncle, was certainly his elder, and had already gained a reputation by his writings when Herodotus was still an infant. At any rate it is clear from the extant work of Herodotus that he must have devoted himself early to the literary life, and commenced that extensive course of reading which renders him one of the most instructive as well as one of the most charming of ancient writers. The poetical literature of Greece was in his time already large; the prose literature was more extensive than is generally supposed: yet Herodotus shows an intimate acquaintance with the whole of it. He has drunk at the Homeric cistern till his entire being is impregnated with the influence thence derived. The *Iliad* and the *Odyssey* are as familiar to him as Shakespeare to the most highly educated of modern Englishmen. He is acquainted with the poems of the epic cycle, the *Cypria*, the *Epigoni*, etc. He quotes or otherwise shows familiarity with the writings of Hesiod, Olen, Musæus, Bacis, Lysistratus, Archilochus of Paros, Alcæus, Sappho, Solon, Æsop, Aristeas of Proconnesus, Simonides of Ceos, Phrynichus, Æschylus, and Pindar. He quotes and criticises Hecatæus, the best of the prose writers who had preceded him, and makes numerous allusions to other authors of the same class. It may be questioned whether there was any single work of importance in the whole range of extant Greek literature with the contents of which Herodotus had not made himself acquainted by the time that he undertook the composition of his "History."

It must not, however, be supposed that the great Halicarnassian was at any time a mere recluse student. There can be no reasonable doubt that from a very early age his inquiring disposition led him to engage in travels, both in Greece and in foreign countries, which must have been continued year after year for a considerable period, and which made him as familiar with men as with books. He traversed Asia Minor and European Greece in all directions, probably more than once; he visited all the most important islands of the Archipelago,—Rhodes, Cyprus, Delos, Paros, Thasos, Samothrace, Crete, Samos, Cythera, and Ægina. He undertook the long and perilous journey from Sardis to the Persian capital Susa, passed some considerable time at Babylon, and went a voyage to Colchis, and another along the western shores of the Black Sea as far as the estuary of the Dnieper; he travelled in Scythia and in Thrace, visited Zante and Magna Græcia, explored the antiquities of Tyre, coasted along the shores of Palestine, saw Gaza, and made a long stay in Egypt. At the most moderate estimate, his travels covered a space of thirty-one degrees of longitude, or 1700 miles, and twenty-four of latitude, or nearly the same distance. Nor was he content, like the modern tourist, with hasty glimpses of the countries which he visited. At all the more interesting sites he took up his abode for a time; he examined, he inquired, he made measurements, he accumulated materials. Having in his mind the scheme of his great work, he gave ample time to the elaboration of all its parts, and took care to obtain by personal observation a full knowledge of all the various countries which were to form the scene of his narrative.

The travels of Herodotus seem to have been chiefly accomplished between his twentieth and his thirty-seventh year (464–447 B. C.). It was probably in his early manhood that as a Persian subject he visited Susa and Babylon, taking advantage of the Persian system of posts which he describes in his fifth book. His residence in Egypt must, on the other hand, have been subsequent to 460 B. C., since he saw the skulls of the Persians slain by Inarus in that year. Skulls are rarely visible on a battlefield for more than two or three seasons after the fight, and we may therefore presume that it was during the reign of Inarus (460–454 B. C.), when the Athenians had great authority in Egypt, that he visited the country, making himself known as a learned Greek, and therefore receiving favor and attention on the part of the Egyptians, who were so much beholden to his countrymen. On his return from Egypt, as he proceeded along the Syrian shore, he seems to have landed at Tyre, and from thence to have gone to Thasos, which lay off the coast of Thrace. His Scythian travels are thought to have taken place prior to 450 B. C.

It is a question of some interest from what centre or centres these various expeditions were made. Up to the time of the execution of Panyasis, which is placed by chronologists in or about the year 457 B. C., there is every reason to believe that Halicarnassus was the historian's home; and thus we may assume that, for some seven or eight years, that city was the point from which he started and to which he returned. His travels in Asia Minor, in European Greece, and among the islands of the Ægean probably belong to this period, as does also his journey to Susa and Babylon. We are told that when he quitted Halicarnassus on account of the tyranny of Lygdamis, in or about the year 457 B. C., he took up his abode in Samos

That island was an important member of the Athenian confederacy, and in making it his home Herodotus would have put himself under the protection of Athens. The fact that Egypt was then largely under Athenian influence may have induced him to proceed, in 457 or 456 B. C., to that country. The complete knowledge that he has of the whole of Egypt indicates a stay there of some years, and it was perhaps not till 454 B. C. that he returned to his Samian home. The stories that he had heard in Egypt of Sesostris may then have stimulated him to make voyages from Samos to Colchis, Scythia, and Thrace. When he had seen these countries, he had made acquaintance with almost all the regions which were to be the scene of his projected history, and could apply himself to the task of its composition with the comfortable feeling that he possessed all the local knowledge requisite for graphic and telling description.

After Herodotus had resided for some seven or eight years in Samos, events occurred in his native city which induced him to return thither. The tyranny of Lygdamis had gone on from bad to worse, and at last the citizens rose in rebellion against him, and he was expelled. According to Suidas, Herodotus was himself an actor, and indeed the chief actor, in the enterprise; but no other author confirms this statement, which is intrinsically improbable. It is certain, however, that a revolt broke out, that Lygdamis was dethroned, and that Halicarnassus became a voluntary member of the Athenian confederacy, to which it continued thenceforth attached. Herodotus would now naturally return to his native city, and enter upon the enjoyment of those rights of free citizenship on which every Greek set a high value. He would also, if he had by this time composed his history, or any considerable portion of it, begin to make it known by recitation among his friends and acquaintance. There is reason to believe that these first attempts to push himself into notice were not received with much favor,—the prophet did not obtain honor in his own country,—his countrymen ridiculed the work which they had been expected to admire; and the disappointed author, chagrined at his failure, precipitately withdrew from his native town, and sought a refuge in Greece proper (about 447 B. C.).

A writer of late date (125–200 A. D.) and low credit, Lucian of Samosata, in one of his rhetorical pieces, declares that on quitting Halicarnassus Herodotus proceeded straight to Olympia, and finding the quadriennial festival in progress recited his work to the assembled multitudes, who were highly delighted with it, and freely expressed their admiration. The statement, however, is improbable, and is rejected by most critics, who point out with reason the unsuitability of the work for recitation before an assemblage of persons from all parts of Greece, and call attention to the suspicious circumstance that the story is first told 600 years after the time of its supposed occurrence. From earlier and better writers we learn that Athens was the place to which the disappointed author betook himself, and that he appealed from the verdict of his countrymen to Athenian taste and judgment. By recitations held in that city he made his work known to the best Grecian intellects, and won such approval that in the year 445 B. C., on the proposition of a certain Anytus, he was voted a sum of ten talents (£2400) by decree of the people. At one of the recitations Thucydides was present with his father, Olorus, and was so moved that he burst into tears, whereupon Herodotus remarked to the father—"Olorus, your son has a natural enthusiasm for letters."

Athens was at this time the centre of intellectual life, and could boast a galaxy of talent such as has rarely been gathered together either before or since. The stately Pericles, his clever rival Thucydides the son of Melesias, the fascinating Aspasia, the eloquent Antiphon, the scientific musician Damon, the divine Phidias, Protagoras the subtle disputant, Zeno the inventor of logic, the jovial yet bitter Cratinus, the gay Crates, Euripides the master of pathos, Sophocles the most classic even of the ancients, formed a combination of which even Athens might be proud, and which must have charmed the literary aspirant. Accepted into this brilliant society, on familiar terms with all probably, as he certainly was with Olorus, Thucydides, and Sophocles, he cannot but have found his Attic sojourn delightful, and have been tempted, like many another foreigner, to make Athens his permanent home. It is to his credit that he did not yield to this temptation. At Athens he must have been a dilettante, an idler, without political rights or duties, a mere literary man. As such he would have soon ceased to be respected in a society where literature was not recognized as a separate profession, where a Socrates served in the infantry, and a Sophocles commanded fleets, and a Thucydides was general of an army, and an Antiphon was for a time at the head of the state. Men were not men according to Greek notions unless they were citizens; and Herodotus, aware of this, probably sharing in the feeling, was anxious, having lost his political status at Halicarnassus, to obtain such status elsewhere. At Athens the franchise, jealously guarded at this period, was not to be attained without great expense and difficulty. Accordingly, in the year 444 B. C., on the scheme of sending a colony to Thurii in Italy being broached by Pericles, Herodotus was among those who gave in their names; and in the spring of the following year he sailed from Athens to Italy with the other colonists, and became a citizen of the new town.

From this point of his career, when he had reached the age of forty, we lose sight of Herodotus almost wholly. He seems to have made but few journeys, one to Crotona, one to Metapontum, and one to Athens (about 430 B. C.) being all that his work indicates. No doubt he was employed mainly, as Pliny testifies, in retouching and elaborating his general history. He may also have composed at Thurii that special work on the history of Assyria to which he twice refers in his first book, and which is quoted by Aristotle. It has been supposed by many that he lived to a great age, and argued that "the never-to-be-mistaken fundamental tone of his performance is the quiet talkativeness of a highly cultivated, tolerant, intelligent, *old* man" (Dahlmann). But the indications derived from the later touches added to his work, which form the sole evidence on the subject, would rather lead to the conclusion that his life was not very prolonged. There is nothing in the nine books which may not have been written as early as 430 B. C.; there is no touch which, even probably, points to a later date than 424 B. C. As the author was evidently engaged in polishing up his work to the last, and even promises touches which he does not give, we may assume that he did not much outlive the date last mentioned, or, in other words, that he died at about the age of sixty. The predominant voice of antiquity tells us that he died at Thurii, where his tomb was shown in later ages.

In estimating the great work of Herodotus, and his genius as its author, it is above all things necessary to conceive aright what that work was intended to be. It has been called "a universal history," "a history of the wars between the Greeks and the barbarians," and "a history of the struggle between Greece and Persia." But these titles are all of them too comprehensive. Herodotus, who omits wholly the histories of Phœnicia, Carthage, and Etruria, three of the most important among the states existing in his day, cannot have intended to compose a "universal history," the very idea of which belongs to a later age. He speaks in places as if his object was to record the wars between the Greeks and the barbarians; but as he omits the Trojan war, in which he fully believes, the expedition of the Teucrians and Mysians against Thrace and Thessaly, the wars connected with the Ionian colonization of Asia Minor, and others, it is evident that he does not really aim at embracing in his narrative all the wars between Greeks and barbarians with which he was acquainted. Nor does it even seem to have been his object to give an account of the entire struggle between Greece and Persia. That struggle was not terminated by the battle of Mycale and the capture of Sestos in 479 B. C. It continued for thirty years longer, to the peace of Callias. The fact that Herodotus ends his history where he does shows distinctly that his intention was, not to give an account of the entire long contest between the two countries, but to write the history of a particular war—the great Persian war of invasion. His aim was as definite as that of Thucydides, or Schiller, or Napier, or any other writer who has made his subject a particular war: only he determined to treat it in a certain way. Every partial history requires an "introduction;" Herodotus, untrammelled by examples, resolved to give his history a magnificent introduction. Thucydides is content with a single introductory book, forming little more than one-eighth of his work, Herodotus has six such books, forming two-thirds of the entire composition.

By this arrangement he is enabled to treat his subject in the *grand* way, which is so characteristic of him. Making it his main object in his "introduction" to set before his readers the previous history of the two nations who were

the actors in the great war, he is able in tracing their history to bring into his narrative some account of almost all the nations of the known world, and has room to expatiate freely upon their geography, antiquities, manners and customs, and the like, thus giving his work the "universal" character which has been detected in it, and securing for it, without trenching upon unity, that variety, richness, and fulness which are a principal charm of the best histories, and of none more than his. In tracing the growth of Persia from a petty subject kingdom to a vast dominant empire, he has occasion to set out the histories of Lydia, Media, Assyria, Babylon, Egypt, Scythia, Thrace, and to describe the countries and the peoples inhabiting them, their natural productions, climate, geographical position, monuments, etc.; while, in noting the contemporaneous changes in Greece, he is led to tell of the various migrations of the Greek race, their colonies, commerce, progress in the arts, revolutions, internal struggles, wars with one another, legislation, religious tenets, and the like. The greatest variety of episodical matter is thus introduced; but the propriety of the occasion and the mode of introduction are such that no complaint can be made—the episodes never entangle, encumber, or even unpleasantly interrupt the main narrative.

The most important quality of an historian is trustworthiness; for a professed history is of no value unless we can place reliance upon its truth. It has been questioned, both in ancient and in modern times, whether the history of Herodotus possesses this essential requisite. Several ancient writers call his veracity in question, accusing him of the crime of conscious and intentional untruthfulness. Moderns generally acquit him of this charge; but his severer critics still urge that, from the inherent defects of his character, his credulity, his love of effect, and his loose and inaccurate habits of thought, he was unfitted for the historian's office, and has produced a work of but small historical value. It is impossible, within the limits of an article such as the present, to enter fully upon this controversy. Perhaps it may be sufficient to remark that the defects in question certainly exist, and detract to some extent from the authority of the work, more especially of those parts of it which deal with remoter periods, and were taken by Herodotus on trust from his informants, but that they only slightly affect the portions which treat of later times and form the special subject of his history. In confirmation of this view, it may be noted that the authority of Herodotus for the circumstances of the great Persian war, and for all local and other details which come under his immediate notice, is accepted by even the most sceptical of modern historians, and forms the basis of their narratives.

Among the merits of Herodotus as an historian, the most prominent are the diligence with which he has collected the materials for his history, the candor and impartiality with which he has placed his facts before the reader, the political dispassionateness which he displays in the judgments that he passes upon party leaders, the absence of undue national vanity, and the breadth of his conception of the historian's office, which makes his work a storehouse of diversified knowledge for which the student of antiquity can never be sufficiently grateful. On the other hand, he has no claim to rank as a critical historian; he has no conception of the philosophy of history, no insight into the real causes that underlie political changes, no power of penetrating below the surface, or even of grasping the real interconnection of the events which he describes. He belongs distinctly to the romantic school; his forte is vivid and picturesque description, the lively presentation to the reader of scenes and actions, characters and states of society, not the subtle analysis of motives, or the power of detecting the undercurrents which sway events, or the generalizing faculty which draws lessons from history and makes the past illumine the darkness of the future.

But it is as a writer that the merits of Herodotus are most conspicuous and most unquestioned. "O that I were in a condition," says Lucian, "to resemble Herodotus, if only in some measure! I by no means say in all his gifts, but only in some single point; as, for instance, the beauty of his language, or its harmony, or the natural and peculiar grace of the Ionic dialect, or his fulness of thought, or by whatever name those thousand beauties are called which to the despair of his imitator are united in him." Cicero calls his style "copious and polished;" Quintilian, "sweet, pure, and flowing;" Longinus says he was "the most Homeric of historians;" Dionysius, his countryman, prefers him to Thucydides, and regards him as combining in an extraordinary degree the excellencies of sublimity, beauty, and the true historical method of composition. Moderns are almost equally complimentary. "The style of Herodotus," says one, "is universally allowed to be remarkable for its harmony and sweetness." "The charm of his style," argues another, "has so dazzled men as to make them blind to his defects." Various attempts have been made to analyze the nature of the charm which is so universally felt; but it may be doubted whether any of them are very successful, whether the aroma of the flower does not evaporate in the critic's alembic. All, however, seem to agree that among the qualities for which the style of Herodotus is to be admired are simplicity, freshness, naturalness, and harmony of rhythm. Master of a form of language peculiarly sweet and euphonical, and possessed of a delicate ear which instinctively suggested the most musical arrangement possible, he gives his sentences, without art or effort, the most agreeable flow, is never abrupt, never too diffuse, much less prolix or wearisome, and being himself simple, fresh, *naïf* (if we may use the word), honest, and somewhat quaint, he delights us by combining with this melody of sound simple, clear, and fresh thoughts, perspicuously expressed, often accompanied by happy turns of phrase, and always manifestly the spontaneous growth of his own fresh and unsophisticated mind. Reminding us in some respects of the quaint mediæval writers, Froissart and Philippe de Comines, he greatly excels them, at once in the beauty of his language and the art with which he has combined his heterogeneous materials into a single perfect harmonious whole.

As might have been expected from its excellence, the history of Herodotus has been translated by many persons and into many languages. About 1450, at the time of the revival of learning, a Latin version was made and published by Laurentius Valla. This was revised in 1537 by Heushach, and accompanies the Greek text of Herodotus in many editions. The first complete translation into a modern language was the English one of Littlebury, published in 1737. This was followed in 1786 by the French translation of Larcher, a valuable work, accompanied by copious notes and essays. Beloe, the second English translator, based his work on that of Larcher. His first edition, in 1791, was confessedly very defective; the second, in 1806, still left much to be desired. A good German translation, but without note or comment, was brought out by Friedrich Lange at Berlin in 1811. Andrea Mustoxidi, a native of Corfu, published an Italian version in 1820. In 1822 Auguste Miot endeavored to improve on Larcher; and in 1828–32 Dr. Adolf Schöll brought out a German translation with copious notes (new ed., 1855), which has to some extent superseded the work of Lange. About the same time a new English version was made by Mr. Isaac Taylor (London, 1829). Finally, in 1858–60, the history of Herodotus was translated by Canon Rawlinson, assisted in the copious notes and appendices accompanying the work by Sir Gardner Wilkinson and Sir Henry Rawlinson. More recently we have translations in German by Bähr (Stuttgart, 1867) and Stein (Oldenburg, 1875); in French by Giguet (1857) and Talbot (1864); and in Italian by Ricci (Turin, 1871–76), Grandi (Asti, 1872), and Bertini (Naples, 1871–2). A Swedish translation by F. Carlstadt was published at Stockholm in 1871.

The best recent editions of the Greek text of Herodotus are the following:—*Herodoti Historiæ*, ed. Schweighäuser, 5 vols. 8vo, Strasburg, 1816; *Herodoti Halicarnassei Historiarum libri IX.*, ed. Gaisford, Oxford, 1840; *Herodotus, with a Commentary*, by J. W. Blakesley, B. D., 2 vols. 8vo, London, 1854; *Herodoti Musæ*, ed. Bähr, 4 vols. 8vo, Leipsic, 1856–61, 2d ed.; *Herodoti Historiæ*, ed. Abicht, 2 vols. 8vo, Leipsic, 1869; and *Herodoti Historiæ*, ed. H. Stein, 2 vols., 1869–71. Among works of value illustrative of Herodotus may be mentioned Bouhier, *Recherches sur Hérodote*, Dijon, 1746; Rennell, *Geography of Herodotus*, London, 1800; Niebuhr, *Geography of Herodotus and Scythia*, Eng. trans., Oxford, 1830; Dahlmann, *Herodot, aus seinem Buche sein Leben*, Altona, 1823; Eltz, *Quæstiones Herodoteæ* Leipsic, 1841; Kenrick, *Egypt of Herodotus*, London, 1841 Mure, *Literature of Greece*, vol. iv., London, 1852; Abicht, *Uebersicht über den Herodoteischen Dialect* (Leipsic, 1869, 3d ed. 1874), and *De codicum Herodoti fide ac auctoritate* (Naumburg, 1869); Melander, *De anacoluthis Herodoteis* (Lund, 1869) Matzat, "Ueber die Glaubenswürdigkeit der geograph. Angaben Herodots über Asien," in *Hermes*, vi.; Büdinger, *Zur egyptischen Forschung Herodots* (Vienna, 1873, reprinted from the *Sitzungsber.* of the Vienna Acad.); Merzdorf, *Quæstiones grammaticæ de dialecto Herodotea* (Leipsic, 1875); A. Kirchhoff, *Ueber die Entstehungszeit des Herodotischen Geschichtswerk* (Berlin, 1878); and Adolf Bauer, *Herodots Biographie* (Vienna, 1878). For

notices of current literature see Bursian's *Jahresbericht*. Students of the original may also consult with advantage the lexicons of Æmilius Portus (Oxford, 1817) and of Schweighäuser (London, 1824). (G. R.)

HÉROLD, Louis Joseph Ferdinand (1791–1833), French musician, was born in Paris, January 28, 1791, the son of François Joseph Hérold, an accomplished pianist, who, however, did not at first wish his son to adopt the musical profession. It was indeed not till after his father's death that Hérold in 1806 entered the Paris conservatoire, where he studied under Catel and Méhul, one of the leading composers of the time, by whose teaching his pupil profited soon and permanently. In 1812 he gained the grand prix de Rome (a travelling scholarship awarded by the French Government to the best pupils of the conservatoire), and accordingly started for Italy, where he remained till 1815, and composed a symphony, a cantata, and several pieces of chamber music. It was also during his stay in Italy that Hérold for the first time ventured on the stage with the opera *La Gioventù di Enrico V.*, first performed at Naples in 1815 with moderate success. Returning to Paris he had the good fortune to be invited by Boieldieu to participate in the composition of an opera called *Charles de France*, performed in 1816, and soon followed by Hérold's first French opera, *Les Rosières* (1817), which was received very favorably. Of the numerous dramatic works which Hérold produced for the next fifteen years in rapid succession it is unnecessary to give a detailed account. Only the names of some of the more important may be mentioned here:—*La Clochette* (1817), *L'Auteur mort et vivant* (1820), *Marie* (1826), and the ballets *La Fille mal Gardée* (1828) and *La Belle au bois dormant* (1829). Hérold also wrote a vast quantity of pianoforte music of a more or less ephemeral kind, in spite of his time being much occupied by his duties as accompanist at the Italian opera in Paris. In 1831 he produced one of the two works which have given immortality to his name, the romantic opera *Zampa*, which has met with immense success not only in France but also in Germany, where it has kept the stage till the present day, and is considered Hérold's masterpiece. In France that eminence is justly accorded to the *Le Pré aux Clercs* (first performance December 15, 1832), in every way a representative work of the French school, in which French *esprit* and French chivalry find their most perfect embodiment. Grace, liveliness, and true dramatic spirit are Hérold's best qualities, and secure him a prominent place amongst the composers of *opéra comique*, in the more refined sense which has been lost by most composers of modern France. Hérold died January 19, 1833, of the lung disease from which he had suffered for many years, and the effects of which he accelerated by incessant work.

HERON, or Hero, a mathematician and natural philosopher of Alexandria, was the pupil of Ctesibius, and flourished probably about a century or a century and a half before Christ. His name has been preserved in the well-known experiment of Hero's fountain, in which, by means of condensed air, water is made to spring from a jet in a continuous stream. Several of Heron's writings are entirely lost, and of those that remain some have never been printed. His most valuable work is that on *Pneumatics*, in which are given his experiments on the elasticity of the air and of steam. His *Mechanics* and *Barulcus* treat of the subjects which would now be comprised in an elementary book on dynamics. At the end of his *Catapeltica* or *Belopoietica*, which are probably the same, occurs Heron's solution of the ancient and much discussed problem to find two mean proportionals between two given straight lines. *Cheirobalistra*, *Cambestria*, *Camarica*, *Automata*, are the titles of some of his other physical works. His mathematical works (see Hultsch's *Heronis Alexandrini Geometricorum et Stereometricorum Reliquiæ*, Berlin, 1864) are very fragmentary, and it is difficult to determine whether several of them are not to be attributed to later and anonymous writers. Heron seems to have been the first to show how the area of a triangle may be found from its three sides. See two papers by Vincent and Boncompagni in *Bullettino di bibliogr. e di storia delle scienze matem. ecfisiche*, iv.

HERON, called the younger, to distinguish him from his namesake of Alexandria, was, like him, a mathematician and natural philosopher. By some he is supposed to have flourished in the first half of the 7th century A. D.; by others, with more probability, to have lived at Constantinople in the 10th century. He wrote a treatise on *Besieging Engines* which still exists, and another on the *Construction of Sun-dials*, which is now lost. Some mathematical writings assigned to him should perhaps be referred to Heron the elder (see *Mémoires Présentés à l'Académie des Inscriptions*, 1ère série, tome iv., Paris, 1854).

HERON—French, *Héron;* Italian, *Aghirone, Airone;* Latin, *Ardea;* Greek, ἐρωδιός; Anglo-Saxon, *Hragra;* Icelandic, *Hegre;* Swedish, *Häger;* Danish, *Heire;* German, *Heiger, Reiher, Heergans;* Dutch, *Reiger*—a long-necked, long-winged, and long-legged bird, the representative of a very natural group, the *Ardeidæ*, which through the neglect or ignorance of ornithologists has been for many years encumbered by a considerable number of alien forms, belonging truly to the Cranes, *Gruidæ* (see vol. vi. p. 484), and Storks, *Ciconiidæ*, whose structure and characteristics are wholly distinct, however much external resemblance some of them may possess to the Herons. Eliminating these intruders, it is difficult or even impossible to estimate with any accuracy the number of species of *Ardeidæ* which exist. Professor Schlegel in 1863 enumerated 61, besides 5 of what he terms "conspecies," as contained in the collection at Leyden (*Mus. des Pays Bas*, Ardeæ, 64 pp.),—on the other hand, G. R. Gray in 1871 (*Hand-list*, etc., iii. pp. 26–34) admitted above 90, while Dr. Reichenow (*Journ. für Ornithologie*, 1877, pp. 232–275) recognizes 67 as known, besides 15 "subspecies" and 3 varieties, arranging them in 3 genera, *Nycticorax*, *Botaurus*, and *Ardea*, with 17 subgenera. But it is difficult to separate the Family, with any satisfactory result, into genera, if structural characters have to be found

Fig. 1.—Heron.

for these groups, for in many cases they run almost insensibly into each other—though in common language it is easy to speak of Herons, Egrets, Bitterns, Night-Herons, and Boatbills. With the exception of the last, Professor Schlegel retains all in the genus *Ardea*, dividing it into *eight* sections, the names of which may perhaps be Englished —Great Herons, Small Herons, Egrets, Semi-egrets, Rail-like Herons, Little Bitterns, Bitterns, and Night-Herons. It may be expedient here to adopt this arrangement, though the present writer would guard himself against being supposed to give it more than partial and provisional assent.

The common Heron of Europe, *Ardea cinerea* of Linnæus, is universally allowed to be the type of the family, and it may also be regarded as that of Professor Schlegel's first section. The species inhabits suitable localities throughout the whole of Europe, Africa, and Asia, reaching Japan, many of the islands of the Indian Archipelago, and even Australia. Though by no means so numerous as formerly in Britain, it is still sufficiently common to render a description of it almost unnecessary,[1] and there must be few

[1] In many parts of England it is generally called a "Hernser"—being a corruption of "Heronsewe," which, as Professor Skeat states (*Etymol. Dictionary*, p. 261), is a perfectly distinct word from "Heron-

persons who have not seen it rising slowly from some river-side or marshy flat, or passing overhead in its lofty and leisurely flight on its way to or from its daily haunts; while they are many who have been entertained by watching it as it sought its food, consisting chiefly of fishes (especially eels and flounders) and amphibians—though young birds and small mammals come not amiss—wading midleg in the shallows, swimming occasionally when out of its depth, or standing motionless to strike its prey with its formidable and sure beak. When sufficiently numerous the Heron breeds in societies, known as Heronries, which of old time were protected both by law and custom in nearly all European countries, on account of the sport their tenants afforded to the falconer. Of late years, partly owing to the withdrawal of the protection they had enjoyed, and still more, it would seem, from agricultural improvement, which, by draining meres, fens, and marshes, has abolished the feeding-places of a great population of Herons, many of the larger Heronries have broken up—the birds composing them dispersing to neighboring localities and forming smaller settlements, most of which are hardly to be dignified by the name of Heronry, though commonly accounted such. Thus the number of so-called Heronries in the United Kingdom, and especially in England and Wales, has become far greater than formerly, but no one can doubt that the number of Herons has dwindled. Mr. Harting, after being at great pains to collect statistics on the subject, gave, in 1872 (*Zoologist*, s. s. pp. 3261–3272; with additions and corrections, pp. 3404–3407), a list of those existing in the three kingdoms, more than 200 in number, of which a little over one-half are in England and Wales, more than 50 in Scotland, and nearly 50 in Ireland. The sites chosen by the Heron for its nest vary greatly. It is generally built in the top of a lofty tree, but not unfrequently (and this seems to have been much more usual in former days) near or on the ground among rough vegetation, on an island in a lake, or again on a rocky cliff of the coast. It commonly consists of a huge mass of sticks, often the accumulation of years, lined with twigs, and in it are laid from four to six sea-green eggs. The young are clothed in soft flax-colored down, and remain in the nest for a considerable time, therein differing remarkably from the "pipers" of the crane, which are able to run almost as soon as they are hatched. The first feathers assumed by young Herons in a general way resemble those of the adult, but the fine leaden-gray back, the pure white breast, the black throat-streaks, and especially the long pendent plumes, which characterize only the very old birds, and are most beautiful in the cocks, are subsequently acquired. The Heron measures about 3 feet from the bill to the tail, and the expanse of its wings is sometimes not less than 6 feet, yet it weighs only between 3 and 4 lb.

Large as is the common Heron of Europe, it is exceeded in size by the Great Blue Heron of America, *Ardea herodias*, which generally resembles it in appearance and habits, and both are smaller than the *A. sumatrana* or *A. typhon* of India and the Malay Archipelago, while the *A. goliath*, of wide distribution in Africa and Asia, is the largest of all. The Purple Heron, *A. purpurea*, as a well-known European species having a great range over the Old World, also deserves mention here. Of the species included in Professor Schlegel's second section, little need now be said. They inhabit the tropical parts of Africa, Australasia, and America. The Egrets, forming his third group, require more notice, distinguished as they are by their pure white plumage, and, when in breeding-dress, by the beautiful dorsal tufts of decomposed feathers that ordinarily droop over the tail, and are so highly esteemed as ornaments by Oriental magnates. The largest species is *A. occidentalis*, only known apparently from Florida and Cuba; but one not much less, the Great Egret, *A. alba*, belongs to the Old World, breeding regularly in south-eastern Europe, and occasionally straying to Britain. A third, *A. egretta*, represents it in America, while much the same may be said of two smaller species, *A. garzetta*, the Little Egret of English authors, and *A. candidissima*, and a sixth, *A. intermedia*, is common in India, China, and Japan, besides occurring in Australia. The group of Semi-egrets, containing some nine or ten forms, among which the Buff-backed Heron, *A. bubulcus*, is the only species that is known to have occurred in Europe, is hardly to be distinguished from the last section except by their plumage being at certain seasons varied in some species with slaty-blue and in others with rufous. The Rail-like Herons form Professor Schlegel's next section, but it can scarcely be satisfactorily differentiated, and the epithet is misleading, for its members have no Rail-like affinities, though the typical species, which inhabits the south of Europe, and occasionally finds its way to England, has long been known as *A. ralloides*.[1] Nearly all these birds are tropical or subtropical. Then there is the somewhat better defined group of Little Bitterns, containing about a dozen species—the smallest of the whole family. One of them, *A. minuta*, though very local in its distribution, is a native of the greater part of Europe, and has bred in England. It has a close counterpart in the *A. exilis* of North America, and is represented by three or four forms in other parts of the world, the *A. pusilla* of Australia especially differing very slightly from it. Ranged by Professor Schlegel with these birds, which are all remarkable for their skulking habits, but more resembling the true Herons in their nature, are the common Green Bittern of America, *A. virescens*, and its very near ally the African *A. atricapilla*, from which last it is almost impossible to distinguish the *A. javanica*, of wide range throughout Asia and its islands, while other species, less closely related, occur elsewhere as *A. flavicollis*—one form of which, *A. gouldi*, inhabits Australia.

Fig. 2.—Bittern.

The true Bitterns, forming the genus *Botaurus* of most authors, seem to be fairly separable, but more perhaps on account of their wholly nocturnal habits and correspondingly adapted plumage than on strictly structural grounds, though some differences of proportion are observable. The common Bittern of Europe, *B. stellaris*, was formerly an abundant bird in many parts of Britain; but, since the reclamation of the bogs and fens it used to inhabit, it is become only an irregular visitant,—though not a winter passes without its appearing in some numbers, when its uncommon aspect, its large size, and beautifully pencilled plumage cause it to be regarded as a great prize by the lucky gun-bearer to whom it falls a victim. Its value as a delicacy for the table, once so highly esteemed, has long vanished. The old fable of this bird inserting its beak into a reed or plunging it into the ground, and so causing the booming sound with which its name will be always asso-

shaw," commonly confounded with it. The further corruption of "Hernser" into "handsaw," as in the well-known proverb, was easy in the mouth of men to whom hawking the Heronsewe was unfamiliar.

[1] It is the "Squacco-Heron" of modern British authors—the distinctive name, given "Sguacco" by Willughby and Ray from Aldrovandus, having been misspelt by Latham.

ciated, is also exploded, and nowadays indeed so few people in Britain have ever heard its loud and awful voice, which seems to be uttered only in the breeding-season, and is therefore unknown in a country where it no longer breeds,[1] that incredulity as to its booming at all has in some quarters succeeded the old belief in this as in other reputed peculiarities of the species. The Bittern is found from Ireland to Japan, in India, and throughout the whole of Africa—suitable localities being, of course, understood. Australia and New Zealand have a kindred species, *B. pœciloptilus*, and North America a third, *B. Mugitans* or *B. lentiginosus*. The former is said to bellow like a bull, but authorities differ as to the vocal powers of the latter,[2] which has several times wandered to Europe, and is distinguishable by its smaller size and uniform grayish-brown primaries, which want the tawny bars that characterize *B. stellaris*. Nine other species of Bitterns from various parts of the world are admitted by Professor Schlegel, but some of them should perhaps be excluded from the genus *Botaurus*.

Of the Night-Herons the same author recognizes six species, all of which may be reasonably placed in the genus *Nycticorax*, characterized by a shorter beak and a few other peculiarities, among which the large eyes deserve mention. The first is *N. griseus*, a bird widely spread over the Old World, and not unfrequently visiting England, where it would undoubtedly breed if permitted. Professor Schlegel unites with it the common Night-Heron of America; but this, though very closely allied, is generally deemed distinct, and is the *N. nævius* or *N. gardeni* of most writers. A clearly different American species, with a more southern habitat, is

Fig. 3.—Boatbill.

the *N. Violaceus* or *N. cayennensis*, while others are found in South America, Australia, some of the Asiatic Islands, and in West Africa. The Galapagos have a peculiar species, *N. pauper*, and another, so far as is known, peculiar to Rodriguez, *N. megacephalus*, existed in that island at the time of its being first colonized, but is now extinct.

The Boatbill, of which only one species is known, seems to be merely a Night-Heron with an exaggerated bill,—so much widened as to suggest its English name,—but has always been allowed generic rank. This curious bird, the *Cancroma cochlearia* of most authors, is a native of tropical America, and what is known of its habits shows that they are essentially those of a *Nycticorax*.[3]

Bones of the common Heron and Bittern are not uncommon in the peat of the East-Anglian fens. Remains from Sansan and Langy in France have been referred by M. Alphonse Milne-Edwards to Herons under the names of *Ardea perplexa* and *A. formosa*; a tibia from the Miocene of Steinheim by Dr. Fraas to au *A. similis*, while Professor Owen recognized a portion of a sternum from the London Clay as most nearly approaching this Family.

It remains to say that the Herons form part of Professor Huxley's section *Pelargomorphæ*, belonging to his larger group *Desmognathæ*, and to draw attention to the singular development of the patches of "powder-down" which in the family *Ardeidæ* attain a magnitude hardly to be found elsewhere. Their use is utterly unknown. (A. N.)

HEROPHILUS. See Anatomy, vol. i. p. 703.

HERRERA, Fernando de (1534–1597), lyrical poet, born at Seville in 1534. Although an ecclesiastic, he addressed his verses to an Andalusian lady, said to have been the countess of Gelves, under different names; but his love was as Platonic as Petrarch's, and served only to lend additional beauty and tenderness to his poems. Herrera has been celebrated in a sonnet by Cervantes; and his poems were taken as models by the later poet, Lope de Vega. He died at Seville in 1597. Flourishing at a time when the Castilian language was not yet ripe for the higher lyrical efforts, Herrera endeavored to remedy the defects of his native tongue by expelling from poetry the more vulgar and trivial words, by introducing words in their place from Greek, Latin, and Italian, and by employing unfamiliar inflections and inverted constructions so as to approach more nearly the model of the classical tongues. His system, however, was theoretical and artificial, and not inspired by any genuine impulse of taste, so that in many instances where he strives to be elevated and correct, he succeeds only in being affected and formal.

Herrera published his critical views in 1580, in able notes to the works of Garcilaso, whose Italian style he followed in a volume of poems which appeared in 1582. Of these the sonnets are poor, the elegies good, and the sixteen canzones or odes best of all. The finest of these last are perhaps the two on the battle of Lepanto and on the overthrow of Sebastian of Portugal. The Pindaric ode on sleep has been frequently praised. Pacheco, the painter, published additional poems of Herrera in 1619; and Fernandez added still more in the fourth and fifth volumes of his *Poesias Castellanas*, in 1808. *The Battle of the Giants*, *The Rape of Proserpine*, *The Amadis*, and *The Loves of Laurino and Cœrona* are among the titles of longer poems of Herrera which are now lost. Of his prose works the chief are the *Relacion de la Guerra de Chipre y batalla de Lepanto*, 1572; and the *Vida y muerte de Tomas Moro*, 1592, translated from Stapleton's Latin *Lives of the Three Thomases*. His *History of Spain till the time of Charles V.*, said by Rioja to have been completed about 1590, has not come down to our time.

HERRERA, Francisco (1576–1656), surnamed el Viejo (the old), historical and fresco painter, studied under Luis Fernandez in Seville, his native city, where he spent the most of his life. Although so rough and coarse in manners that neither scholar nor child could remain with him, the great talents of Herrera, and the promptitude with which he used them, brought him abundant commissions. He was also a skilful worker in bronze, an accomplishment that led to his being charged with coining base money. From this accusation, whether true or false, he sought sanctuary in the Jesuit college of San Hermenegildo, which he adorned with a fine picture of its patron saint. Philip IV., on his visit to Seville in 1624, having seen this picture, and learned the position of the artist, pardoned him at once, warning him, however, that such powers as his should not be degraded. In 1650 Herrera removed to Madrid, where he lived in great honor till his death in 1656. Herrera was the first to relinquish the timid manner of the old Spanish school of painting, and to initiate the free, vigorous touch and style which reached such perfection in Velazquez, who had been for a short time his pupil. His pictures are marked by an energy of design and freedom of execution quite in keeping with his bold, rough character. He is said to have used very long brushes in his painting; and it is also said that, when pupils failed, his servant used to dash the colors on the canvas with a broom under his directions, and that he worked them up into his designs before they dried. The drawing in his pictures is correct, and the coloring original and skilfully managed, so that the figures stand out in

[1] The last-recorded instance of the Bittern breeding in England was in 1868, as mentioned by Mr. Stevenson (*Birds of Norfolk*, ii. p. 164). All the true Bitterns, so far as is known, lay eggs of a light olive-brown color.

[2] Richardson, a most accurate observer, positively asserts (*Fauna Boreali-Americana*, ii. p. 374) that its booming exactly resembles that of its Old-World congener, but American ornithologists seem only to have heard the croaking note it makes when disturbed.

[3] The very wonderful Shoe-bird (*Balæniceps*) has been regarded by many authorities as allied to *Cancroma*, but there can be little doubt that it is more nearly related to the genus *Scopus* belonging to the Storks. The Sun-Bittern (*Eurypyga*), by some systematists considered to belong to the *Ardeidæ*, would appear to have greater affinity to the *Rallidæ*, if it does not form a Family of itself.

striking relief. What has been considered his best easel-work, the Last Judgment, in the church of San Bernardo at Seville, is an original and striking composition, showing in its treatment of the nude how ill-founded the common belief was that Spanish painters, through ignorance of anatomy, understood only the draped figure. Perhaps his best fresco is that on the dome of the church of San Buenaventura; but many of his frescos have perished, some by the effects of the weather, and others by the artist's own carelessness in preparing his surfaces. He has, however, preserved several of his own designs in etchings. For his easel-works Herrera often chose such humble subjects as fairs, carnivals, ale-houses, and the like.

See Stirling's *Annals of the Artists of Spain*, 3 vols., 1848.

HERRERA, Francisco (1622–1685), surnamed el Mozo (the young), historical and fresco painter, son of the subject of last notice, was also a native of Seville. Unable to endure his father's cruelty, the younger Herrera, seizing what money he could find, fled to Rome. There, instead of devoting himself to the antiquities and the works of the old Italian masters, he gave himself up to the study of architecture and perspective, with the view of becoming a fresco-painter. He did not altogether neglect easel-work, but became renowned for his pictures of still-life, flowers, and fruit, and from his skill in painting fish was called by the Italians *Lo Spagnuolo degli pesci*. In later life he painted portraits with great success. He returned to Seville on hearing of his father's death; and in 1660 was appointed subdirector of the new academy there under Murillo. His vanity, however, brooked the superiority of no one; and throwing up his appointment he went to Madrid. There he was employed to paint a San Hermenegildo for the barefooted Carmelites, and to decorate in fresco the roof of the choir of San Felipe el Real. The success of this last work procured for him a commission from Philip IV. to paint in fresco the roof of the Atocha church. He chose as his subject for this the Assumption of the Virgin. Soon afterwards he was rewarded with the title of painter to the king, and was appointed superintendent of the royal buildings. He died at Madrid in 1685. Herrera el Mozo was of a somewhat similar temperament to his father, and offended many people by his inordinate vanity and suspicious jealousy. His pictures are inferior to the older Herrera's both in design and in execution; but in some of them traces of the vigor of his father, who was his first teacher, are visible. He was by no means an unskilful colorist, and was especially master of the effects of chiaroscuro. As his best picture Sir Edmund Head in his *Handbook* names his San Francisco, in Seville Cathedral. An elder brother, known as Herrera el Rubio (the ruddy), who died very young, gave great promise as a painter.

See Stirling's *Annals of the Artists of Spain*, 3 vols., 1848.

HERRERA Y TORDESILLAS, Antonio de (1549–1625), Spanish historian, was born in 1549, at Cuellar, in the province of Segovia in Spain. His father, Roderigo de Tordesillas, and his mother, Agnes de Herrera, were both of good family. After studying for some time in his native country, Herrera proceeded to Italy, and there became secretary to Vespasian Gonzago, with whom, on his appointment as viceroy of Navarre, he returned to Spain. Gonzago, sensible of his secretary's abilities, commended him on his death-bed to Philip II. of Spain; and that monarch, no less discerning, appointed Herrera first historiographer of the Indies, and one of the historiographers of Castile. Placed thus in the enjoyment of an ample salary, Herrera devoted the rest of his life to the peaceful pursuit of literature, retaining his offices till the reign of Philip IV., by whom he was appointed secretary of state, very shortly, however, before his death, which took place at Madrid on March 29, 1625. Of Herrera's writings, the most valuable is his *Historia General de los Hechos de los Castellanos en las Islas y Tierra Firme del Mar Oceano* (Madrid, 1601–15, 4 vols. fol.), a work which relates the history of the Spanish-American colonies from 1492 to 1554. The author's official position gave him access to the state papers and to other authentic sources not attainable by other writers, while he did not scruple to borrow largely from other MSS., especially from that of Las Casas. He used his facilities carefully and judiciously; and the result is a work on the whole accurate and unprejudiced, and quite indispensable to the student either of the history of the early colonies, or of the institutions and customs of the aboriginal American peoples. Although it is written in the form of annals, mistakes are not wanting, and several glaring anachronisms have been pointed out by Quintana. "If," to quote Dr. Robertson, "by attempting to relate the various occurrences in the New World in a strict chronological order, the arrangement of events in his work had not been rendered so perplexed, disconnected, and obscure that it is an unpleasant task to collect from different parts of his book and piece together the detached shreds of a story, he might justly have been ranked among the most eminent historians of his country."

Herrera's other works are the following:—*Historia de lo Sucedido en Escocia é Inglaterra en quarenta y quatro años que vivió la reyna Maria Estuarda* (Madrid, 1589); *Cinco Libros de la Historia de Portugal, y Conquista de las Islas de los Açores, 1582 y 1583* (*ib.*, 1591); *Historia de lo Sucedido en Francia, 1585–1594* (*ib.*, 1598); *Historia General del Mundo del tiempo del Señor Rey Don Felipe II., desde 1559 hasta su muerte* (*ib.*, 1601–12, 3 vols. fol.); *Tratado, Relacion, y Discurso historico de los movimientos de Aragon* (*ib.*, 1612); *Comentarios de los Hechos de los Españoles, Franceses, y Venecianos en Italia, etc., desde 1281 hasta 1559* (*ib.*, 1624, fol.).

HERRICK, Robert (1591–1674), English poet, was born in Cheapside, London, and baptized on the 24th of August, 1591. He was the seventh child of Nicholas Herrick, goldsmith, of the city of London, who died in 1592, under suspicion of suicide. The children were brought up by their uncle, Sir William Herrick, one of the richest goldsmiths of the day, to whom in 1607 Robert was bound apprentice. In 1613 he proceeded to Cambridge; and it was no doubt between these dates that the young poet was introduced to that circle of wits which he was afterwards to adorn. He seems to have been present at the first performance of *The Alchemist* in 1610, and it was probably about this time that Ben Jonson adopted him as his poetical "son." He entered the university as fellow-commoner of St. John's College, and he remained there until, in 1616, upon taking his degree, he removed to Trinity Hall; in 1620 he became master of arts. From this date until 1629 we entirely lose sight of him; it has been variously conjectured that he spent these nine years preparing for the ministry at Cambridge, or in much looser pursuits in London. In the latter year his mother died, and, taking orders, he was presented to the rural living of Dean Prior, not far from Totnes in Devonshire. He entered upon this new career on October 2, 1629, being in his thirty-ninth year. At Dean Prior he resided quietly until 1648, when he was ejected by the Puritans. The solitude there oppressed him at first; the village was dull and remote, and he felt very bitterly that he was cut off from all literary and social associations; but soon the quiet existence in Devonshire soothed and delighted him. He was pleased with the rural and semi-pagan customs that survived in the village, and in some of his most charming verses he has immortalized the morris-dances, wakes, and quintains, the Christmas mummers and the Twelfth Night revellings, that diversified the quiet of Dean Prior. Herrick never married, but lived at the vicarage surrounded by a happy family of pets, and tended by an excellent old servant named Prudence Baldwin. His first appearance in print was in some verses he contributed to *A Description of the King and Queen of Fairies*, in 1635. In 1640 a volume of *Wit's Recreations* contained sixty-two small poems afterwards acknowledged by Herrick in the *Hesperides*, and one not reprinted until our own day. These partial appearances make it probable that he visited London from time to time. We have few hints of his life as a clergyman. Anthony Wood says that Herrick's sermons were florid and witty, and that he was "beloved by the neighboring gentry." A very aged woman, one Dorothy King, stated that the poet once threw his sermon at his congregation, cursing them for their inattention. The same old woman recollected his favorite pig, which he taught to drink out of a tankard. In 1648 he published his celebrated collection of lyrical poems, entitled *Hesperides, or the Works both Human and Divine of Robert Herrick*, only a few weeks, it would seem, after his ejection from his living by the Puritans. That he was reduced to great poverty in London has been stated, but Dr. Grosart shows this to be very unlikely. In August, 1662, Herrick returned to Dean Prior, supplanting his own supplanter, Dr. John Syms. He died in his eighty-fourth year, and was buried at Dean Prior, October 15, 1674. A monument was erected to his memory in the parish church in 1857.

As a pastoral lyrist Herrick stands first among English poets. His genius is limited in scope, and comparatively unambitious, but in its own field it is unrivalled. His tiny poems—and of the thirteen hundred that he has left behind him not one is long—are like jewels of various value, heaped together in a casket. Some are of the purest water, radiant with light and color, some were originally set in false metal that has tarnished, some were rude and repulsive from the first. Out of the unarranged, heterogeneous mass the student has to select what is not worth reading, but, after he has cast aside all the rubbish, he is astonished at the amount of excellent and exquisite work that remains. Herrick has himself summed up, very correctly, the themes of his sylvan muse when he says:—

> I sing of brooks, of blossoms, birds and bowers,
> Of April, May, of June and July flowers,
> I sing of May-poles, hock-carts, wassails, wakes,
> Of bridegrooms, brides, and of their bridal-cakes.

He saw the picturesqueness of English homely life as no one before him had seen it, and he described it in his verse with a certain purple glow of Arcadian romance over it, in tones of immortal vigor and freshness. His love poems are still more beautiful; the best of them have an ardor and tender sweetness which give them a place in the forefront of modern lyrical poetry, and remind us of what was best in Horace and in the poets of the Greek anthology.

After suffering complete extinction for more than a century, the fame of Herrick was revived by Mr. Nichols (Sylvanus Urban), who introduced his poems to the readers of the *Gentleman's Magazine* of 1796 and 1797. Dr. Drake followed in 1798 with considerable enthusiasm. By 1810 interest had so far revived in the forgotten poet that Dr. Nott ventured to print a selection from his poems, which attracted the favorable notice of the *Quarterly Review*. In 1823 the *Hesperides* and the *Noble Numbers* were for the first time edited by Mr. T. Maitland, afterwards Lord Dundrennan. Other editions followed in 1839, 1844, 1846, 1850, 1852, and 1859. A more complete collection, by Mr. W. C. Hazlitt, was brought out in 1869. In 1876 followed Dr. Grosart's exhaustive and authoritative edition in three vols., and in 1877, under the title of *Chrysomela*, a very elegant selection by Mr. F. T. Palgrave, with a prefatory essay. There are therefore few English poets of the 17th century whose writings are now more accessible to every class of readers than those of Herrick.

HERRING (*Clupea harengus*, *Häring* in German, *Le Hareng* in French, *Sill* in Swedish), a fish belonging to the genus *Clupea*, of which more than sixty different species are known in various parts of the globe. The sprat, pilchard or sardine, and shad are species of the same genus. Of all sea-fishes *Clupeæ* are the most abundant; for although other genera may comprise a greater variety of species, they are far surpassed by *Clupea* with regard to the number of individuals. The majority of the species of *Clupea* are of greater or less utility to man; it is only a few tropical species that acquire, probably from their food, highly poisonous properties, so as to be dangerous to persons eating them. But no other species equals the Common Herring in importance as an article of food or commerce. It inhabits in incredible numbers the German Ocean, the northern parts of the Atlantic, and the seas north of Asia. The herring inhabiting the corresponding latitudes of the North Pacific is another species, but most closely allied to that of the eastern hemisphere. Formerly it was the general belief that the herring inhabits the open ocean close to the Arctic Circle, and that it migrates at certain seasons towards the northern coasts of Europe and America. This view has been proved to be erroneous, and we know now that this fish lives throughout the year in the vicinity of our shores, but at a greater depth, and at a greater distance from the coast, than at the time when it approaches land for the purpose of spawning.

Herrings are readily recognized and distinguished from the other species of *Clupea* by having an ovate patch of very small teeth on the vomer (that is, the centre of the palate). In the dorsal fin they have from 17 to 20 rays, and in the anal fin from 16 to 18; there are from 53 to 59 scales in the lateral line, and invariably 56 vertebræ in the vertebral column. They have a smooth gill-cover, without those radiating ridges of bone which are so conspicuous in the pilchard and other *Clupeæ*. The sprat cannot be confounded with the herring, as it has no teeth on the vomer, and only 47 or 48 scales in the lateral line.

Herrings grow very rapidly; according to H. A. Meyer's observations, they attain a length of from 17 to 18 mm. during the first month after hatching, 34 to 36 mm. during the second, 45 to 50 mm. during the third, 55 to 61 mm. during the fourth, and 65 to 72 mm. during the fifth. The size which they finally attain and their general condition depend chiefly on the abundance of food (which consists of crustaceans and other small marine animals), on the temperature of the water, on the season at which they have been hatched, etc. Their usual size is about 12 inches, but in some particularly suitable localities they grow to a length of 15 inches, and instances of specimens measuring 17 inches are on record. In the Baltic, where the water is gradually losing its saline constituents, thus becoming less adapted for the development of marine species, the herring continues to exist in large numbers, but as a dwarfed form, not growing either to the size or to the condition of the North-Sea herring. The herring of the American side of the Atlantic is specifically identical with that of Europe. A second species (*Clupea leachii*) has been supposed to exist on the British coast; but it comprises only individuals of a smaller size, the produce of an early or late spawn. Also the so-called "white-bait" is not a distinct species, but consists chiefly of the fry or the young of herrings, and is obtained "in perfection" at localities where these small fishes find an abundance of food, as in the estuary of the Thames. The important subject of herring-fishing has already been treated in the article FISHERIES (see vol. ix. pp. 218, 224, etc.).

Several excellent accounts of the herring have been published, as by Valenciennes in the 20th vol. of the *Histoire naturelle des Poissons*, and more especially by Mr. J. M. Mitchell, *The Herring, its Natural History and National Importance*, Edin., 1864. Older treatises are—P. Neucrantz, *De Harengo*, Lübeck, 1654; J. S. Dodd, *Essay towards a Natural History of the Herring*, Lond., 1768; J. Sola, *Essay towards a Natural History of Herrings*; Bock, *Versuch einer vollständigen Natur- und Handels-Geschichte des Härings*, Königsberg, 1769.

HERRNHUT, a town of Saxony, in the circle and 18 miles south-east of the town of Bautzen, and situated on the Löbau and Zittau Railway, is chiefly known as the principal seat of the Moravian or Bohemian Brotherhood, styled on the Continent Herrnhuter, a colony of whom, fleeing from persecution in their own country, settled at Herrnhut in 1722, on a site presented by Count Zinzendorf. The buildings include houses for the brethren, the sisters, and the widowed of both sexes. The town is remarkable for its regularity, cleanness, and stillness. Linen, paper (to varieties of which Herrnhut gives its name), tobacco, and various minor articles are manufactured. The Hutberg commands a pleasant view. The population in 1905 was 1,331. Berthelsdorf, a village about a mile distant, has been the seat of the directorate of the community since about 1789.

HERSCHEL, CAROLINE LUCRETIA (1750–1848), sister of Sir William Herschel, the eighth child and fifth daughter of her parents, was born at Hanover on the 16th March, 1750. On account of the prejudices of her mother, who did not desire her to know more than was necessary for being useful in the family, she received in youth only the first elements of education. After the death of her father in 1767 she, in order to fit herself to earn her bread, obtained permission to learn millinery and dressmaking, but continued to assist her mother in the management of the household until the autumn of 1772, when she accompanied to England her brother William, who had established himself as a teacher of music in Bath. At once she became a valuable co-operator with her brother, both in his professional duties and in the astronomical researches to which he had already begun to devote all his spare time. She was the principal singer at his oratorio concerts, and acquired such a reputation as a vocalist that she was offered an engagement for the Birmingham festival, which, however, she declined. When her brother accepted the office of astronomer-royal, she became his constant assistant in his observations, and also executed the laborious calculations which were connected with them. For these services she in 1787 received from the king a salary of £50 a year. Her chief amusement during her leisure hours was to sweep the heavens with a small Newtonian telescope planted on the lawn. Besides detecting by this means many of the small nebulæ included in Sir William Herschel's catalogue, she succeeded in discovering seven comets, in the discovery of five of which she could lay claim to priority, viz., those of 1786, 1788, 1791, 1793, and 1795. In 1797 she presented to the

Royal Society a catalogue of 560 stars taken from Flamsteed's observations, and not included in the British catalogue, together with a collection of errata that should be noticed in the same volume. Though she returned to Hanover in 1822 she did not abandon her astronomical studies, and in 1828 she completed the reduction, to January, 1800, of 2500 nebulæ discovered by her brother. In 1835 the Astronomical Society, to mark their sense of the benefits conferred on science by such a series of laborious exertions, unanimously resolved to present her with their gold medal, and also elected her an honorary member of the society. In 1846 she received a gold medal from the king of Prussia. She retained the use of her intellectual faculties, and also preserved her interest in science, to the close of a long life. Her death took place on 9th January, 1848. *The Memoir and Correspondence of Caroline Herschel*, by Mrs. John Herschel, appeared at London in 1876.

HERSCHEL, Sir Frederick William (1738–1822), generally known as Sir William Herschel, one of the most illustrious of astronomers, was born at Hanover, November 15, 1738. His father was a musician employed as hautboy player in the Hanoverian guards. The family had migrated from Bohemia in the early part of the 17th century, on account of religious troubles, they themselves being Protestants. Herschel's earlier education was necessarily of a very limited character, chiefly owing to the troubles in which his country at that time was involved; but, being at all times an indomitable student, he, by his own exertions, more than repaired this deficiency of his youth. He became a very skilful musician, both theoretical and practical; while his attainments as a self-taught mathematician were fully adequate to the prosecution of those branches of astronomy which, by his labors and his genius, he so eminently advanced and adorned. Whatever he did he did methodically and thoroughly; and in this methodical thoroughness lay the secret of what Arago very properly terms his astonishing scientific success.

In 1755, at the age of seventeen, he joined the band of the Hanoverian guards, and with his detachment visited England, accompanied by his father and eldest brother; in the following year he returned to his native country, but two years later, impelled by the troubles that surrounded him, he finally quitted Hanover to seek his fortunes in England. As might have been expected, the earlier part of his career in his adopted country was attended with formidable difficulties and much privation. We find him engaged in several towns in the north of England as organist and teacher of music, but these were occupations not attended with any lucrative results. In 1766 the tide of his fortunes began to flow, inasmuch as he obtained the appointment of organist to the Octagon Chapel in Bath, at that time the resort of the wealth and fashion of the city, and of its numerous distinguished visitors.

The next five or six years of his life were spent in establishing his reputation as a musician, and he thereby eventually became the leading musical authority in the place, and the director of all the chief public musical entertainments. His circumstances having thus become easier, he revisited Hanover for the purpose of bringing back with him his sister Caroline, with the view of her rendering him such services as she could in his multifarious undertakings. She arrived in Bath with her brother in August, 1772, being at that time in her twenty-third year. She thus describes her brother's life soon after her arrival:—"He used to retire to bed with a basin of milk or a glass of water, with Smith's *Harmonics* and Ferguson's *Astronomy*, etc., and so went to sleep buried under his favorite authors; and his first thoughts on waking were how to obtain instruments for viewing those objects himself of which he had been reading." It is not without significance that we find him thus reading Smith's *Harmonics;* to that study loyalty to his profession would impel him; as a reward for his thoroughness this led him to Smith's *Optics;* and this, by a natural sequence, again led him to astronomy, for the purposes of which the chief optical instruments were devised. It was in this way that he was introduced to the writings of Ferguson and Keill, and subsequently to those of Lalande, whereby he was educating himself for an astronomer and for undying fame. In those days telescopes were very rare, very expensive, and not very efficient, for the Dollonds had not as yet perfected even their beautiful little achromatics of 2¾ inches aperture. So Herschel was obliged to content himself with hiring a small Gregorian reflector of about 2 inches aperture, which he had seen exposed for loan in a tradesman's shop. Not satisfied with this implement, he procured a small lens of about 18 feet focal length, and set his sister to work on a pasteboard tube of that length, so as to make him a telescope. A tube of this construction naturally bent, and it was useless for all purposes but for the determined eyes of William Herschel. This material was soon displaced for tin, and thus a sorry sort of vision was obtained of Jupiter and Saturn and the moon. He then sought for a reflector of much larger dimensions from artists in London. No such instrument, however, was for sale; and the terms demanded for the construction of a reflecting telescope of 5 or 6 feet focal length he regarded as too exorbitant even for the gratification of such desires as his own. So he was driven to the only alternative that remained; he must construct a large telescope for himself. His first step in this direction was to purchase the debris of an amateur's implements for grinding and polishing small mirrors; and thus, by slow degrees, and by indomitable perseverance, he in 1774 had, as he says, the satisfaction of viewing the heavens with a Newtonian telescope of 6 feet focal length constructed by his own hands. But he was not a man to be contented with viewing the heavens as a mere star-gazer; on the contrary, he had from the very first conceived the gigantic project and the hope of surveying the entire heavens, and, if possible, of ascertaining the plan of their general structure on a settled and systematic mode of procedure, if only he could but provide himself with adequate instrumental means. With this view he, his brother, and his sister toiled for many years at the grinding and polishing of hundreds of specula, always retaining the best, and recasting the others, until the best of the previous performances had been surpassed. This was the work of the daylight in those seasons of the year when the fashionable visitors of Bath had quitted the place, and had thus freed the family from professional duties. After 1774 every available hour of the night was devoted to the long-hoped-for scrutiny of the skies. In those days no machinery had been invented for the construction of telescopic mirrors; the man who had the hardihood to undertake the polishing doomed himself to walk leisurely and uniformly round an upright post for many hours, without removing his hands from the mirror, until his work was done. On these occasions Herschel received his food from the hands of his faithful sister. But his reward was nigh.

In May, 1780, his first two papers containing some of the results of his astronomical observations during the last six years were communicated to the Royal Society through the influential introduction of Dr. Watson. Herschel had made the acquaintance of this excellent man and skilful physician in a characteristic manner. In order to obtain a sight of the moon the astronomer had taken his telescope into the street opposite his house; the physician happening to pass at the time, and seeing his eye removed for a moment from the instrument, requested permission to take his place. The mutual courtesies and intelligent conversation which ensued soon ripened this casual acquaintance into a solid and enduring regard.

The subject of this first memoir was the varying lustre of several of the stars, and especially that of Mira in the constellation of Cetus. It had been long known to fade in brightness from nearly that of a star of the first magnitude down to invisibility in such telescopes as then existed. Herschel had examined it, and many other variable stars, for himself; it was not, however, a simple or isolated phenomenon that engaged his attention; but, regarding the stars as so many suns, he examined stellar phenomena as possibly leading him to some intelligent conception of what might be occurring in our own sun. The sun, he knew, rotated on its axis, and he knew that dark spots often exist on its photosphere; the questions that he put to himself were—Are there dark spots also on these variable stars? do the stars also rotate on their axes? or are they sometimes partially eclipsed by the intervention of some opaque and invisible bodies? And then he asked himself—What are these singular spots upon the sun? and have they any practical relation to us, the inhabitants of this planet? To these questions he applied his telescopes and his thoughts; and as light from time to time dawned upon his apprehension, he communicated the results to the Royal Society in no less than six memoirs, occupying very many pages in the *Philosophical Transactions*, and extending

in date from 1780 to 1801. It was in the latter year that these remarkable papers culminated in the inquiry whether any relation could be traced in the recurrence of sun-spots, regarded as evidences of solar activity (allied to volcanic), and the varying seasons of our planet, as exhibited by the varying price of corn? Herschel's solution of the question was scarcely final, and the question has recently cropped up again, with more than a renewal of its former interest.

In the following year (1781) he communicated to the Royal Society the first of a series of papers containing the results of his telescopic inquiries in relation to the rotation of the planets and of their several satellites. The object which he had in view was not so much to ascertain the velocities or times of their rotation, as rather to discover whether those rotations are strictly uniform. From the result he expected to gather, by analogy, the probability of an alteration in the length of our own day. These inquiries occupy the greater part of seven memoirs extending from 1781 to 1797. In the course of these telescopic observations he lighted on the curious appearance of a white spot near to each of the poles of the planet Mars. On investigating the inclination of its axis to the plane of its orbit, and finding that it closely resembled that of our earth, he concluded that its changes of climate also would resemble our own, and that these white patches were probably polar snow. Modern investigations have confirmed his conclusion. He also discovered that, as far as his observations extended, the times of the rotations of the various satellites round their axes are in analogy with our own moon, viz., equal to the times of their revolution round their primaries. Here again we observe that his discoveries arise out of the complete and systematic and comprehensive nature of the investigation in which he is engaged. Nothing with such a man is accidental.

In the same year (1781) Herschel made a discovery which, as we shall see, soon completely altered the character of his professional life. In the course of his systematic examination of the heavens with a view to the discovery of the plan of their construction, he lighted on an object which at first he supposed to be a comet, but which, by its subsequent motions and appearance, turned out to be a new planet, moving outside of the orbit of Saturn. To this planet he in due time assigned the name of Georgium Sidus; but this name has by general consent been laid aside in favor of Uranus. It was discovered with a favorite 7-foot reflector having an aperture of 6½ inches; subsequently, when he had provided himself with a much more powerful telescope, of 20 feet focal length, he discovered what he believed to be no less than six satellites. Modern observations have shorn this gloomy planet of four of these supposed attendants, but at the same time have added two others apparently not observed by Herschel. No less than seven memoirs on the subject were communicated by him to the Royal Society, extending from the date of the discovery in 1781 to 1815. There is a peculiarity worthy of notice in Herschel's mode of observation which led to the discovery of this planet. He had observed that the spurious diameters of stars are not much affected by increasing the magnifying powers, but that the case is different with other celestial objects; hence if anything in his telescopic field attracted his notice by peculiarity of appearance, he immediately varied the magnifying power in order to decide the nature of the object. Thus Uranus was discovered; and had a similar method been applied to Neptune, that planet would have been discovered at Cambridge some months before it was recognized at Berlin.

We now come to the commencement of Herschel's most important series of observations, culminating in what ought probably to be regarded as his most capital discovery. A material part of the task which he had set himself as the work of his astronomical life embraced the determination of the relative distances of the stars from our sun and from each other. Now, in the course of his scrutiny of the heavens, he had observed many stars in apparently very close contiguity, but often greatly differing in their relative brightness. He concluded that, on the average, the brighter star would be the nearer to us, and the smaller enormously more distant. He considered that an astronomer on the earth, in consequence of its immense orbital displacement of some 180 millions of miles every six months, would see such a pair of stars under different perspective aspects; and this variety of perspective aspect observed and measured would, he thought, lead to an approximate determination of their distance. With this view he mapped down the places and aspects of all the double stars that he met with, and communicated in 1782 and 1785 very extensive catalogues of the results. Indeed, the very last scientific memoir that he ever wrote, sent to the Royal Astronomical Society in the year 1822, at the time when he was its first president and already in the eighty-fourth year of his age, related to these investigations. In the first of these memoirs he throws out the hint that these apparently contiguous stars must, if constituted after the material laws of our solar system, circulate round each other through the effects of gravitation; but he significantly adds that the time had not yet arrived for settling the question. Thus the philosopher abides his time in patience and confidence, and a dozen years afterwards (1793) he remeasures the relative positions of many of these contiguous pairs, and we may conceive what his feelings must have been at finding the verification of his prediction. For he found that some of these stars had circulated round each other, after the manner required by the laws of gravitation. Thus Herschel had demonstrated the action of the same mechanical laws among the distant members of the starry firmament which bind together the harmonious motions of our solar system. This sublime discovery would of itself suffice to immortalize his memory in the respectful homage of all future races of intelligent men. If only Herschel had lived long enough to learn the approximate distances of some of these binary combinations, he would at once have been able to calculate their masses when compared with that of our own sun; and thus, knowing, as we now do, that these stars in their weights are strictly comparable with the weight of our own sun, he would have found another of his analogical conjectures realized.

In the year 1782, in consequence of his fame, Herschel was invited to Windsor by George III., and then accepted the offer made by the king to become his private astronomer, and henceforth devote himself wholly to a scientific career. The salary offered and accepted was £200 per annum, to which an addition of £50 per annum was subsequently made for the astronomical assistance of his faithful sister. Dr. Watson, to whom alone the amount of this salary was mentioned, made the natural remark, "Never before was honor purchased by a monarch at so cheap a rate." In this way the great philosophical astronomer removed from Bath first to Datchet and soon afterwards permanently to Slough, within the easy access of his royal patron at Windsor.

The old pursuits at Bath were soon resumed at Slough, but with renewed vigor and without the old professional interruptions. The greater part, in fact, of the papers already referred to are dated from Datchet and Slough, for the magnificent astronomical speculations in which he was engaged, though for the most part conceived in the earlier portion of his philosophical career, required years of patient observation before they could be fully examined and realized.

It was at Slough in 1783 that he wrote his first memorable paper on the "Motion of the Solar System in Space"—a sublime speculation, yet through his genius realized by considerations of the utmost simplicity. He returned to the same subject with fuller details in 1805. It was also after his removal to Slough that he published his first memoir containing his speculative ideas on the construction of the heavens, which from the first had been the chief aim of his toils both of mind and body. In a long series of remarkable papers, addressed as usual to the Royal Society, and extending from the year 1784 to 1818, when he was eighty years of age, he demonstrated the fact that our sun is a star situated not far from the bifurcation of the Milky Way, and that all the stars visible to us lie more or less in clusters scattered throughout a comparatively thin stratum, but in the other two dimensions stretching immeasurably further into space. At one time he imagined that his powerful instruments had pierced through this stellar stratum of the Milky Way, and that he had approximately determined the form of some of its boundaries. In the last of his memoirs he had convinced himself of his error, and he admitted that to his telescopes our stratum of stars is "fathomless." Over this stratum of stars and their planetary attendants, the whole being in ceaseless motion round some common centre of gravity as the resultant point of the combined gravitation, Herschel discovered on either side a canopy of discrete nebulous masses, from the condensation

of at least a part of which the whole stellar universe had been formed,—a magnificent conception, pursued with a force of genius and put to the practical test of observation with an industry almost incredible. It was the work of a single mind, carried to its termination with no assistance beyond that of a loyal sister, almost as remarkable a personage as himself.

Hitherto we have said nothing about that grand reflecting telescope, of 40 feet focal length and 4 feet aperture, which is too often regarded as the chief effort of his genius and his perseverance. The full description of this celebrated instrument will be found in the 85th volume of the *Transactions* of the Royal Society. Gigantic as it really was, we are disposed to regard it as among the least of his great works. On the day that it was finished (August 28, 1789) Herschel saw at the first view, in a grandeur not witnessed before, the Saturnian system with all its six satellites, five of which had been discovered long before by Huygens or Cassini, while the sixth, latterly named Enceladus, he had, two years before, sighted by glimpses in his exquisite little telescope of 6½ inches aperture, but now saw in unmistakable brightness with the towering giant he had just completed. On the 17th of September, he discovered a seventh, which proved to be the nearest of all the satellites of Saturn. It has since that time received the name of Mimas. It is somewhat remarkable that, notwithstanding his long and repeated scrutinies of this planet, the eighth satellite, Hyperion, and the crape ring should have escaped him.

Herschel married the widow of Mr. John Pitt, a wealthy London merchant, on May, 8, 1788, by whom he had an only son, John Frederick William. The prince regent conferred a Hanoverian knighthood upon him in 1816. But a far more valued and less tardy distinction was the Copley medal assigned to him by his associates in the Royal Society in 1781.

He died at Slough on August, 25, 1822, in the eighty-fourth year of his age, and was buried under the tower of St. Laurence Church, Upton, within a few hundred yards of the old site of the 40-foot telescope. A mural tablet on the wall of the church bears a Latin inscription from the pen of the late Dr. Goodall, provost of Eton College. A collected edition of his astronomical memoirs would speak of his genius in unmistakable language; but this has not yet been published. (C. P.)

HERSCHEL, Sir John Frederick William, Bart. (1792–1871), the illustrious astronomer, the only son of Sir F. William Herschel, was born at Slough, Bucks, in the year 1792. His early home was a singular one, and eminently adapted to nurture into greatness any child born, as he was, with natural gifts capable of wide development. The examples about him were those of silent but ceaseless industry, busied about things which, at the first view, seemed to have no apparent connection with the world outside the walls of his abode, but which, at a mature period of his life, he, with rare eloquence, taught his countrymen to appreciate as foremost among those influences which satisfy and exalt the nobler instincts of our nature.

His scholastic education commenced at Eton, but maternal fears or prejudices soon removed him to the house of a private tutor. Thence, at the early age of seventeen, he was sent to St. John's College, Cambridge, and the form and method of the mathematical instruction he there received exercised a material influence on the whole complexion of his scientific career. In due time the young student acquired the highest academical distinction of his year, graduating as senior wrangler. It was during his undergraduateship that he and two of his fellow-students who subsequently attained to very high eminence in their respective careers of life, Dean Peacock and Mr. Babbage, entered into a sort of moral compact that they would "do their best to leave the world wiser than they found it,"—a compact loyally and successfully carried out by all three to the end. As a commencement of this laudable attempt we find Herschel associated with these two friends in the production of a work on the differential calculus, and on cognate branches of mathematical science, which changed the whole style and aspect of mathematical learning in England, and brought it up to the level of the Continental methods. Two or three memoirs communicated to the Royal Society on new applications of mathematical analysis at once placed him in the front rank of the cultivators of this branch of knowledge. Of these his father had the gratification of introducing the first, but the others were presented in his own right as a fellow.

His first intention had been to study for the bar, and with this view he left the university, and placed himself under the guidance of an eminent special pleader of that day. Probably this temporary choice of a profession arose from the extraordinary success which for some time had attended the efforts of so many eminent Cambridge mathematicians in legal pursuits. Be that as it may, an early acquaintance with Dr. Wollaston in London soon changed the direction of his studies. In 1820, assisted by his father, he completed a mirror of 18 inches diameter and 20 feet focal length, for a reflecting telescope. This, subsequently improved by his own hands, became the instrument which enabled him to effect the astronomical observations which, more than any other of his great works, form the basis of his fame. In 1821–23 we find him associated with Mr. South in the re-examination of his father's double stars, by the aid of an achromatic telescope and other appliances, the like of which for excellence and power had not hitherto been collected. For this work in 1826 he received the recognition of the Astronomical Society by the award of their gold medal; the French Institute also presented him with the Lalande medal for the same contribution to astronomical science. It ought also to be mentioned that in 1821 the Royal Society had presented him with the Copley medal for his mathematical contributions to their *Transactions*. From 1824 to 1827 he held the distinguished and responsible post of secretary to that society. In 1827 he was elected to the chair of the Astronomical Society, which office he also filled on two subsequent occasions. In the course of the discharge of his important offices in the last-named society he ennobled its literature by his memorable presidential addresses and obituary notices of deceased fellows, which, it is not too much to say, are, by their combination of eloquence and wisdom, the chief adornments of their printed memoirs. In 1831 the honor of knighthood was conferred on him by William IV., and two years later he again received the recognition of the Royal Society by the award of one of their medals for his memoir "On the Investigation of the Orbits of Revolving Double Stars." There is a significance in this award; the father had been the original discoverer of the extension of gravitation to the remotest boundaries of the visible universe, and the son had now put the crowning stone to this edifice of discovery by the invention of a graphical method whereby the eye could as it were see the two component stars of the binary system revolving before it, after the regularity of the Newtonian law.

Before the end of the year 1833, being then about forty years of age, Sir John Herschel had re-examined all his father's discoveries of double stars and nebulæ, and had added many similar bodies to his own list; this alone constituted a gigantic work even for the lifetime of any astronomer in that day. For it should be remembered that the astronomer was not as yet provided with those curious and valuable automatic contrivances for observing and for recording observations which at present most materially abridge the labor and increase the accuracy of astronomical work such as that in which Sir John had been engaged. And he had no assistant. Equatorial clocks for turning the telescope, electrical chronographs for recording the times of the phenomena observed, were at that date unknown.

His scientific life now entered another and very characteristic phase. The bias of his mind, as he subsequently was wont to declare, was towards chemistry and the phenomena of light, rather than towards astronomy. Indeed, very shortly after taking his academical degree at Cambridge, he proposed himself as a candidate for the vacant chair of chemistry in that university; but, as he said with some humor, the result of the election was that of the votes he had a glorious minority of one. In fact Herschel had become an astronomer from a sense of duty, just as his father had become one by fascination and fixed resolve; hence it was by filial loyalty to his father's memory that he was now impelled to undertake the completion of that work which at Slough had been so grandly commenced. William Herschel had explored the northern heavens; John Herschel determined to explore the heavens of the south, as well as re-explore the north. "I resolved," he said, "to attempt the completion of a survey of the whole surface of the heavens; and for this purpose to transport into the other

hemisphere the same instrument which had been employed in this, so as to give a unity to the results of both portions of the survey, and to render them comparable with each other." In accordance with this resolution, he and his family embarked for the Cape on the 13th November, 1833; they arrived in Table Bay on the 15th January, 1834; and proceedings, he says, "were pushed forward with such effect that on the 22d of February I was enabled to gratify my curiosity by a view of κ Crucis, the nebula about η Argus, and some other remarkable objects in the 20-foot reflector, and on the night of the 4th of March to commence a regular course of sweeping."

To give an adequate description of the vast mass of labor completed during the next four busy years of his life at Feldhausen would require the transcription of a considerable portion of the *Cape Observations*, a volume which probably is not surpassed in varied interest or astronomical importance by any scientific work in existence; although it might perhaps be equalled by a judicious selection from Sir William's "Memoirs," now scattered in some thirty volumes of the *Philosophical Transactions*. It was published, at the sole expense of the late duke of Northumberland, but not till 1847, nine years after the author's return to England, for the very cogent reasons assigned by himself:—"The whole of the observations, as well as the entire work of reducing, arranging, and preparing them for the press, have been executed by myself." There are 164 pages of catalogues of southern nebulæ and clusters of stars. There are then careful and elaborate drawings of the southern appearance of the great nebula in Orion, and of the region surrounding the remarkable star of Argo. The labor and the thought bestowed upon some of these objects are almost incredible; several months were well spent upon a minute spot in the heavens containing 1216 stars, but which an ordinary spangle, held at a distance of an arm's length, would eclipse. These catalogues and charts being completed, he proceeds to discuss their significance, which in the eyes of science possesses an absorbing interest. He confirms his father's hypothesis that these wonderful masses of glowing vapors are not irregularly scattered, and without apparent law, hither and thither in the visible heavens, but are collected in a sort of canopy, whose vertex is at the pole of that vast stratum of stars in which our solar system finds its position,—buried in it, as he supposes, at a depth not greater than that of the average distance from us of an eleventh magnitude star. Then follows his catalogue of the relative positions and magnitudes of the southern double stars. And he applies to one of them, γ Virginis, that beautiful graphical method invented by himself, whereby he determines the orbit of the two components round each other; and he had the satisfaction of witnessing with his own eyes the fulfilment of a prediction he had made some years before, viz., that the two stars would, in the course of their orbital movements, appear to close up into a single star, inseparable by any telescopic power. The double stars and their stately revolutions and lustrous colors dismissed, in the next chapter he proceeds to describe the observations which he had made on their varying and relative brightness. It has been already detailed how his father commenced his scientific career by similar observations on the varying magnitudes of many stars, and how his remarks culminated years afterwards in the question whether the variation of the lustre of our sun, by the presence or absence of sun spots, affected our harvests and the price of corn. The son carries his speculations backwards to a still more philosophical depth. The variation from time to time, he remarks, in the lustre of our sun, to the extent of half a magnitude, would account for those strange alternations of a semi-arctic and semi-tropical climate which geological researches have disclosed as having occurred in various regions of our globe.

Herschel returned to his English home in the spring of 1838. As was natural and honorable to all concerned, he was welcomed with an enthusiastic greeting. By the queen at her coronation he was created a baronet; and, what to him was better than all such rewards, other men caught the contagion of his example, and labored in fields similar to his own, with an adequate portion of his success. In particular Mr. Lassell transported a telescope as large as the celebrated Herschelian telescope to Malta, where with excellent results he "minded the heavens" for the space of four years. He was rewarded there, and at his own English residence near Liverpool, by the discovery of new satellites of Saturn and of Uranus, constituting what Sir John Herschel, animated by a fraternal sympathy, well called an epoch in astronomy. Mr. De La Rue also, at Islington and at Cranford, followed zealously and successfully in the wake of the same infectious enthusiasm.

Herschel was a highly accomplished chemist. His discovery of the solvent power of hyposulphite of soda on the otherwise insoluble salts of silver, in 1819, exercised a most important influence on the practical applications of photography twenty years afterwards; and in 1839, the natal era of that valuable art, he, independently of Mr. Fox Talbot, had discovered the means of taking and multiplying photographic pictures, and early in the spring of that year exhibited more than twenty photographic pictures to the Royal Society, including one of the old 40-foot telescope. He was the first person to introduce the now well-known terms *positive* and *negative* in photographic images, and to deposit upon glass a sensitized film for the reception of the picture. He also paved the way for Professor Stokes's important discovery of the change which luminous waves may suffer in their period of oscillation, by his addition of the lavender rays to the spectrum, and by his announcement of "epipolic dispersion," as exhibited by sulphate of quinine. Several other important and successful researches of his, connected with the undulatory theory of light, are scattered through the pages of his treatise on "Light" published in the *Encyclopædia Metropolitana*.

To the other varied accomplishments of his gifted mind we must add the graces of a deep poetic feeling. Perhaps no man can become a truly great mathematician or great philosopher, if unendowed with the versatile powers of the imagination. John Herschel possessed this endowment to a large extent; and he had reserved for himself as a solace and enjoyment in old age the translation of the *Iliad* into verse. He had at an earlier period of life translated in a similar manner Schiller's *Walk*. But the main work of his declining years was the collection of all his father's catalogues, combined with his own observations and those of other astronomers of nebulæ and double stars, each into a single volume. He lived to complete the former, and to present it to the Royal Society, who have published it in a separate form in the *Philosophical Transactions*. The latter work he had not fully completed at his death; but he bequeathed as much of it as was finished to the Astronomical Society. That society has printed a portion of it, which serves as an index to the observations of various astronomers on double stars up to the year 1866.

A complete list of his various contributions to learned societies will be found in the Royal Society's great catalogue, and from them may be gathered most of the records of his busy scientific life. Sir John Herschel met with an amount of public recognition which was unusual in the time of his illustrious father. Naturally he was a member of almost every important learned society in both hemispheres. For five years he held the office of master of the mint, the same appointment which, more than a century before, had been occupied by Sir Isaac Newton; his friends also offered to propose him as president of the Royal Society and again as a member of parliament for the university of Cambridge, but neither office was within the scope of his own desires.

In private life Sir John Herschel was a firm and most active friend; he had no jealousies; he avoided all scientific feuds; he gladly accorded a helping hand to those who consulted him in scientific difficulties; he never discouraged, and still less disparaged, men younger than or inferior to himself; he was pleased when his own work was appreciated, but that was never an object of his solicitude: it was said of him by a discriminating critic, and without extravagance, that "his was a life full of the serenity of the sage and the docile innocence of a child."

He died at Collingwood, his residence near Hawkhurst in Kent, May 11, 1871, in the seventy-ninth year of his age, and his remains are interred in Westminster Abbey close to the grave of Sir Isaac Newton.

Sir John Herschel, independently of the labors connected with his *Cape Observations*, was the author of several books, one of which at least, *On the Study of Natural Philosophy* (1830), possesses an interest which no future advances of the subjects on which he wrote can obliterate from the attention of thoughtful men in any age. In 1849 came the *Outlines of Astronomy*, of which it is enough to say that, notwithstanding the obvious disadvantage arising from the practice of stereotyping textbooks which relate to progressive sciences, there is no more instructive volume extant on the subject of which it treats. His articles, "Meteorology," "Physical Geography," and "Telescope," contributed to the 8th edition of the *Encyclopædia Britannica*, were afterwards published separately. There is also another very valuable little book, which originated from a happy peculiarity of Sir John Herschel's dignified simplicity and truthfulness of mind. When he was at the Cape he more

than once assisted in the attempts there made to diffuse a love of knowledge among men not engaged in literary pursuits. In one of his addresses he, with a kindly and far-seeing wisdom, told his audience that the advance of a nation's intelligence or a nation's fame did not depend upon a few successful philosophers toiling in their lonely studies, and gathering great reputations for their learning or their discoveries, but that a nation's progress rather lay in the diffusion of their knowledge among the masses of the population. Acting practically on this principle, he, on his return to England, published, in *Good Words* and elsewhere, a series of papers on interesting points of natural philosophy, which have since been collected in a volume called *Familiar Lectures on Scientific Subjects*. None but a deep thinking philosopher could have written this book; none but a clear thinking master of his subjects could have made it what it is, enticingly intelligible. Another volume of his, not so widely known to the public as any of the above works, is his *Collected Addresses*, in which he is seen in his happiest and most instructive mood, walking, as it were, at liberty among sympathizing associates, in his own fields, and enamored of their beauties. (C. P.)

HERSENT, Louis (1777–1860), French painter, was one of David's most distinguished pupils, and became one of the most noted painters of the Restoration. He was born at Paris on 10th March, 1777, and obtained the Prix de Rome in 1797; in the Salon of 1802 appeared his Metamorphosis of Narcissus, and he continued to exhibit with rare interruptions up to 1831. His most considerable works under the empire were Achilles parting from Briseis, and Atala dying in the arms of Chactas (both engraved in Landon's *Annales du Musée*); an Incident of the life of Fénelon, painted in 1810, found a place at Malmaison, and Passage of the Bridge at Landshut, which belongs to the same date, is now at Versailles. Hersent's typical works, however, belong to the period of the Restoration; Louis XVI. relieving the Afflicted (Versailles) and Daphnis and Chloe (engraved by Langier and by Gelée) were both in the Salon of 1817; at that of 1819 the Abdication of Gustavus Vasa brought to Hersent a medal of honor, but the picture, purchased by the duke of Orleans, was destroyed at the Palais Royal in 1848, and the engraving by Henriquel-Dupont is now its sole record. Ruth, produced in 1822, became the property of Louis XVIII., who from the moment that Hersent rallied to the Restoration zealously patronized him, made him officer of the legion of honor, and pressed his claims at the Institute, where he replaced Van Spaendonck. He continued in favor under Charles X., for whom was executed Monks of Mount St. Gotthard, exhibited in 1824. In 1831 Hersent made his last appearance at the Salon with portraits of Louis Philippe, Marie Amélie, and the duke of Montpensier; that of the king, though good, is not equal to the portrait of Spontini (Berlin), which is probably Hersent's *chef-d'œuvre*. After this date Hersent ceased to exhibit at the yearly salons. Although in 1846 he sent an excellent likeness of Delphine Gay and one or two other works to the rooms of the Société d'Artistes, he could not be tempted from his usual reserve even by the international contest of 1855. Five years later, on 2d October, 1860, he died. His work shows every artistic merit which can be attained by steadily directed intelligence and labor; his skilful arrangement, delicacy of line, and certainty in execution are points which have excited the admiration even of those who find him wanting in feeling, in interest, and in sense of color. Louis XVI. relieving the Afflicted, the treatment of which indicates the approach of the realistic movement, is less theatrical than Daphnis and Chloe, which combines, in the true spirit of the Restoration, drawing-room graces with a pseudo-classic style; but both show the same dryness and hardness of manner which Hersent had acquired under the influence of the first empire, and from which he never was able to free himself.

HERSFELD, a town of Prussia, capital of a circle in the government district of Cassel, province of Hesse-Nassau, is pleasantly situated at the confluence of the Geisa and Haune with the Fulda, on the railway from Frankfort to Bebra, 10 miles N. N. E. of Fulda. The greater part of its old fortifications remain, but the ramparts and ditches have been laid out as promenades. The principal buildings are the ancient town-house; the parish church, completed in 1320, in the Gothic style, with a fine tower and a large bell; the ruins of the collegiate church in the Byzantine style, erected in the beginning of the 12th century on the site of the cathedral, but burnt down by the French during the Seven Years' War; and outside the town the ancient monastery with its surrounding grounds. Among the public institutions are a gymnasium, a higher town school, an orphanage, and a district infirmary. The town has important manufactures of cloth and leather, as well as dye-works, worsted mills, and soap-boiling works. The population in 1875 was 6929.

Hersfeld owes its origin to a Benedictine abbey which, founded by Lullus, archbishop of Mainz, about 760, was richly endowed by Charlemagne, and became in the 12th century an ecclesiastical principality. In 1370 the town came under the protection of Hesse, and in 1525 it gave in its formal allegiance to it. The abbey was secularized in 1648, but Hersfeld remained the capital of a principality until 1828.

HERSTAL, or in its older form Heristal, a market-town of Belgium, on the left bank of the Meuse, 3 or 4 miles north-east of Liége, and skirting the road which leads from that city to Maestricht. Its population, which in 1900 numbered 18,322, is mainly supported by its coal mines and iron industries. Herstal probably derives its name from being a "Heerstelle" or permanent camp of the Franks. It is well known as the birthplace and family seat of Pippin, the major-domo of the Austrasian kingdom, some few traces of whose castle are still pointed out above the town. And though it cannot maintain its claim to be the birthplace also of Charlemagne, it was undoubtedly a frequent place of residence for this greatest of the Carolingians; and in 870 it gave its name to the treaty by which Charles the Bald and Lewis the German decided the partition of Lotharingia. The lordship of Herstal passed to the house of Nassau in 1444; and in 1702, on the death of William III. of England, its possession was disputed between the house of Orange and the king of Prussia. The decision of the courts was given in 1714 in favor of Prussia; but the new possessors, finding the feelings of the people of Herstal against them, sold the lordship to Liége for 140,000 thalers. Another Herstal, distinguished as the Saxon, was the place where Charlemagne had his winter quarters in the year 797. It is now the village of Herstelle on the Weser, in the government of Minden.

HERTFORD, County of, Hertfordshire, or Herts, an inland county in the south-east of England, is situated between 51° 36′ and 52° 5′ N. lat., and 0° 13′ E. and 0° 45′ W. long. It is bounded on the N. by Cambridgeshire, N. W. by Bedfordshire, E. by Essex, S. by Middlesex, and S. W. by Buckinghamshire. The area comprises 391,141 acres or 611 square miles. Plate XV.

The aspect of the county is pleasant and picturesque, its surface being broken by gentle undulations which in some parts form a quick succession of hills and valleys. The highest summit is Kensworth Hill on the border of Bedfordshire, about 910 feet above sea-level. Fine oak and other trees are grown in the hedges, and from being pruned obliquely they form high walls of living timber shading narrow winding lanes. The arable and pasture lands of the farms are intermingled with the parks and ornamental woods of the country seats which are scattered thickly throughout the county. These features, varied by its winding rivers, impart to it a peculiar beauty, while in luxuriance it is not surpassed by any county in England.

The principal rivers are the Lea, which, rising some miles beyond Luton in Bedfordshire and entering Hertfordshire at Hidemill, flows south-east to Hatfield and then east by north to Hertford and Ware, whence it bends southward, and passing along the eastern boundary of the county falls into the Thames a little below London, having received in its course the Maram, the Beane, the Rib, and the Stort, which all flow southward in the north-eastern part of the county, the Stort for some distance forming the boundary between it and Essex; the Colne, which, flowing through the south-western part of the county, falls into the Thames at Brentford, having received in its course the Ver, the Bulborne, and the Gade; the Ivel, which, rising in the north-west of the county, soon passes into Bedfordshire. The New River, one of the water supplies of London, made by Sir Hugh Myddleton (1607–13), has its source in some springs near Ware, and runs parallel for many miles with the Lea. The Grand Junction Canal from London to Birmingham traverses the south-west corner of the county, passing by Watford and Berkhampstead. There are mineral springs in the parishes of Chipping Barnet, Northaw, and Watton.

Geologically the county consists of Cretaceous and Tertiary rocks, the greater part being Lower, Middle, and

BEDFORDSHIRE
CAMBRIDGESHIRE
BUCKINGHAMSHIRE
MIDDLESEX
ESSEX
Ampthill
Shefford
Maulden
Meppershall
Shillington
Henlow
Stotfold
Arlesey
Hitchin
Letchworth
Willian
Baldock
Norton
Bygrave
Radwell
Newnham
Ashwell
Caldecot
Hinxworth
Royston
Barley
Reed
Barkway
Nuthampstead
Anstey
Wyddiall
Buntingford
Throcking
Cottered
Rushden
Orwell
Clothall
Wallington
Standon
Buckland
Measden
Brent Pelham
Furneux Pelham
Stocking Pelham
Hormead
Quendon
Saffron Walden
Great Eastern Railway
Tenny Stratford
Woburn
Flitwick
Harlington
Midland Railway
London & North Western Railway
Leighton Buzzard
Hockliffe
Watling Street
Stanbridgeford Sta
Dunstable
Icknield Way
Luton
Caddington
Wingrave
Cheddington
Marsworth
Pitstone
Long Marston
Aylesbury Canal
Tring
Berkhamsted
Wendover
Chesham
Amersham
Chalfont St Peter
Rickmansworth
Watford
Bushey
Elstree
Edgware
Harefield
Hemel Hempstead
St Albans
Kings Langley
Abbots Langley
Bovingdon
Chipperfield
Sarratt
Chorleywood
Lt Missenden
Gt Missenden
High Wycombe
Northolt
Harpenden
Redbourn
Wheathampstead
Sandridge
Stanborough
Welwyn
Codicote
Knebworth
Stevenage
Walkern
Graveley
Ardeley
Lilley
Offley
Hexton
Pirton
Ickleford
Wellbury
Weston
Cumberlow Gr
Throcking
Aspenden
Westmill
Cole Park
Munden
Braughing
Albury
Standon
Berry Gr
Bishop Stortford
Mundens
Hadham Hall
Much Hadham
Wickham Hall
Stanstead
Elsenham
Thorley
Hatfield
Hatfield Park
Essendon
Bayford
Hoddesdon
Broxbourne
Wormley
Cheshunt
Goffs Oak
Waltham Cross
Waltham Abbey
Enfield
Edmonton
Chipping Barnet
Totteridge
Whetstone
Southgate
Colney Hatch
Stanmore
Hatfield Broad Oak
Harlow
Roydon
Stanstead
Sawbridgeworth
Hertford
Ware
Amwell
Wadesmill
Thundridge
Widford
Gilston
Eastwick
Epping
Chipping Ongar
Ongar
Theydon Bois
Roding
Lea
New River
Great Northern Railway
Midland Railway
London & North Western Railway
Grand Junction Canal
Aylesbury Canal
Scale of Miles
Meridian of Greenwich

Upper Chalk, which in the south-eastern part of the county are covered by Tertiary deposits belonging to the London basin. Over a large part of the eastern side of the county there are superficial deposits of glacial origin, and on the western side there are traces of the Lower Tertiary beds having formerly extended over a much wider area, outliers of the beds being of not unfrequent occurrence, and the drift deposits on the chalk hills being largely composed of their debris. The vales traversed by the rivers and streams exhibit in the bottoms a rich sandy loam; the sloping sides are covered by loams of inferior quality; and the flat surface of the high ground is generally formed of a loam of reddish hue tending towards common clay, with which it is often confounded.

The climate is mild, dry, and remarkably salubrious. On this account the London physicians were accustomed to recommend the county for persons in weak health, and it was so much coveted by the noble and wealthy as a place of residence, that it was a common saying—"He who buys a home in Hertfordshire pays two years' purchase for the air."

According to the agricultural returns for 1879, the total area of arable land was 339,187 acres, of which 145,666 acres were under corn crops, 39,443 under green crops, 38,416 under rotation grasses, 97,548 permanent pasture, and 18,111 fallow. The area under woods was 20,714 acres. It will thus be seen that the main produce of Hertfordshire is corn. The principal crop is wheat, which in 1879 occupied 59,363 acres. The varieties mostly grown are white, and they are not surpassed by those of any county in England. Wheathampstead on the river Lea receives its name from the fine quality of the wheat grown in that district. Of barley, which is largely made use of in the county for malting purposes, there were 49,129 acres in 1879, and of oats only 25,779. Little or no rye is grown, and of pease and beans together there were in 1879 only a little over 11,000 acres. Of green crops, turnips and Swedes occupied in 1879 an area of 21,578 acres, while potatoes had only 2576. Vetches are largely grown for the London stables, extending to 8191 acres in 1879. The greator part of the permanent grass is made use of for hay. There are some very rich pastures on the banks of the river Stort, extending from Hertford to Hockeril on the borders of the river Lea, and also near Riokmansworth, where they are watered by the river Colne. The percentage of oultivated area in 1879 was 86·7 instead of 85·1 in 1870; of area under corn crops 37·2 instead of 38·5; under groen crops 10·1 instead of 11·5; under rotation grasses 9·8 instead of 10·2; and of pormanent pasture 24·9 instead of 22·0. The most common system of rotation is the five-course—turnips or fallow, barley, clover, wheat, oats. In the south-west part of the county large quantities of cherries and apples are grown for the London market. On the best soils nearest to London culinary vegetables are forced by the aid of rich manure, and more than one crop are sometimes obtained in a year.

Generally speaking, the quantity of stock kept is small. Not much attention is paid to the breeds of cattle, but among cows the Suffolk variety is the most common. The number of cattle in 1879 was only 31,754, or an average of 9·3 to every 100 acres under cultivation, the average for England being 11·9, and for the United Kingdom 21·0. Of these the number of cows in milk or in calf was 11,802. The number of horses in 1879 was 15,022, or an average of 4·4 to every 100 acres, the avorage for England being 4·5 and for the United Kingdom 4·1. The horses used for agricultural purposes are chiefly Suffolk punches. The number of sheop in 1879 was 171,133, or an average of 50·4 to every 100 acres under cultivation, the average for England being 75·3, and for the United Kingdom 68·0. The principal kinds are the Southdown and Wiltshire, and a cross between Cotswolds and Leicesters. Pigs in 1879 numbered 30,404, or an average of 8·9 to every 100 acres under cultivation, the average for England being 7·2, and that for the United Kingdom 6·7.

In Hertfordshire the number of resident proprietors is very large, which circumstance, as well as the proximity to London, has doubtless greatly aided the development of agricultural enterprise. The average extent of the farms is about 200 acres, and the modern improvements are everywhere adopted.

According to the return of owners of land for 1872–73, the soil was divided among 12,387 proprietors, holding land the gross annual rental of which was £1,163,192. Of the owners 77 per cent. held less than one acre, and tho total annual value for tho county was £2, 17s. 3½d. per acre. There were only eight propriotors who held upwards of 4000 acres, viz., Marquis of Salisbury, Hatfield, 13,389; Abel Smith, Watton, 10,212; Earl Cowper, Panshanger, 10,122; Earl of Verulam, Gorhambury, St. Albans, 8625; Earl Brownlow, Ashridge Park, 8551; Lord Dacre, The Hoo, Welwyn, 7100; Charles C. Halo, King's Walden, 6558; and Earl of Essex, Cashiobury Park, Watford, 6157. W. R. Baker, Bayfordbury, comes next with 3911 acres.

The staple trade of tho county is in corn and malt, most of which is sent to the metropolis. There are numerous flour-mills, as well as breweries, tanneries, tile-works, and coach factories, but tho principal manufactures are paper, silk, and straw plait.

Hertfordshire is so much intorsectod by railways that no place in any part of the county is more than 5 miles distant from a station. On the eastern border there is tho Great Eastern, with branches to Hertford and Buntingford. The middle of the county is traversed by the Great Northern, with branches from Hatfield to Hertford, Luton, Dunstable, and St. Albans, and from Hitchin to Royston, and thence to Cambridge. The Midland passes through St. Albans, with branches to tho Great Northern and London and North-Western. The London and North-Western traverses the south-western corner.

The county comprises 8 hundreds, and the municipal boroughs of Hertford and St. Albans. The principal towns are the municipal and parliamentary borough of Hertford (municipal borough, 7169), the city of St. Albans (8298), Hitchin (7630), Watford (7461), Bishop Stortford (6250), Hemel-Hempstead (5996), Ware (4917), Berkhampstead (4083), Tring (4045), Barnet (3720). For parliamentary representation tho county is an undivided constituency, and returns three members, while one member is returned for tho borough of Hertford. Hertfordshiro is in the south-eastern circuit. There were formerly two courts of quarter sessions, one for the county and one for the liberty of St. Albans, which liberty had also a separate commission of the peace, but the county and the liberty are now amalgamated, though prisoners are tried both at Hertford and St. Albans. The jail for the county is at the latter city. The county is divided into fifteen petty sessional divisions, and for some purposes into two divisions, those of Hertford and the liberty of St. Albans. The boroughs of Hertford and St. Albans have commissions of the peace. Ecclesiastically tho county is in the diocese of St. Albans, and contains 138 civil parishes, townships, or places, as well as parts of other parishes extending into adjoining counties. The total population in 1871 was 192,226, of whom 93,244 were males and 98,982 females. The population in 1901 was 250,350. Since the first census in 1801 it has inoreased by 94,833, or 97 per cent.

History and Antiquities.—Previous to the Roman invasion the Celtic inhabitants of Hertfordshire, as of the other parts of South Britain, had been subdued by the Belgæ. In 54 B. C. Cassivelaunus, the chief of the Cassii, led an army to oppose Cæsar, but he was defeated, and his capital Verulam, near the present town of St. Albans, taken. At Verulam and Berkhampstead traces of ancient British works may yet be seen; and it has been conjectured that British stations existed at Royston, Braughing, and various other places in the county. Numerous British coins have been found at Verulam. Three principal British roads or trackways crossed the county: Watling Street passed through its south-west corner, in a north-west direction by St. Albans to Dunstable; Ermine Streot entered tho south-east corner at Little Hookgate, whence it proceeded by Gough's Oak and Broxbourne Bury to Ware, holding thence much the same course as the present road by Buntingford to Royston; Icknield Street, from Dunstable to Royston, crossed tho north-west corner. There are numerous barrows at Royston, and along the range of chalk hills at the northern edge of the county. Hertfordshire was the scene of an important part of the struggle carried on against the Romans by Caractacus about 44 A. D.; and during the rebellion of Boadicea the Romans were defeated on the road from Verulam to Colchester, and Verulam itself was taken and devastated by the Britons. The shire was included within the Roman province of Flavia. Among the Roman stations within its limits were the capital *Verulamium*, which the Romans rebuilt and fortified; *Forum Dianæ*, not far from Dunstable; *Ad Fines*, supposed to have been near Braughing, where there are remains of a vallum with fosse; and probably others at Royston and Bishop Stortford. Watling Street and Ermine Street wore causewayed as Roman roads, and other branch roads traversed the county in various directions. Roman antiquities have been found at Verulam, Braughing, Royston, Wilbury Hill (where there are remains of an ancient camp), Cheshunt, Hemel-Hempstead, and Bishop Stortford. After the conquest of England by the Anglo-Saxons, Hertfordshire was included partly in Mercia and partly in Essex.. It was the scene of frequent contests between the Saxons and the Danes. In 896 the Danes, having anchored their vessels in the Lea near the town of Ware, laid siege to Hertford, whereupon Alfred the Great, by dividing the stream into three channels, stranded their vessels and compelled them to retreat to the Severn. After the battle of Senlac in 1066, William the Conqueror, in order to force the earls to hurry home from London to their earldoms, crossed the Thames at Wallingford and marched into Hertfordshire, where at Berkhampstead an attempt was made by the abbot of St. Albans to stop his course by cutting down the trees; and at a meeting of nobles held at the town he took an oath to rule according to tho ancient laws and customs of tho country. The subsequent events of historic importance connected with the county are

the capture of Hertford castle by the revolted barons under the French dauphin, December 6, 1216; the battle between the royalists and the armies of the White Rose at St. Albans, May 22, 1455, in which Henry VI. was wounded and taken prisoner; a second battle near St. Albans, 17th February, 1461, in which the earl of Warwick was defeated by Queen Margaret; the defeat near Barnet of the earl of Warwick by Edward IV., 14th April, 1471; and the arrest by Cromwell of the high sheriff of the county as he was proceeding to St. Albans for the purpose of proclaiming by order of Charles I. that all the Parliamentary commanders were rebels and traitors.

Among the objects of antiquarian interest may be mentioned the cave of Royston, rediscovered in 1742, doubtless at one time used as a hermitage, and containing rude carvings of the crucifixion and other sacred subjects; Waltham cross, in the Pointed style of architecture, (restored in 1833), erected to mark the spot where rested the body of Eleanor, Queen of Edward I., on its way to Westminster for interment; and the Great Bed of Ware referred to in Shakespeare's *Twelfth Night*, for many years shown to visitors at the Crown Inn of that town, and in September, 1864, put up to auction at the Saracen's Head for 100 guineas and bought in. The principal monastic buildings are the noble pile of St. Albans abbey, founded about 793 in honor of the first Christian martyr of Great Britain; the remains of Sopwell Benedictine nunnery near St. Albans, founded in 1140; the remains of the priory of Ware, dedicated to St. Francis, and originally a cell to the monastery of St. Ebrulf at Utica in Normandy; and the remains of the priory at Hitchin built by Edward II. for the White Carmelites. Among the more interesting churches may be mentioned those of Abbots Langley and Hemel-Hempstead, both of late Norman architecture; Baldock, a handsome Gothic building supposed to have been erected by the Knights Templars in the reign of Stephen; Royston, formerly connected with the priory of the canons regular; Hitchin, built in the 15th century on the site of an older structure, with a fine porch in the Perpendicular style and an altarpiece by Rubens; Hatfield, dating from the 13th century; Berkhampstead, chiefly in the Perpendicular style, with a tower of the 16th century. The ruins of secular buildings of importance are the massive remains of Berkhampstead castle, Hertford castle, Hatfield palace, the slight traces at Bishop Stortford, and the earthworks at Anstie. Of the numerous mansions of interest only a few can be mentioned:—the Rye House, erected in the reign of Henry VI., tenanted by Rumbold, one of the principal agents in the plot to assassinate Charles II.; Moor Park, Rickmansworth, at one time the property of St. Albans abbey, granted by Henry VII. to John de Vere, earl of Oxford, for some time in the possession of Cardinal Wolsey and subsequently of the duke of Monmouth, who built the present mansion, which, however, after it was sold by the duchess of Monmouth to Mr. Styles, was cased with Portland stone, and received various other additions at a cost of £150,000; Knebworth, the seat of the Lyttons, originally a Norman fortress, rebuilt in the time of Elizabeth in the Tudor style, and restored in the present century; Hatfield House, the manor of which was granted to the abbey of St. Ethelred at Ely by King Edgar, and with the palace was made over to Henry VIII., from whose reign it remained a royal residence until the time of James I., who exchanged it for the palace of Theobalds with Sir Robert Cecil, afterwards earl of Salisbury, by whom the present mansion in the Elizabethan style was erected, being founded in 1611; Panshanger House, now the principal seat of the Cowpers, a splendid mansion in the Gothic style erected at the beginning of the present century; Cashiobury House, the seat of the earls of Essex, supposed to derive its name from the old British tribe Cassii, and the manor of which was formerly held by the abbot of St. Albans, rebuilt in the beginning of the present century from designs by Wyatt, somewhat resembling those of Windsor Castle; Gorhambury House, formerly the seat of the Bacons, and the residence of the great chancellor, but rebuilt by the Grimstons. Among the eminent persons connected with the county were Nicholas Brakespeare (Pope Adrian IV.), Francis Bacon, Sir John Mandeville, William Cowper, Charles Lamb, and Lord Lytton.

The old histories of Hertfordshire by Cox, Salmon, and Chauncey have been superseded by the splendid work of Clutterbuck, 3 vols. folio, 1815–27, and the laborious compilation now in course of publication by John Edwin Cussans.

HERTFORD, a town of England, capital of the above county, is situated in a sheltered valley on the river Lea, and on the Great Northern and Great Eastern Railways, 26 miles north of London by rail. It is somewhat irregularly built, but is neat, clean, and well-paved. The principal buildings are the shire-house or town-hall, erected on the site of the former edifice, and finished in 1771; the corn exchange, erected in 1858; the church of All Saints recently restored, a cruciform structure of the 14th century, with a square tower surmounted by a spire; the new church of St. Andrews, occupying the site of the old one; the brick edifice which occupies the site of the ancient castle, and includes some portions of the old building; and the infirmary. The county jail has lately been sold under the provisions of the new Prisons Act. There are a large number of educational institutions, including the preparatory school for Christ's Hospital, London; Hale's grammar school for boys, the Cowper Testimonial school for boys, the Abel Smith Memorial school for girls, and the Green Coat school for boys and girls of poor parents who have never received alms. The town depends for its prosperity chiefly on agriculture. The trade is principally in wheat and wool, and a large quantity of malt is made for the London breweries. There are also breweries, iron foundries, and flour and oil mills. The population of the municipal borough in 1901 was 9,320, and of the parliamentary borough 12,500. Area of the municipal borough is 864 acres, and of the parliamentary borough 1123 acres.

The name Hertford is identified by Bede with *Herudford*, meaning red ford, but more probably it is a corruption of Hereford, meaning army ford, and indeed it is spelt in this way by Saxon authorities and in some monastic charters. In 673 a council was convened at Hertford by Theodore, Archbishop of Canterbury, at which two Saxon kings attended. The castle was erected about 905 by Edward the Elder, who at the same time rebuilt the town, which had in all probability been devastated by the Danes. Its custody and the government of the town were given by William the Conqueror to Peter de Valoignes. Subsequently it was surrendered to the crown. In the reign of John it was captured by the revolted barons headed by the dauphin of France. By Edward III. the castle was made the occasional prison of John II. king of France and David king of Scotland. Hertford is recorded as a borough in Domesday. It received its first charter from Queen Mary in 1554, and this was renewed and modified by Elizabeth, and confirmed and extended by James I. and Charles II. The borough sent two members to parliament from the reign of Edward I. to the 50th of Edward III., when the privilege was suspended until the reign of James I. Since the Reform Act of 1867 it has returned only one member.

HERTZ, HENRIK (1798–1870), Danish poet, was born of Jewish parents in Copenhagen, August 25, 1798. At that date it was unusual for Jews to enjoy a professional education, but young Hertz showed such marked literary bias that in 1817 he was sent to the university. His father having died in his infancy, and the family property having been destroyed in the bombardment of 1807, the boy was brought up by his relative, M. L. Nathanson, for many years editor of the principal Danish newspaper. Young Hertz was destined for the law, and passed his juridical examination in 1825. But his taste was all for polite literature, and in 1827 he came forward as a dramatic author by the publication of two plays, *Herr Burchardt and his Family* and *Love and Policy;* the latter enjoyed considerable success on the stage. In 1828 followed the comedy of *Flyttedagen*, which occupied itself with the humors of moving house on quarter-day. In 1830 he brought out what was a complete novelty in Danish literature, a drama in rhymed verse, *Amor's Strokes of Genius*. In the same year Hertz published anonymously *Gjenyangerbrevene*, or Letters from a Ghost, which he pretended were written by Baggesen, who had died in 1826, and which were full of satirical humor and fine critical insight. The success of this book was overwhelming; Copenhagen talked of nothing else for a whole season; but Hertz preserved his anonymity, and the secret was not known until many years later. In 1832 he published a didactic poem, *Nature and Art*, and *Four Poetical Epistles*. *A Day on the Island of Als* was his next comedy, followed in 1835 by *The Only Fault*. Hertz passed through Germany and Switzerland into Italy in 1833; he spent the winter there, and returned the following autumn through France to Denmark. In 1836 his comedy of *The Savings Bank* enjoyed a great success. But it was not till 1837 that he developed his most important talent by writing the romantic drama of *Svend Dyring's House*, a beautiful and original piece, which still holds the stage. His historical tragedy *Valdemar Atterdag* was not so well received in 1839; but in 1845 he achieved an immense success with his lyrical drama *King René's Daughter*, which has been translated into almost every European language, and successfully acted all over the civilized world. To this succeeded the tragedy of *Ninon* in 1848, the romantic comedy of *Tonietta* in 1849, *A Sacrifice* in 1853, *The Youngest* in 1854. His lyrical poems appeared in successive collections, dated 1832, 1840, and 1844. From 1858 to 1859 he edited a very interest-

ing literary journal entitled *Weekly Leaves*. He died in 1870. Hertz is one of the first of Danish lyrical poets. His poems are full of color and passion, his versification has more witchcraft in it than any other poet's of his age, and his style is grace itself. He has all the sensuous fire of Keats without his proclivity to the antique. As a romantic dramatist he is scarcely less original. He has bequeathed to the Danish theatre, in *Svend Dyring's House* and *King René's Daughter*, two pieces which have survived the vicissitudes of forty years, and which are as popular as ever. He is a troubadour by instinct; he has little or nothing of Scandinavian local coloring, and succeeds best when he is describing the scenery or the emotions of the glowing south.

HERTZEN, Alexander (1812–1870), was born at Moscow in 1812, a very short time before the occupation of that city by the French. His father, Ivan Yakovlef, after a personal interview with Napoleon, was allowed to leave, when the invaders arrived, as the bearer of a letter from the French to the Russian emperor. His family attended him to the Russian lines. Then the mother of the infant Alexander (a young German Protestant of Jewish extraction from Stuttgart, according to A. von Wurzbach), only seventeen years old, and quite unable to speak Russian, was forced to seek shelter for some time in a peasant's hut. A year later the family returned to Moscow, where Hertzen passed his youth,—remaining there, after completing his studies at the university, till 1834, when he was arrested and tried on a charge of having assisted, with some other youths, at a festival during which verses by Sokolovsky, of a nature uncomplimentary to the emperor, were sung. The special commission appointed to try the youthful culprits found him guilty, and in 1835 he was banished to Viatka. There he remained till the visit to that city of the hereditary grand-duke (afterwards Alexander II.), accompanied by the poet Joukofsky, led to his being allowed to quit Viatka for Vladimir, where he was appointed editor of the official gazette of that city. In 1840 he obtained a post in the ministry of the interior at St. Petersburg; but in consequence of having spoken too frankly about a death due to a police officer's violence, he was sent to Novgorod, where he led an official life, with the title of "state councillor," till 1842. In 1846 his father died, leaving him by his will a very large property. Early in 1847 he left Russia, never to return. From Italy, on hearing of the revolution of 1848, he hastened to Paris, whence he afterwards went to Switzerland. In 1852 he quitted Geneva for London, where he settled for some years. In 1864 he returned to Geneva, and after some time went to Paris, where he died, January 21, 1870.

His literary career began in 1842 with the publication of an essay, in Russian, on *Dilettantism in Science*, under the pseudonym of "Iskander," the Turkish form of his Christian name,—convicts, even when pardoned, not being allowed in those days to publish under their own names. His second work, also in Russian, was his *Letters on the Study of Nature* (1845–6). In 1847 appeared his novel *Kto Vinovat?* (Whose Fault?), and about the same time were published in Russian periodicals the stories which were afterwards collected and printed in London in 1854, under the title of *Prervannuie Razskazui* (Interrupted Tales). In 1850 two works appeared, translated from the Russian manuscript, *Vom Anderen Ufer* (From another Shore) and *Lettres de France et d'Italie*. In French appeared also his essay *Du Développement des idées révolutionnaires en Russie*, and his memoirs, which after being printed in Russian, were translated under the title of *Le Monde russe et la Révolution* (3 vols. 1860–62), and were in part translated into English as *My Exile to Siberia* (2 vols., 1855). From a literary point of view his most important work is *Kto Vinovat?* a story describing how the domestic happiness of a young tutor, who marries the unacknowledged daughter of a Russian sensualist of the old type, dull, ignorant, and genial, is troubled by a Russian sensualist of the new school, intelligent, accomplished, and callous, without there being any possibility of saying who is most to be blamed for the tragic termination. But it was as a political writer that Hertzen gained the vast reputation which he at one time enjoyed. Having founded in London his "Free Russian Press," of the fortunes of which, during ten years, he gave an interesting account in a book published (in Russian) in 1863, he issued from it a great number of Russian works, all levelled against the system of government prevailing in Russia. Some of these were essays, such as his *Baptized Property*, an attack on serfdom; others were periodical publications, the *Polyarnaya Zvyezda* (or Polar Star), the *Kolokol* (or Bell), and the *Golosa iz Rossii* (or Voices from Russia). The *Kolokol* soon obtained an immense circulation, and exercised an extraordinary influence. For three years, it is true, the founders of the "Free Press" went on printing, "not only without selling a single copy, but scarcely being able to get a single copy introduced into Russia;" so that when at last a bookseller bought ten shillings' worth of *Baptized Property*, the half sovereign was set aside by the surprised editors in a special place of honor. But the death of the emperor Nicholas in 1855 produced an entire change. Hertzen's writings, and the journals he edited, were smuggled wholesale into Russia, and their words resounded throughout that country, as well as all over Europe. Their influence became overwhelming. Evil deeds long hidden, evil-doers who had long prospered, were suddenly dragged into light and disgrace. His bold and vigorous language aptly expressed the thoughts which had long been secretly stirring Russian minds, and were now beginning to find a timid utterance at home. For some years his influence in Russia was a living force, the circulation of his writings was a vocation zealously pursued. Stories tell how on one occasion a merchant, who had bought several cases of sardines at Nijni-Novgorod, found that they contained forbidden print instead of fish, and at another time a supposititious copy of the *Kolokol* was printed for the emperor's special use, in which a telling attack upon a leading statesman, which had appeared in the genuine number, was omitted. At length the sweeping changes introduced by Alexander II. greatly diminished the need for and appreciation of Hertzen's assistance in the work of reform. The freedom he had demanded for the serfs was granted, the law-courts he had so long denounced were remodelled, trial by jury was established, liberty was to a great extent conceded to the press. It became clear that Hertzen's occupation was gone. When the Polish insurrection of 1863 broke out, and he pleaded the insurgents' cause, his reputation in Russia received its death-blow. From that time it was only with the revolutionary party that he was in full accord, and it is by that section of Russian Liberals alone that his opinions are now considered of authority. For the great reforms, however, which followed the Crimean War, Russia is much indebted to the outspoken utterances of Alexander Hertzen, and will be so in all probability for the constitutional changes which are likely to follow the repressive measures of 1879.

In 1873 a collection of his works in French was commenced in Paris. A volume of posthumous works, in Russian, was published at Geneva in 1870. His *Memoirs* supply the principal information about his life, a sketch of which appears also in A. von Wurzbach's *Zeitgenossen*, pt. 7, Vienna, 1871. See also the *Revue des Deux Mondes* for July 15 and Sept. 1, 1854. *Kto Vinovat* has been translated into German under the title of *Wer ist Schuld?* in Wolffsohn's *Russlands Novellendichter*, vol. iii. The title of *My Exile in Siberia* is misleading; he was never in that country. (W. R. S. R.)

HERULI, Æruli, or Eruli, a nomadic and warlike German tribe who inhabited the northern shores of the Black Sea, but afterwards divided into various sections and wandered into different parts of Europe. They made their first appearance in history in the 3d century, as taking part with the Goths in their incursions against the eastern provinces of the Roman empire. In the 4th century they acknowledged the overlordship of the Gothic king Ermanric, but when Attila, king of the Huns, made his descent upon Gaul, they joined his standard. After the overthrow of the Huns, in which they suffered considerably, they established an organized and distinct confederacy on the banks of the Danube, and under the leadership of Odoacer, assisted in 476 in the overthrow of the Western empire. Under their king Rudolph they in the beginning of the 6th century attempted the subjugation of the Longobardi, but were defeated and dispersed, some of them proceeding to Scandinavia, and others being allowed by the emperor Anastasius to settle on the south bank of the Danube. In the time of Justinian some of them embraced Christianity. A large portion of them afterwards joined the Gepidæ in their wars against the Eastern empire; but others who remained afforded Justinian important assistance in his wars against the Vandals and East Goths, so that they frequently fought against one another. About the end of the 6th century

they became submerged and lost in other nations, and disappeared from historical records. The Heruli were bold, hardy, and extremely pugnacious. For a considerable period they retained intact their strong individuality, and presented a firm resistance to the influences of surrounding civilizations. They put to death without mercy the sick and the aged, and are said even to have offered human sacrifices.

HERVEY, James (1714–1758), a popular religious writer of the 18th century, was born at Hardingstone, near Northampton, on February 26, 1714, and was educated at the grammar school of Northampton, whence in 1731 he passed to Lincoln College, Oxford. At the university he came under the influence of John Wesley and others of that school, and for some time manifested an inclination towards their theology; ultimately, however, while retaining his regard for the men and his sympathy with their religious aims, he adopted a thoroughly Calvinistic creed, and resolved to retain connection with the Established Church. Having taken holy orders in 1737, he became curate to his father in the family livings of Weston Favell and Collingtree, to which he himself succeeded in 1752. There, under the disadvantage of very weak health, he labored with great diligence in the discharge of his parochial duties, and also wrote numerous religious works, which though of but slight literary or theological value, rapidly became highly popular, and in many English and Scottish houses, especially of the humbler class, took a place on the same shelf with the *Pilgrim's Progress* and the *Whole Duty of Man*. His earliest work, *Meditations and Contemplations*, containing "Meditations among the Tombs," "Reflections on a Flower Garden," and a "Descant on Creation" (1746), and "Contemplation on the Night and Starry Heavens" (1747), said to have been modelled on Boyle's *Occasional Reflections on Various Subjects*, within fourteen years passed through as many editions. *Theron and Aspasio, or a Series of Letters upon the most important and interesting Subjects*, which appeared in 1755, and was equally well received, called forth some adverse criticism even from Calvinists, on account of tendencies which were considered to lead to Antinomianism, and was strongly objected to by Wesley in his *Preservative against unsettled Notions in Religion*. Besides carrying into England the theological disputes to which Fisher's *Marrow of Modern Divinity* had given rise in Scotland, it also led to what is known as the Sandemanian controversy as to the nature of saving faith. Hervey died on December 25, 1758. A "new and complete" edition of his *Works*, with a memoir, appeared in 1797. See also *Collection of the Letters of James Hervey, to which is prefixed an account of his Life and Death* (1760).

HERVEY, John Hervey, Lord (1696–1743), the "Narcissus," "Sporus," and "Lord Fanny" of Pope's satire, a nobleman of political and social distinction in the reign of George II., was son of John first earl of Bristol, and was born on October 13, 1696. Educated and trained for public life at Westminster and Clare Hall, Cambridge, he became a favorite at the court of the prince and princess (afterwards George II. and Queen Caroline), to which Pope, Gay, Arbuthnot, Chesterfield, and other wits resorted, and which was celebrated for the beauty and accomplishments of its ladies, such as Miss Bellenden (afterwards duchess of Argyle), Miss Howe, Miss Lepell, and Mrs. Howard, whose names will live for ever in the poetry of Pope, Gay, and Swift, and in the lively memoirs and correspondence of that brilliant circle. Hervey was married to Miss Lepell in 1720. Having entered the House of Commons as member for Bury (1725), he in 1730 received the appointment of vice-chamberlain to the king; in 1733 Sir Robert Walpole called him up to the House of Lords, where he proved a frequent and effective speaker; and in 1740 he succeeded Lord Godolphin as lord privy seal, which office he held until the Walpole administration was driven from power in 1742. Notwithstanding miserable health he continued to take an active part in politics until his death, which occurred on August 8, 1743. He was survived by four sons, three of whom became successively earls of Bristol. Destitute of any commanding talents or solid principle, a sceptic in religion and a profligate in morals, Lord Hervey was yet far above the intellectual rank assigned him by his merciless satirist, Pope. He wrote and spoke vigorously on public questions, was studious and laborious, a fair scholar, and a writer of pleasing occasional verses. The origin of the hostility which led to the allusion in the *Dunciad* (iv. 104) in 1728, and afterwards to the attacks in the *Prologue* and *Epilogue to the Satires*, remains obscure. "It would be now idle," as Mr. Croker remarks, "to seek for a cause of quarrel which the parties were, a hundred years ago, unable or unwilling to explain; but may it not be sufficiently accounted for by the jealousies almost inevitable between persons of such similar and therefore discordant tastes and tempers, living together in a circle of tittle-tattle, scandal, and pasquinades?" Political differences had probably something to do with it, Lord Hervey and Lady Mary Wortley Montague (who shared with him the poet's enmity) having at the accession of George II. adhered to Walpole, while Pope and his brother wits were chiefly associated with the opposition. Lord Hervey left behind him *Memoirs of the Reign of George the Second, from his Accession to the Death of Queen Caroline*, which were not published until 1848, when they appeared in two volumes, edited, with a biographical notice, by Mr. Croker. The work throws much light on the interior of the court—its coarseness, dulness, and immorality; but it is as degrading to the author as it is to the English monarchy, for Lord Hervey appears rather in the light of a court parasite and malignant gossip than in that of a fair historian or an English gentleman.

HERZEGOVINA, an Illyrian province, ethnographically belonging to the Serbo-Croatian nationality, under the titular dominion of the Turkish sultan, but since 1878 administered by Austria-Hungary. The Turks included it in the vilayet of Bosnia. It is bounded N. and E. by Bosnia, S. by Montenegro, and W. by Dalmatia, only touching the Adriatic by the narrow enclaves of Klek and Suttorina. The province extends about 117 miles in a south-east direction between 17° 10′ and 20° 15′ E. long. By the treaty of Berlin the Herzegovinian districts of Niksich and Dormitor have been placed under the government of the prince of Montenegro.

Population.—The Austrians have not yet (1879) had time to complete trustworthy statistics as to the population and resources of the province, and those published in the days of Turkish administration must be received with great reserve. The best statistical accounts of Herzegovina are those collected for the Austrian Government by the staff-officers Majors Roskiewicz and Thoemmel, and their discrepancy is the best proof of the difficulties which have hitherto prevented an exact calculation.

According to Roskiewicz the population of Herzegovina amounted in 1868 to 230,000 souls. Thoemmel (in 1867) gives it as 207,970, of whom 101,348 were Pravoslavs or adherents of the Orthodox Greek Church, 56,000 Mahometans, 49,217 Roman Catholics, 1340 Gipsies, and 65 Jews. Dr. Blau (late Prussian consul-general at Seraievo) fixes the Herzegovinian population in 1872 approximately at 230,000, viz., 130,000 of the Orthodox Greek Church, 55,000 Mussulmans, 42,000 Roman Catholics, 2500 Gipsies and 500 Jews. Klaich, however, the most recent Slavonic authority on the province (1878), reduces the total population to 185,421. During the troubles that ensued on the insurrection of 1875, about two-thirds of the Christian population fled beyond the Dalmatian and Montenegrin border, and the fearful mortality among these refugees has largely diminished the Herzegovinian population during the last three years. See Supplements.

With the exception of the Gipsies, the Jews, and a small sprinkling of Osmanli officials, the whole population is Slavonic, the Mahometans being for the most part renegade descendants of the feudal nobility that had formed itself here before the Turkish conquest. Much of the old Slavonic customs and family life still holds among the Herzegovinian Mussulmans, and here as in Bosnia polygamy is unknown. The Herzegovinians are tall, broad, and darker, and of greater personal bravery than the Bosnians; they are brachycephalic. In frame as well as character they approach very nearly to the Montenegrin type, and in the mountain districts they are divided, like the Montenegrins and Albanians, into clans or nahias, whose loyalty is reserved for their own waiwodes or military chiefs. Their temperament is pre-eminently poetic, in so much that the recent insurrection has already given rise to many epic lays, which are recited to the sound of the guzla or Serbian lyre by the national minstrels. The Serbo-Croatian language is spoken in its purest form in Herzegovina, and the Narenta valley has been called the Serbian Val d'Arno. The Orthodox Greek population is chiefly settled in the district east of the Narenta; to the west of that river the population is mostly Roman Catholic, and the Mahometans inhabit the larger towns. According to the *Schematismus* of the

Franciscan P. Bakula, the population of the capital Mostar amounted in 1873 to 29,116, of whom 20,306 were Mahometans, 5008 Greeks, and 2821 Roman Catholics. Of the other towns, Ljubuska has, according to Klaich, a population of about 3000 souls, Stolatz 3500, Focha 10,000, Niksich (now under Montenegro) 4000, and Trebinje 3000.

Natural Features.—Herzegovina, which has been described as the Turkish Switzerland, is divided into a variety of mountain plateaus by the parallel ranges of the Dinaric Alps; and the whole country is bisected by the river Narenta, which cleaves its way through the mountains from the Bosnian frontier towards the Adriatic. The valley of the Narenta and its tributaries forms the main artery of the province. There is situated the capital Mostar; and a fine high-road, the only avenue of communication between Seraievo (Bosna Serai) and the Adriatic, follows the river bank from the Dalmatian frontier to the Bosnian. The "polyes" or mountain plateaus are the most characteristic feature of the country. The smaller towns and villages group themselves on their level and comparatively fertile surface, and the districts or cantons thus formed are walled round by a natural rampart of white limestone mountains. These "polyes" may be described as oases in what is otherwise a desert expanse of mountains. The surface of some, as notably the great Mostarsko Blato, is marshy, and in spring forms a lake; others are watered by streams which disappear in swallow-holes of the rock, and make their way by underground channels either to the sea or the Narenta. The most conspicuous example of these is the Trebinstica, which disappears in two swallow-holes in Popovopolje, and after making its way by a subterranean passage through a range of mountains, wells up in the mighty source of Ombla near Ragusa, and hurries in undiminished volume to the Adriatic. The climate of Herzegovina is cold in winter and oppressively hot (maximum 100° Fahr. in shade) in summer. The scirocco is a prevalent wind, as well as the bora, the fearful north-north-easter of Illyria, which, sweeping down the lateral valleys of the Dinaric Alps, overwhelms everything in its path. The snow-fall is slight, and, except on a few of the loftier peaks, the snow soon melts. In the valleys, as that of the Narenta, the flora approaches that of Dalmatia and Southern Italy, and olives, mulberries, figs, melons, pomegranates, grapes, rice, and maize flourish. The Dinaric Alps, which stretch across the province from N. W. to S. E., are as a rule barer and loftier than those of Bosnia. To the west of the Narenta, indeed, their flanks are in places covered with a forest growth of beech and pine, but north-east of that river they present for the most part a scene of lunar desolation. They are of the Tertiary formation common to the Mediterranean geological zone, but their limestone has a more dolomitic character than that of the Bosnian ranges. The group of mountains in the north-west bend of the Narenta, the Krabac, Lipeta, and Porim Planinas, attain altitudes varying from 4000 to 5000 feet; the dolomitic peaks of Orobac, Samotica, and Veliki Cap rise over 6000; Orien on the Dalmatian-Montenegrin frontier 6300; and Mount Dormitor, in the tract of Herzegovina now ceded to Montenegro, reaches a height of 8500 feet. The river Narenta is navigable for small steamers as far as Metkovitch, the Dalmatian frontier station, and for *trabaccoli* as far as Chaplina beyond Gabella, but the narrow and rocky bed of the stream beyond this point makes it doubtful whether the navigation can ever be extended as far as Mostar.

Produce and Industries.—In mineral wealth Herzegovina cannot compete with Bosnia. Lignite exists in considerable abundance in the Narenta valley near Mostar, at Konjica, and at Stolac. Mineral springs occur near Ljubuska; asphalt towards Metkovitch and Drazevo on the Dalmatian frontier. Rice is cultivated in the Trebisat valley and about Ljubuska. Mulberries are cultivated in the Narenta valley for silk worms, which were introduced here by the famous vizier Ali Pasha, but the culture is at present small. The wine of Konjica and Mostar resembles Dalmatian, and might be excellent, and the Trebinje tobacco is celebrated. Previous to the insurrection the chief wealth of the inhabitants consisted in cattle. Roskiewicz estimates the numbers as 100,000 horned cattle, 1,200,000 sheep and goats, and 100,000 swine; but there has been a terrible decrease during the three years of anarchy. Before the insurrection the annual value of the exports of the province, consisting principally of sheep's wool, hides, wax, wine, and tobacco, amounted to about 18,170,000 piastres (£163,530). The imports, principally cloth and woollen goods, were estimated at 17,500,000 piastres (£157,500).

History.—The old Serbian zupa of Chelm or Zachlumje was incorporated in the banat of Bosnia by the ban Stephen in 1326. Afterwards exchanged for Primorjo with the king of Hungary, it was reannexed by the ban Stephen Tvartko, afterwards first king of Bosnia, who granted it as a fief to his distinguished general Vlatko Hranich. Vlatko's grandson, known as Stephen Cosaccia from his birthplace Cosac, took advantage of the weakness of King Tvartko III. of Bosnia to transfer the immediate suzerainty of his county to the emperor Frederick IV., who in 1440 created him duke, or, as his Slavonic subject, borrowing the German word, expressed it, *Herzega*, of St. Sava. This and the further title of keeper of St. Sava's sepulchre he derived from the tomb of the patron saint of Serbia in his monastery of Milesevo. From this time the Slav population of Illyria begins to know the dominions of Cosaccia as the "Herzegovina" or duchy, a general term which embraced, besides the former county of Chelm, the two old Serbian zupas of Tribunja and Primorje, also governed by the "Herzega." The original Herzegovina thus extended from the sea-coast of Dalmatia to the confines of Rascia. The duke was prevailed on at the parliament of Konjica to recognize the suzerainty of the Bosnian king; he fixed his residence at Mostar, which he greatly enlarged, and which has since remained the capital of Herzegovina. The shrewd policy of Stephen Cosaccia, which offered an asylum for the Bogomiles or Puritans of Bosnia, hounded from their homes by the bigotry of a priest-ridden king, was greatly instrumental in warding off for a while from the duchy the blow that overwhelmed Bosnia. The duke managed with Bogomilian help to defend Herzegovina with some success; and though in 1464 the country was overrun and rendered tributary by the sultan's hordes, it was not till 1483, twenty years after the final conquest and extinction of the Bosnian kingdom, that the Turkish Beglerbeg succeeded in dispossessing Stephen Cosaccia's son and successor Duke Vladislav. The whole country was now incorporated in the Sandjakate of Bosnia. At different times the Venetians succeeded in recovering for Christendom parts of Herzegovina, and by the peace of Carlowitz in 1699 and that of Passarowitz in 1718 Primorje or the Herzegovinian coast-land, Castelnuovo, and Risano were finally merged in Venetian Dalmatia, and have thus descended to the Austrians. The only remaining strips of Herzegovinian sea-coast, the narrow enclaves of Klek and Suttorina, were left to the Turks by Ragusan dread of Venetian contact, supported by the good offices of England. The history of Herzegovina under the Turks is to a great extent a blank: the viziers of Herzegovina who resided at Mostar imitated by their quasi-independence of their Bosnian superiors the defiant attitude adopted by the duke of St. Sava to his Bosnian suzerain. Feudalism under a Mahometan guise continued to survive here. The spahis, begs, or agas were merely mediæval lords who had apostatized to Islam. They kept their ancestral castles, their banners, their mediæval title deeds and patents of nobility. They exacted feudal service from their serfs and retainers. They indulged in the mediæval passion for hawking. One of these Mahometan nobles, Ali, aga of Stolac, did such good service for Sultan Mahmoud in his struggle with the Bosnian magnates that he was made vizier of Herzegovina, which was freed for a while from dependence on the Bosnian government. The reforms of Sultan Mahmoud did not by any means remove the grievances of the rayah population of Herzegovina. The serfs had now to satisfy the extortion of imperial tax-farmers and exoisemen as well as the demands of their feudal lords. The begs and agas continued to exact their forced labor and a third of the produce; the central Government levied a tithe which at the date of the outbreak had become an eighth. Three kinds of cattle tax, the tax for exemption from military service levied on every infant in arms, forced labor on the roads, forced loan of horses, a heavy excise on grapes and tobacco, and a variety of lesser taxes combined to burden the Christian peasants; but what was more galling than the amount, was the manner in which these various taxes were extorted,—the iniquitous assessment of tax-farmers and excisemen, and the brutal license of the zaptiehs who were quartered on recalcitrant villagers. Meanwhile the profligate expenditure of the imperial voluptuary at Stamboul and the peculation of his ministers hurried on the crisis. The public bankruptcy of Turkey put the last straw on the rayah's back. On July 1, 1875, the villagers of Nevesinje, which gives its name to a mountain plateau east of Mostar, unable to bear the extortion of the tax-farmers, and goaded to madness by the outrages inflicted on them by the zaptiehs and bashi-bazouks, rose against their oppressors. The insurrection rapidly spread through Herzegovina and thence to Bosnia. The Herzegovinians under their leaders Peko Pavlovich, Socica, Ljubibratich, and others held out for a year against all the forces that Turkey could despatch against them, and in two struggles in the gorge of Muratovizza alone the Turks lost over 2000 men. In July, 1876, the principalities joined in the struggle; the Russo-Turkish war followed, and

by the treaty of Berlin the government of Bosnia and Herzegovina was confided to Austria-Hungary, while Niksich and the country about Mount Dormitor were detached from Herzegovina and annexed to Montenegro. On July 31, 1878, the Austrian troops crossed the Herzegovinian frontier, and the news roused the Mahometan fanatics to a desperate effort. On August 2d the Mahometans of Mostar, imitating the example of Seraievo, and believing themselves betrayed by the Turkish Government, rose *en masse*, murdered the Turkish governor and officials, and proclaimed a ulema head of a provisional government. The Austrians, however, pressed forward, and crushing some ineffectual efforts at resistance entered Mostar on the 5th of August. By the 29th of September the reduction of Herzegovina was completed by the capture of the hillfort of Klobuk. Since the completion of the occupation, the government of the province has been under the military governor at Seraievo, controlled by the foreign office at Vienna. The sultan still remains sovereign *de jure*, nor have the Austro-Hungarian administrators as yet been able to regulate the agrarian difficulty which lies at the root of all the evils that have afflicted the province.

Authorities.—Mauro Orbini, *Contado di Chelmo* (in his *Storia degli Slavi*, Pesaro, 1601); *Spicilegium, etc., de Bosniæ Regno*, Leyden, 1737; Schimek, *Politische Geschichte des Königreichs Bosnien. Ruma*, Vienna, 1787; Farlato, *Illyricum Sacrum*, vol. iv.; Ami Boué, *La Turquie d'Europe*; Sir G. Wilkinson, *Dalmatia and Montenegro*, London, 1848; Kovachevich, *Bosna*, Belgrade, 1851; Thoemmel, *Beschreibung des Vilajet Bosnien*, Vienna, 1867; Roskiewicz, *Studien über Bosnien u. Herzegovina*, Vienna, 1868; E. de Sainte-Marie, *L'Herzégovine*, Paris, 1875, and "Itinéraires en Herzégovine" in *Bull. de Soc. Géogr. de Paris*, 1876; Evans, *Through Bosnia and Herzegovina*, London, 1876, and *Illyrian Letters*, London, 1878; Stillman, *Herzegovina and the late Uprising*, London, 1877; Dr. Blau, *Reisen in Bosnien u. d. Herzegovina*, Berlin, 1877; Klaioh, *Bosna*, Agram, 1878; Haardt, *Die Occupation Bosniens u. d. Herzegovina*, Vienna, 1878; *Correspondence respecting affairs in Bosnia and Herzegovina*, issued by the English Foreign Office, 1876, etc., and Reports of Consuls Holmes and Freeman. (A. J. E.)

HERZOGENBUSCH, or 's Hertogenbosch. See Bois-le-duc.

HESEKIEL, George Louis (1818–1874), German author and journalist, was born August 12, 1818, in Halle, where his father, a man of considerable distinction, was a preacher and inspector of schools. Hesekiel studied history and philosophy in Halle, Jena, and Berlin, and devoted himself in early life to journalism and literature. In 1848 he settled in Berlin, where he lived till his death, February 26, 1874, achieving a considerable reputation both as a writer of books and as editor of the *Neue Preussische Zeitung*. He attempted many different kinds of literary work, the most ambitious being perhaps his patriotic songs, of which he published a volume during the revolutionary excitement of 1848–49. Another collection—*Neue Preussenlieder*—appeared in 1864 after the Danish war, and there was a third in 1870—*Gegen die Franzosen, Preussische Kriegs- und Königslieder*. Among his novels may be mentioned *Vier Junker* (1864) and *Der Schultheiss vom Zeyst* (1875). By far the best known of his works is his life of Prince Bismarck—*Das Buch vom Fürsten Bismarck* (3d edition, enlarged, 1873). This biography, which has been translated into English by R. R. H. Mackenzie, is written from the point of view of an ardent admirer of the great chancellor. It is of no value as an estimate of his political importance, but it has acquired a certain popularity because of the mass of more or less interesting anecdotes which the author has brought together respecting both the public and the private life of his hero. It has lately, however, been rather thrust into the shade by the more piquant revelations of Herr Busch.

HESIOD, the father of didactic poetry in Greece, is placed by Herodotus before Homer, but not more than 400 years before his own epoch; and, though the settlement of the question must depend on the internal evidence of the Hesiodic poems, this testimony is corroborated by the Parian marble and the historian Ephorus. He probably flourished about nine centuries before Christ. His father had migrated from Cyme in Æolia to Bœotia, exchanging there a seafaring life for agriculture; and Hesiod and his brother, a scapegrace named Perses, were born at Ascra, near the base of Helicon and under the mountains which encircle Bœotia. Of this locality—whose claim to be his birthplace was disputed by the city Orchomenus on the score of possession of his relics—Hesiod's description differs from that of modern topographers in pronouncing the climate ungenial, with alternations of excessive heat and cold; but the poet's prejudice may have been influenced by the injustice of Bœotian law-courts, and it was at any rate here, as he fed his father's flocks beside Helicon, that he received his commission from the Muses to be their prophet and poet—a commission which he recognized by dedicating to them an eared tripod won by him in a contest of song at funeral games in Eubœa, and extant at Helicon in the age of Pausanias (*Theog.*, 20–34; Pausan., ix. 31, § 3). But to this call were linked, no doubt, literary antecedents in Æolia, as well as local associations of music and poetry in Hellas. His earliest poem, the famous *Works and Days*, embodies the experiences of his life afield, and, interwoven with episodes of fable, allegory, and personal history, forms a sort of Bœotian shepherd's calendar. The first portion is an ethical enforcement of honest labor and dissuasive of strife and idleness (1–383); the second consists of hints and rules as to husbandry (384–764); and the third is a religious calendar of the months, with remarks on the days most lucky or the contrary for rural or nautical employments. The connecting link of the whole poem is the author's advice to his brother, who appears to have bribed the corrupt judges to deprive Hesiod of his already scantier inheritance, and to whom, as he wasted his substance lounging in the agora, the poet more than once returned good for evil, though he tells him there will be a limit to this unmerited kindness. In the *Works and Days* the episodes which rise above an even didactic level are the "Creation and Equipment of Pandora," the "Five Ages of the World," and the much-admired "Description of Winter" (by some critics judged post-Hesiodic). It is in the *Works and Days* especially that we glean indications of Hesiod's rank and condition in life, that of a stay-at-home farmer of the lower class, whose sole experience of the sea was a single voyage of 40 yards across the Euripus, and an old-fashioned bachelor whose misogynic views and prejudice against matrimony have been conjecturally traced to his brother Perses having a wife as extravagant as himself.

The other poem attributed to Hesiod or his school which has come down in great part to modern times is *The Theogony*, a work of grander scope, inspired alike by older traditions and abundant local associations. It seems that no more congenial task could have suggested itself to the Ascræan shepherd than to work into system, as none had essayed to do before, the floating legends of the gods and goddesses and their offspring. This task Herodotus attributes to him, and he is quoted by Plato in his *Symposium* (p. 178 B) as the author of the *Theogony*. The first to question his claim to this distinction was Pausanias, the geographer (200 A. D.). The Alexandrian grammarians had no doubt on the subject; and indications of the hand that wrote the *Works and Days* may be found in the severe strictures on women, in the high esteem for the wealth-giver Plutus, and in coincidences of verbal expression. If, too, as commentators assert, the proper beginning of the *Works and Days* is at verse 11—

> Οὐκ ἄρα μοῦνον ἐήν Ἐρίδων γένος, ἀλλ' ἐπὶ γαῖαν
> Εἰσι δύω,

it is hard to avoid the conclusion that the poet there corrects a statement made in his *Theogony* (225), where he had described Eris, the daughter of Night, as one and indivisible. One thing is clear, that, as Mr. Grote puts it, it was the aim of Hesiod, or the member of his school who composed the *Theogony*, "to cast the divine functions into a systematic sequence,"—so welding into intelligible coherence the generations and genealogies of the deities of Hellas, whom Homer had dealt with in passing and scattered notices only. The *Theogony* consists of three divisions—(1) a cosmogony, or creation; (2) a theogony proper, recounting the history of the dynasties of Zeus and Cronus; and (3) a brief and abruptly terminated heroogony, or generation of heroes by immortal sires from mortal mothers; the starting-point not improbably of the Hesiodic poem, the *Eoiai*, or "Catalogues of Women," of which all but a few fragments are lost. Prefaced by an account of the Muses' visit to their bard, the *Theogony* proceeds, from the spontaneous generation of Erebus and Night from Chaos, to detail a cosmogonic order at first corresponding with the Mosaic. The first ruler of creation, Uranus, is disabled and dethroned by Cronus, and Cronus in turn by his sixth son by Rhea, Zeus; but the chronicling of Titans and Cyclopes, of Nereids and Oceanids, divine rivers and water-nymphs, defies even the briefest enumeration. The poet has interwoven several episodes of rare merit, such as the contest of Zeus and the Olympian gods with the Titans, or the description of the prison-house in which the vanquished Titans are confined, with the Giants

for keepers and Day and Night for janitors (735 *seq.*). Notable also is the version of the legend of Pandora given in the *Theogony* as compared with that in the *Works and Days*. The *Theogony* omits the part played in the earlier poem by Epimetheus in accepting Pandora at Jove's hands in spite of the counsel of Prometheus, as well as the mention of the casket of evils from which in the *Works and Days* Pandora lifts the lid with such woeful results.

The only other approach to a poem of Hesiod is the so-called *Shield of Hercules*, a piece of patch-work with which interpolators have done their worst. The opening verses are attributed by a nameless grammarian to the fourth book of *Eoiai*. The theme of the piece is the expedition of Hercules and Iolaus against the robber Cycnus; but its main object apparently is to describe the shield of Hercules (141–317). C. O. Müller deems this description worthy of a place beside Homer's shield of Achilles in *Il.* xiii., and recognizes in it the genuine spirit of the Hesiodic school. Titles and fragments of other lost poems of Hesiod have come down to us: didactic, as the *Maxims of Chiron;* genealogic, as the *Ægimius;* and mythic, as the *Marriage of Ceyx* and the *Descent of Theseus to Hades*.

A strong characteristic of Hesiod's style is his sententious and proverbial philosophy (as in *Works and Days*, 24–5, 40, 218, 345, 371). There is naturally less of this in the *Theogony*, yet there too not a few sentiments take the form of the saw or adage. With the poet's history, apart from the evidence of his poems, we have little acquaintance. There is reason to suppose that in later life he removed from Ascra to Orchomenus, where, according to Pausanias, were his sepulchre and epitaph. Tradition has assigned a tragical ending to a life seemingly placid and unemotional; but the story that he met a violent death near the Locrian Œneon in the territory of Naupactus, by reason of an intrigue with a sister of his host, or a guilty knowledge of such intrigue, is probably valueless except as evidence of the hero-worship of Hesiod in Locris and Bœotia (*cf.* Friedel, *Die Sage vom Tode Hesiods*, Leipsic, 1879). The poet will be remembered as the first of didactic poets, the accredited systematizer of Greek mythology, and the rough but not unpoetical sketcher of the lines on which Virgil wrought out his exquisitely finished *Georgics*.

Among the older editions of the Hesiodic poems may be mentioned those published at Venice in 1495 and 1537, and those of Heinsius (Leyd. 1622), Schrevelius (Leyd. 1650), Grævius (Amst. 1701), Robinson (Oxf. 1737); and among those of modern date, Paley (Lond. 1861), Lehrs (Leips. 1840, new ed. 1868), Schömann (Berl. 1869), Köchly and Kinkel (Leip. 1870), Flach (Berl. 1874). The *Works and Days* has been edited apart by Spohn (Leip. 1819), Vollbehr (Kiel, 1844), Lennep (Amst. 1847); and the *Theogony* by F. A. Wolf (Halle, 1783), Lennep (Amst. 1843), Schömann (Berl. 1869), and Flach (Berl. 1873). The *Fragments* were collected by Markscheffel (Leip. 1840). The many disputed questions associated with the name of Hesiod have given rise to a vast critical and polemic literature. In regard to the language of the poems the student may consult W. Clemm, "Krit. Beiträge zur Lehre vom Digamma" in Curtius, *Studien*, ix.; Dr. H. Flach, *Das dialektische Digamma des Hesiodos* (Berl. 1876); Alois Rzach, *Der Dialekt des Hesiodus* (Leip. 1876). The composition and system of the *Theogony* have been investigated by Kock (Breslau, 1842), Gerhard (Berl. 1856), Wolcker (Elberf. 1865), Leitschuh (Wurzburg, 1867), Schömann (Berl. 1868), Flach (Leip. 1874), Fritz Ehlung (Clausthal, 1875); and special studies on the *Works and Days* have been contributed by Twesten (Kiel, 1815), Rank (Götting. 1838), Steitz (Leip. 1869), Betke (Münster, 1872), and Canna (Tur. 1874). Works of more general criticism are Creuzer and Hermann, *Briefe über Homer und Hesiod* (Heidelb. 1817); Thiersch, *Ueber die Gedichte des Hesiods* (Munich, 1813); J. P. Mahaffy, "Studies in Greek Literature" in *Hermathena*, iv. The MSS. are discussed by Flach, *Die beiden ältesten Handschriften des Hesiod* (Leip. 1877); Kinkel, *De codic. Hesiodeis nonnullis in Anglia asservatis* (Heidelb. 1866); Wrobel, "Uber eine neue Hesiodhandschrift" in *Sitzungsber.* of Vienna Academy, 1879. There are English translations of the Hesiodic poems by Cooke (Lond. 1728), Elton (Lond. 1815), and Banks (Lond. 1856); German translations by J. H. Voss (Heidelb. 1806) and Uschner (Berl. 1865); French translations by Leconte de Lisle (Par. 1869) and Patin (Par. 1872-3); and Italian by Chiodi (Cosenza, 1867) and Pozzuolo (Milan, 1873). (J. DA.)

HESPERIDES, maidens whose number is variously given as three, four, or seven, who guarded the golden apples which Earth gave Hera at her marriage to Zeus. They live far away in the west at the borders of Ocean, in other words at that point of heaven where the sun sets. Hence the sun (according to Mimnermus) sails in the golden bowl that Hephæstus made from the abode of the Hesperides to the land where he rises again. According to other accounts they dwell among the Hyperboreans, who live in quietness and calm, *i. e.*, they dwell in heaven among the souls of them that have died on earth. The golden apples grow on a tree which is guarded by an ever-watchful dragon. The sun is often in German and Lithuanian legends described as the apple that hangs on the tree of the nightly heaven, like the fleece of the sun-ram that was sacrificed and skinned, and the dragon, the envious power, keeps the light back from men till some beneficent power takes it from him. Heracles is the hero who brings back the golden apples to mankind again. Like Perseus, he first applies to the Nymphs, who help him to learn where the garden is. Arrived there he slays the dragon and carries the apples to Argos; and finally, like Perseus, he gives them to Athene. The Hesperides are, like the Sirens, beautiful singers, λιγύφωνοι. They are said to be the daughters of Atlas; or, according to other accounts, they are the children of Erebus and Night, or Phorcys and Ceto, and are thus sisters of the Grææ, who also receive into their care the setting sun. Hesperides are introduced into the Argonautic legend, but it is doubtful if this is really antique, or only a poetic embellishment of the wanderings of the Argonauts.

HESS. Amongst numerous German artists of this name, the following particularly deserve attention.

HEINRICH MARIA HESS—Von Hess, after he received a patent of personal nobility—was born at Düsseldorf in 1798, and brought up to the profession of art by his father, the engraver Karl Ernst Christoph Hess. Karl Hess had already acquired a name when in 1806 the elector of Bavaria, having been raised to a kingship by Napoleon, transferred the Düsseldorf academy and gallery to Munich. Karl Hess accompanied the academy to its new home, and there continued the education of his children. In time Heinrich Hess became sufficiently master of his art to attract the attention of King Maximilian. He was sent with a stipend to Rome, where a copy which he made of Raphael's Parnassus, and the study of great examples of monumental design, probably caused him to become a painter of ecclesiastical subjects on a large scale. In 1828 he was made professor of painting and director of all the art collections at Munich. He decorated the Aukirche, the Glyptothek, and the Allerheiligencapelle at Munich with frescos; and his cartoons were selected for glass windows in the cathedrals of Cologne and Ratisbon. Then came the great cycle of frescos in the basilica of St. Boniface at Munich, and the monumental picture of the Virgin and Child enthroned between the four doctors, and receiving the homage of the four patrons of the Munich churches (now in the Pinakothek). His last work, the Lord's Supper, was found unfinished in his atelier after his death in 1863. Before testing his strength as a composer Heinrich Hess tried genre, an example of which is the Pilgrims entering Rome, now in the Munich Gallery. He also executed portraits, and twice had sittings from Thorwaldsen (Pinakothek and Schack collections). But his fame will rest on the frescos representing scenes from the Old and New Testaments in the Allerheiligencapelle, and the episodes from the life of St. Boniface and other German apostles in the basilica of Munich. Here he holds rank second to none but Overbeck in monumental painting, being always true to nature though mindful of the traditions of Christian art, earnest and simple in feeling, yet lifelike and powerful in expression. Through him and his pupils the sentiment of religious art has been preserved and extended in the Munich school, and will not easily die out.

PETER HESS—afterwards Von Hess—was born at Düsseldorf in 1792, and accompanied his younger brother Heinrich Maria to Munich in 1806. Being of an age to receive vivid impressions, he felt the stirring impulses of the time, and became a painter of skirmishes and battles. In 1813–15 he was allowed to join the staff of General Wrede, who commanded the Bavarians in the military operations which led to the abdication of Napoleon; and there he gained novel experiences of war and a taste for extensive travel. In the course of years he successively visited Austria, Switzerland, and Italy. On Prince Otho's election to the Greek throne King Louis sent Peter Hess to Athens to gather materials for pictures of the war of liberation. The sketches which he then made were placed, forty in number, in the Pinakothek, after being copied in wax on a large

scale (and little to the edification of German feeling) by Nilsen, in the northern arcades of the Hofgarten at Munich. King Otho's entrance into Nauplia was the subject of a large and crowded canvas now in the Pinakothek, which Hess executed in person. From these, and from battle-pieces on a scale of great size in the Royal Palace, as well as from military episodes executed for the czar Nicholas, and the battle of Waterloo now in the Munich Gallery, we gather that Hess was a clever painter of horses. His conception of subject was lifelike, and his drawing invariably correct, but his style is not so congenial to modern taste as that of the painters of touch. He finished almost too carefully with thin medium and pointed tools; and on that account he lacked to a certain extent the boldness of Horace Vernet, to whom he was not unaptly compared. He died suddenly, full of honors, at Munich, in April, 1871. Several of his genre pictures, horse hunts, and brigand scenes may be found in the gallery of Munich.

Karl Hess, the third son of Karl Christoph Hess, born at Düsseldorf in 1801, was also taught by his father, who hoped that he would obtain distinction as an engraver. Karl, however, after engraving one plate after Adrian Ostade, turned to painting under the guidance of Wagenbauer of Munich, and then studied under his elder brother Peter. But historical composition proved to be as contrary to his taste as engraving, and he gave himself exclusively at last to illustrations of peasant life in the hill country of Bavaria. He became clever alike in representing the people, the animals, and the landscape of the Alps, and with constant means of reference to nature in the neighborhood of Reichenhall, where he at last resided, he never produced anything that was not impressed with the true stamp of a kindly realism. Some of his pictures in the museum of Munich will serve as examples of his manner. He died at Reichenhall on the 16th of November, 1874.

HESSE, or Hessia (in German *Hessen*), an old country of Germany, situated on both banks of the Rhine and Main, north and south of Frankfort, has had different boundaries at different times. Its greatest length was about 95 miles, while its breadth has varied considerably. Several detached portions of territory were also included in Hesse.

The earliest recorded inhabitants of the district were the Chatti, whose chief settlement Mattium, probably near Gudensberg, was destroyed by Germanicus in 15 A. D. The Chatti, merged in the Franks, migrated westward, and their place in Hesse was taken by the Saxons. Among these, when conquered by the German kings, several "gaus" or earldoms were founded, some of whose possessors after the death of Charlemagne rose to great power. Two families—those of Werner and of Giso, count of Gudensberg—became latterly the most important. In 1130 the heiress of the Gisos married the landgrave of Thuringia, who thus became the overlord of Hesse. In 1247 the Thuringian male line became extinct, and Hesse, along with the other possessions of the landgrave, was involved in a prolonged war of succession. In 1263 Sophia, duchess of Brabant and niece of the last landgrave, received by treaty the landgraviate of Hesse, as it was from that time called, and two years later resigned it in favor of her son, Henry the Child, the ancestor of the present house of Hesse. Till the death of Philip the Magnanimous in 1567, Hesse continued to be regarded as one state, though sometimes shared by two rulers; but at that date Philip's four sons divided the landgraviate into Hesse-Cassel, Hesse-Marburg, Hesse-Rheinfels, and Hesse-Darmstadt. Of these the second and third lapsed by inheritance in 1583 and 1604 to the others, which became the chief lines. The small landgraviate of Hesse-Homburg was formed in 1596 as part of Hesse-Darmstadt. Hesse-Darmstadt, since the annexation of the other two to Prussia in 1866, has been the only independent part of Hesse left, and generally receives the common name.

Hesse-Nassau is a province of Prussia, formed in 1866 from parts of Hesse-Cassel and the dukedom of Nassau. Hesse-Philippsthal was a collateral line of the house of Hesse-Cassel, founded in 1630, and extinct in 1820. Hesse-Barchfeld, Hesse-Butzbach, Hesse-Rothenburg, Hesse-Rumpenheim, and Hesse-Wanfried were collateral lines of little importance. Population 2,070,052.

For further information see Teuthorn, *Ausführliche Geschichte des Hessen*, 1777–80; Wenck, *Hessische Landesgeschichte*, 1783 and 1803; Pfister, *Ueber den Chattischen und Hessischen Stamm und die älteste Geschichte des Chattischen Stammes*, 1868; Hoffmeister, *Historisch-genealogisches Handbuch über alle Linien des Regentenhauses Hessen*, 1874 Rommel, *Geschichte von Hessen*, 1820–58, 10 vols., Heppe, *Hessische Kirchengeschichte*, 1876.

HESSE-CASSEL, in German Kurhessen, *i. e.*, Electoral Hesse, now forming the government district of Cassel in the Prussian province of Nassau, was till 1866 a landgraviate and electorate of Germany, consisting of several detached masses of territory, to the N. E. of Frankfort-on-the-Main. It contained a superficial area of 3699 square miles, and its population in 1864 was 745,963.

The line of Hesse-Cassel was founded by William IV., surnamed the Wise, eldest son of Philip the Magnanimous. On his father's death in 1567 he received one-half of Hesse, with Cassel as his capital; and this formed the landgraviate of Hesse-Cassel. Additions were made to it by inheritance from his brother's possessions, while, as compensation for losses sustained in the Thirty Years' War, a large part of the countship of Schaumburg and other territory was acquired towards the middle of the 17th century. Charles I., who ascended the throne in 1670, was the first ruler who adopted the system of hiring his soldiers out to foreign powers as mercenaries, as a means of improving the national finances. Frederick I., the next landgrave, had become by marriage king of Sweden, and on his death was succeeded in the landgraviate by his brother, William VIII., who fought as an ally of England during the Seven Years' War. From his successor, Frederick II., who had become a Roman Catholic, 22,000 Hessian troops were hired by England for about £3,191,000, to assist in the war against the North American colonies. The reign of the next landgrave, William IX., was an important epoch in the history of Hesse-Cassel. Ascending the throne in 1785, he took part in the war against France a few years later, but in 1795 peace was arranged by the treaty of Basel. For the loss in 1801 of his possessions on the left bank of the Rhine he was in 1803 compensated by some of the former French territory round Mainz, and at the same time was raised to the dignity of Kurfürst, or Elector William I. In 1806 he made a treaty of neutrality with Napoleon, but after the battle of Jena the latter, suspecting William's designs, occupied his country and expelled him. Hesse-Cassel was then added to Jerome Bonaparte's new kingdom of Westphalia; but after the battle of Leipsic, in 1813, the French were driven out and the elector restored. By the Vienna congress, where he intrigued in vain to be recognized as a king, several changes in the extent of his dominion were made. On his return to his sovereignty, William promised to grant his people a new and popular constitution; but just as the draft was ready to become law by his signature, he drew back, dissolved the diet, and continued to rule without again summoning it. His son, William II., who succeeded in 1821, pursued the same line of policy, and carried on the government without reference to the diet. The discontent which this conduct excited was intensified by the elector's shameless connection with the countess of Reichenbach. Disturbances took place, and the elector, after attempting to pacify his people, appointed his son as regent in 1831, and withdrew to Frankfort, where he died in 1847. The regent, becoming Elector Frederick William I., startled by the Paris revolution of 1848, made many promises to the people, and carried some of them into effect, but on the reaction of 1850, which spread over all Germany, snatched at the first pretext for returning to the former order of things. He attempted to levy the usual taxes without obtaining the consent of his chambers, but the commotion thus caused was so great that he was forced to retire to Wilhelmsbad, along with his very unpopular minister, Hassenpflug. He induced the diet of princes then assembled at Frankfort to support him, and Austrian and Bavarian troops entered Hesse-Cassel to enforce obedience. Prussia, in alarm, immediately occupied the northern part of the country, and a civil war was barely avoided by arrangement. The elector, however, scarcely changed his policy, and the next sixteen years were occupied with disputes between the chambers and the Government. In 1863 Hesse-Cassel joined Austria against Prussia. Prussian troops immediately overran the country, and on the treaty with Austria, the electorate was annexed to the Prussian kingdom. The elector was carried a prisoner to Stettin, and was only released on resigning his claims to the throne of Hesse-Cassel. He died in 1875.

See Wippermann, *Kurhessen seit den Freiheitskriegen*, 1850; Röth, *Geschichte von Hessen-Kassel*, 1853, Gräfe, *Der Verfassungskampf in Kurhessen*, 1851; and works under Hesse.

HESSE-DARMSTADT, Grand Duchy of, the actual Hesse of the present day, is a state of Germany situated on the Rhine and Main, between Prussia on the north and Baden on the south. It consists of two large and several small detached portions of territory. The more northerly of the large portions forms the province of Oberhessen, and is completely surrounded by Prussia. The other, divided

by the Rhine into the provinces of Starkenburg and Rheinhessen, is bounded on the N. by Hesse-Nassau, on the W. by the Rhine Palatinate and Rhenish Prussia, on the S. by Baden, and on the E. by Baden and Bavaria. The extent of the duchy is about 2965 square miles. Oberhessen is mountainous, having the Vogelsberg in the east with Taufstein (2579 feet) as the highest summit in the country, and the Hausberg, a branch of the Taunus, in the south-west. In the south-east of Starkenburg is the Odenwald. Rheinhessen is occupied by fertile hills. The chief rivers are the Rhine, Main, Neckar, Lahn, and Fulda, with their tributaries. There are no lakes, but mineral springs abound in all the provinces. The climate is pleasant and mild in the river valleys and plains, but severe on the heights, especially in Oberhessen. Besides the usual domestic animals, deer of various kinds, wild swine, foxes, martens, and otters are found. Agriculture, including the breeding of horses and cattle, is actively encouraged by Government, and is the principal industry of the people. Forestry and vine-growing are also important, the latter being practised almost exclusively in Rheinhessen. The principal crops are millet, buckwheat, oats, and potatoes; but rape (for oil), hemp, flax, tobacco, and fruit are also cultivated. The manufactures embrace leather (enamelled and colored), tobacco, cigars, shoes, furniture, pocket-books and similar goods, chemicals, matches, machinery, and various textile fabrics. Mining is carried on chiefly in Oberhessen. Iron, copper, manganese, graphite, lignite, salt, marble, and clay are the principal minerals, which are worked for home consumption. In 1878 there were produced in Hesse 45,300 tons of lignite, 91,724 tons of iron ore, and 13,200 tons of salt, representing in value about £62,100. Trade is tolerably important in Hesse. The following numbers of persons engaged in the various industries are taken from the industrial census of 1875:—Horticulturists, 292; fishermen, 65; miners, 1556; workers in stone, clay, glass, 4715; in metals, 8266; in machines, instruments, etc., 7202; in chemical industries, 2153; in lighting materials, soap, resins, etc., 1190; in textile industries, 8274; in paper and leather, 7600; in wood, 11,142; in food and drink, 19,923; in dress and washing, 21,629; in building, 1291; in polygraphic industries, 1291; in artistic industries, 412; in mercantile business, 17,593; in conveyance, 2273; in lodging and boarding, 6016—total, 134,383. The people are well educated; of the recruits in 1878–79 only ·21 per cent. were unable either to read or write. There is a university at Giessen, and the schools, ordinary, technical, and theological, throughout the country are very numerous. The Protestant religion predominates, though the Roman Catholic faith is also recognized by the state. Darmstadt is the capital; Offenbach is the chief manufacturing town; Mainz has perhaps the most active trade. The other chief towns are Alsfeld, Lauterbach, Friedberg, Bingen, Bensheim, and Worms. The population in 1905 was 1,209,175. The government since 1820 has been a constitutional hereditary monarchy, assisted by two chambers, modified in 1856—the one of life members, mostly from among the nobility, the other of popular representatives elected indirectly. The chambers must meet at least once every three years. The ministry of three is responsible to the nation. Hesse is represented in the imperial federal council by 3 votes, and in the reichstag by 9. The annual revenue for the finance-period 1876–78 was £872,375, and the expenditure £872,481. The estimated annual revenue for the period 1879–82 is £1,011,762, and the estimated expenditure £857,124. The public debt in 1879 was £2,041,397, chiefly incurred for railways. For additional statistics see GERMANY.

George I., youngest son of Philip the Magnanimous, received on his father's death in 1567 the upper countship of Katzenelnbogen, and, selecting Darmstadt as his residence, became the founder of the Hesse-Darmstadt line. Additions to the territory were made both in his reign and in that of his son, Louis V. The landgraviate, as it was at first styled, suffered severely from war and its attendant famines and plagues. The Thirty Years' War, a war of succession with Hesse-Cassel, and the Seven Years' War dealt heavy blows at its prosperity. Louis X., who succeeded his father in 1790, involved it in further contests. Joining at first the allies against France, he was compelled in 1793 by the latter power to sign a treaty of neutrality. By the treaty of Lunéville he gave up his possessions on the left bank of the Rhine, receiving as compensation a very much larger district on the right bank. From 1805 till 1813 he was compelled to supply Napoleon with a contingent of troops against the other Germans. In 1806, as member of the Confederation of the Rhine, he assumed the title of grand-duke Louis I. of Hesse. After the battle of Leipsic in 1813, when Napoleon was defeated, Louis again joined the allies. By the decision of the Vienna congress in 1815 considerable change in his dominions was made; but though he was forced to recognize the independence of Hesse-Homburg, which since the beginning of the century had been incorporated with Hesse-Darmstadt, his title of grand-duke was confirmed. Within his country a growing desire for political liberty had been making itself apparent, and in 1820 the grand-duke promulgated a new constitution. This was rejected by the people, and attempts were made in vain by successive diets to frame a constitution pleasing alike to the ruler and the ruled. Louis II. succeeded his father in 1830. His policy in no degree lessened the popular discontent. His son Louis III., who succeeded in 1848, alarmed by the events in Paris of that year, and by commotions in his own country, gave way a little, but under the reaction of 1850 he again restored matters to their old state. Since that time, although no radical change has been effected, the liberal party in the state has been steadily gaining ground. In 1866 Hesse-Darmstadt supported Austria against Prussia, with the result that it had to pay a heavy indemnity and cede certain provinces, including the lately acquired Hesse-Homburg, to Prussia. In 1867 it entered the North German Confederation, and in 1870 the German Confederation. Louis IV. succeeded his uncle in 1877.

A list of works on Hesse is to be found in Walther's *Literarisches Handbuch für Geschichte und Landeskunde von Hessen*, 1841. See also Steiner, *Geschichte des Grossherzogthums Hessen*, 5 vols., 1833–4; Türckheim, *Histoire généalogique de la maison de Hesse*, 1819–20; Heber, *Geschichte des Grossherzogthums Hessen*, 1837; Dieffenbach, *Das Grossherzogthum Hessen in Vergangenheit und Gegenwart*, 1875; Voltz, *Uebersicht der geologischen Verhältnisse des Grossherzogthums Hessen*, 1852; and works under HESSE.

HESSE-HOMBURG, a former landgraviate of Germany, consisted of two parts, the province of Homburg-vor-der-Höhe, on the right bank of the Rhine, and the lordship of Meisenheim (added in 1815), on the left bank, to the north of Frankfort-on-the-Main. It comprehended an area of 106 square miles; and its population in 1864 was 27,374. Homburg now forms part of the Prussian government district of Wiesbaden, and Meisenheim of the government district of Coblentz.

Hesse-Homburg was formed into a separate landgraviate in 1596, by Frederick I., son of George I. of Hesse-Darmstadt. By his two sons it was divided into the parts Hesse-Homburg and Hesse-Homburg-Bingenheim; but the latter returned by inheritance to the original line in 1681. In the reign of Frederick V. (1751–1820) Hesse-Homburg was in 1806 incorporated with Hesse-Darmstadt, but that state was obliged by the Vienna congress to recognize the independence of Hesse-Homburg, which at the same time was increased by the district of Meisenheim. Frederick V. became a member of the German Confederation in 1817. After his death, his five sons successively filled the throne. The last, Ferdinand Henry Frederick, granted a liberal constitution to his people, but in the reaction of 1850 cancelled it. On his death on March 24, 1866, the landgraviate reverted by inheritance to the grand-duke of Hesse-Darmstadt; but in September of the same year that ruler was forced to cede it to Prussia, in consequence of having supported Austria in the Seven Weeks' War.

HESSIAN FLY, a name originally given in the United States in 1776 during the War of Independence to a small fly very destructive to wheat, supposed to have been brought over in straw by the Hessian troops employed on the British side. It is a species of *Cecidomyia*, described under the name *C. destructor* by the American entomologist Say, and belonging to the Dipterous family *Cecidomyiidæ*, the numerous members of which produce galls, distortions, and other injuries in the plants they attack. It was often thought that this insect occurred in England; but the indigenous English wheat-midge, also very destructive, is an allied species, *Diplosis tritici*. A species found in Hungary and Germany, where it has committed great damage, has been supposed to be the true Hessian fly, which has also been recorded from Minorca and Naples; Cohn notices its ravages in Silesia, and Künstler in Austria; and Kaltenbach (who identifies *C. secalina*, Loew, with it) says it is more or less common in Germany, and that it originally came from Europe. Nevertheless, many good authorities have considered that the destructive European fly is not identical with the North American insect, though closely allied to it, and of similar habits. In the United States this minute midge has been a dreadful scourge at times, even to the extent of causing local famine. The female lays 20 or 30

eggs in a crease of the leaf of the young plant, and the larvæ when hatched work their way between the leaf and the stalk, till they come to a joint, a little below the surface, where they remain, head down, sucking the sap, and turn to pupæ enclosed in a covering; this is known as the "flax-seed" condition. The injury occasioned is not detected until the plant grows higher. There are two broods every year, one reaching the fly state in May, the other in August or early in September; as the fly only lives a few weeks, wheat that is sown so late as not to come up until the second brood has disappeared escapes harm. The usual result of the attack is that small aborted ears only are formed, the few grains of which shrivel and will scarcely ripen, the straw also being of inferior quality. The perfect insect is smaller than the common gnat, which it somewhat resembles, and from which its size and more simple antennæ distinguish it. The larvæ are spindle-shaped and reddish-white, with the intestinal canal showing through the skin when full grown; they are about one-seventh of an inch long, and are provided with small hooks near the head; at this stage they group themselves in regular rings round the stem attacked. A very minute natural parasite, *Semiotellus destructor*, belonging to the division *Pteromalides* of the Hymenopterous family *Chalcididæ* is, luckily for agriculturists, usually so plentiful as to be able to keep down the fly, on the larvæ and pupæ of which its own larvæ feed.

Besides the original account by Say (in the *Journal of the Academy of Natural Science*, Philadelphia, 1817), his countryman, Dr. Asa Fitch, has published a history of this insect in the *Transactions of the New York State Agricultural Society*, 1846; and in England the celebrated entomologist Kirby gave an account of it in the *Magazine of Natural History*, 1829. It is figured in the *American Naturalist*, vol. ii. p. 163. A map showing its distribution will be found in Hayden's Report of the United States Geological and Geographical Survey for 1875.

HESSUS, Helius Eobanus (1488–1540), a distinguished German humanist of the 16th century, was born January 6, 1488, at Bockendorf near Frankenberg in Hesse. His family name is not known: the baptismal name Eoban he owed to a local saint; Hessus merely indicates the land of his origin; while the prenomen Helius was assumed by himself partly with reference to the sun-god, patron of poets, and partly also, it is said, with reference to the fact that he had been born on a Sunday. His early education was received in the monastery of Haina, where his father held a menial position, and afterwards at Frankenberg; in 1503 he entered the university of Erfurt, where in 1505 Crotus Rubianus and Ulrich von Hutten became his fellow-students and his firm friends. Though devoting himself enthusiastically to the composition of Latin verse, in which he soon became an acknowledged master, he was far from neglecting the other studies of the place, and shortly after his graduation he held for a short time the post of rector of the St. Severus school. Compelled by disturbances to leave Erfurt in 1510, he for five years led a somewhat wandering life, in the course of which he passed some time in Leipsic as a student of law; in 1515 he returned to his former post at Erfurt, and in 1516 became professor of belles-lettres. He was now prominently associated with Reuchlin, Peutinger, Mutianus, as well as with Crotus Rubianus and Hutten; and from the first he fully identified himself with the cause of Luther and the Reformation. In 1526 he went as teacher of rhetoric and poetry to Nuremberg, but in 1534 returned to Erfurt, whence in 1536 he was called to the chair of poetry and history in Marburg. There he died October 5, 1540.

Hessus was generally regarded by his contemporaries both in Germany and elsewhere as the foremost Latin poet of the age; "if Erasmus was the modern Cicero, Eoban was Virgil and Ovid." His most popular works were a translation into Latin distichs of the Psalms, which passed through more than forty editions, and Latin hexameter translations of Theocritus and of the *Iliad*. He also published *Silvæ*, a collection of idylls, epigrams, and occasional pieces, and a series of Christian *Heroidæ*, in imitation of Ovid. His *Epistolæ* were edited by his friend Joachim Camerarius, who also published his Life (1553). See the monographs of Herz (*H. E. Hesse, ein Lehrer u. Dichterleben aus der Reformationszeit*, 1860), Schwertzell (*H. E. Hessus, ein Lebensbild aus der Reformationszeit*, 1874), and Krause (*H. E. Hessus, sein Leben u. seine Werke*, 1879); also Strauss, *Ulrich von Hutten* (1858; 2d ed. 1871; Engl. transl. 1874).

HESTIA, a Greek goddess, who is probably the latest in origin of the greater deities. She seems to belong to a particular stage in the advance of civilization, and to embody the religious sanction that confirmed the social system then reached. When we compare her worship with that of Agni, the nearest parallel in the Vedic period, we see that the Greeks made this advance after they had separated from the Aryan conquerors of India. Agni is invoked in the *Rig Veda* as the brother, friend, and helper of men, as dwelling with them and mediating between them and the gods. But beyond this Hestia is the hearth-fire as the centre of an association, wider or narrower, which meets in common at the hearth. She is not mentioned in Homer; in the *Odyssey* sometimes one swears by Zeus, the table and the hearth, *i. e.*, by Zeus as the god of the family both in its external relation of hospitality and its internal unity round its own hearth. Hence we have the Zeus ἑστιώναξ, ἑστιοῦχος, ἐφέστιος. The former of these two ideas is too delicate and fine ever to become more than a mere aspect of Zeus, but the second gradually formed itself into a distinct worship, in which the already existing worship of the fire was merged. The fact that Hestia is not mentioned in Homer shows that her worship was not so universally acknowledged at the time which these poems reveal to us. Perhaps we may see in the connection of the Latin Jupiter and Vesta at Lavinium a relic of the original connection of the two; and the fact that the worship of this same goddess under the same name (they are only two forms of the feminine of the passive participle of the root *vas*, burn) is found in Latium and Greece affords strong evidence of a specially close connection between the two races. We find therefore in Hestia relics of the old pre-Greek worship; she is the altar-fire, presiding over all sacrifices, and sharing in the honors of all the gods. The opening sacrifice was offered to Hestia; to her at the sacrificial meal the first and the last libations were poured. The fire of Hestia was always kept burning, or if by any mischance it were extinguished, only sacred fire made by friction, or got direct from the sun, might be used to rekindle it (see Kuhn, *Herabkunft*). But beyond this she is the goddess of the family union, the personification of the idea of home (see Welcker, *Gr. Gött.*, ii. 694), the protectress along with Zeus of the suppliants who fled for refuge to the hearth. To her therefore is ascribed the art of housebuilding. Hestia and Hermes are often united as the representatives of home and private life on the one hand, and of all business and outdoor life on the other. The city union, moreover, is just the family union on a large scale; it has its centre in the prytaneum, where the common hearth-fire round which the magistrates meet is always burning, and where the sacred rites that sanctify the concord of city life are performed. From this fire, as the representative of the life of the city, was taken the fire wherewith that on the hearth of a new colony was kindled. As patroness of the deliberations held in the prytaneum, Hestia is surnamed βουλαία. Even larger unions than the city had their central fire: in Tegea was the Hestia of the Arcadians; and it is probable that the Achæans had theirs at Ægium. In the later mystic philosophy Hestia became the hearth of the universe, the eternal fire at the centre of the world.

As Hestia had her home in the prytaneum, special temples to her rarely occur. There was one in Hermione, where the only symbol of the goddess was a fire always burning on the hearth. We also hear of her house at Olympia. Her statue stood in the prytaneum at Athens beside that of Peace. Though many statues of the Roman Vesta are preserved, more or less based on the Greek conception of Hestia, yet no really Greek representation of the goddess has come down to us.

HESYCHASTS (ἡσυχασταί or ἡσυχάζοντες, also called ὀμφαλόψυχοι, Umbilicanimi, and sometimes referred to as Euchites, Massalians, or Palamites), a quietistic sect which arose among the monks of the Greek Church, and especially of Mount Athos, during the later period of the Byzantine empire, and owing to various adventitious circumstances came into great prominence politically and ecclesiastically for a few years about the middle of the 14th century. Their opinion and practice will be best represented in the words of one of their early teachers (quoted by Gibbon, *Decline and Fall*, c. 63): "When thou art alone in thy cell shut thy door, and seat thyself in a corner; raise thy mind above all things vain and transitory; recline thy beard and chin on thy breast; turn thine eyes and thy thought towards the middle of thy belly, the region of the navel; and search the place of the heart, the seat of the

soul. At first all will be dark and comfortless; but if thou persevere day and night, thou wilt feel an ineffable joy; and no sooner has the soul discovered the place of the heart than it is involved in a mystic and ethereal light." About the year 1337 this Hesychasm, the affinity of which with certain well-known forms of Oriental mysticism is obvious, attracted the attention of the learned and versatile Barlaam, a Calabrian monk, who at that time held the office of abbot in the Basilian monastery of St. Saviour's in Constantinople, and who had visited the fraternities of Mount Athos on a tour of inspection. Amid much that he disapproved, what he specially took exception to as heretical and blasphemous was the doctrine entertained as to the nature of this divine light, the fruition of which was the supposed reward of Hesychastic contemplation. It was maintained to be the pure and perfect essence of God Himself, that eternal light which had been manifested to the disciples on Mount Tabor at the transfiguration. This Barlaam held to be polytheistic, inasmuch as it postulated two eternal substances, a visible and an invisible God. On the Hesychastic side the controversy was taken up by Gregory Palamas, afterwards archbishop of Thessalonica, who labored to establish a distinction between eternal *οὐσία* and eternal *ἐνέργεια*. In 1341 the dispute came before a synod held at Constantinople; the decision, which no doubt was to a large extent determined by the excessive veneration in which the writings of the pseudo-Dionysius were held in the Eastern Church, was adverse to Barlaam, who in consequence returned to Calabria, and afterwards became bishop of Hierace in the Latin communion. Three other synods in relation to the same subject were subsequently held; and at the last of these, held in 1351 under the presidency of the emperor John Cantacuzenus, the uncreated light of Mount Tabor was established as an article of faith for the Greeks, who ever since have been ready to recognize it as an additional ground of separation from the Roman Church. The contemporary historians Cantacuzenus and Nicephorus Gregoras have both dealt very copiously with this subject, which is also more or less discussed in all the church histories. See Engelhardt's article on the Arsenians and Hesychasts in Illgen's *Zeitschr. f. Hist. Theol.*, viii. 48, and the account of the Hesychasts in Herzog's *Encyklopädie*. It may be mentioned that in the time of Justinian the word Hesychast was applied to monks in general simply as descriptive of the quiet and contemplative character of their pursuits.

HESYCHIUS was a grammarian of Alexandria, as we learn from a letter prefixed to his great work. From the fact that he was apparently unknown to Hesychius the Milesian and other writers of the time of Justinian, M. Schmidt considers that he must have flourished later than 530 A. D. On the other hand he cannot have been later than 642 A. D., when the school of Alexandria was scattered by the Saracen conquest. Many bad Greek words occurring in his book show that he belonged to this late period. Welcker (*Rh. Mus.*, ii. 269) places him in the latter part of the 4th century. Belonging to the school of Alexandria, he was probably a pagan; and the explanations of words from Gregory Nazianzen and other Christian writers (*glossæ sacræ*) are interpolations of a later time. He has left a Greek dictionary, containing a copious list of peculiar words, forms, and phrases, with an explanation of their meaning, and often with a reference to the author who used them or to the district of Greece where they were current. Hence the book is of great value to the student of the Greek dialects; while in the restoration of the text of the classical authors generally, and particularly of such writers as Æschylus and Theocritus, who used many unusual words, its value can hardly be exaggerated. The explanations given of many epithets and phrases reveal to us numberless facts about religion and social life, which are of the highest importance in the study of antiquities. In a prefatory letter addressed to his friend Eudocius (who is probably the Eudocius Scholasticus mentioned in the *Etymologicum Magnum* and elsewhere), Hesychius mentions that his work is based on the lexicon of Diogenianus, but that he has also used similar works by Aristarchus, Apion, Heliodorus, etc. (about whom see M. Schmidt's edition, vol. iv.). The text is very corrupt, and the order of the words has often been disturbed. There is no doubt that many interpolations, besides the Christian glosses, have been made.

HETTSTÄDT, or HETTSTEDT, a town of Prussian Saxony, in the circle of Mansfeld, and the government district of Merseburg, is situated on both banks of the Wipper, about 23 miles N. W. of Halle. It is the seat of a commission of justice, and has manufactures of machinery, pianofortes, and artificial manure. The population in 1905 was 9230. In the neighborhood are mines of argentiferous copper, and the surrounding district and villages are occupied with smelting and similar works. Silver and sulphuric acid are the other chief products; nickel and gold are also found in small quantities. Hettstädt is mentioned as early as 1046; in 1220 it possessed a castle; and in 1380 it received the privileges of a town. When the countship of Mansfeld was sequestered, Hettstädt came into the possession of the Saxons, from whom it passed to the Prussians in 1815.

HEUGLIN, THEODOR VON (1824–1876), an eminent African and Arctic traveller, was born 20th March, 1824, at Hirschlanden near Leonberg in Würtemberg, and died at Stuttgart, 5th November, 1876. His father was a Protestant pastor, and he was originally trained to be a mining engineer, but his own early ambition was to contribute to scientific progress by his personal explorations, and he prepared himself for his task by careful and multifarious discipline, studying the natural sciences, and more particularly zoology, acquiring the more serviceable of the modern languages, strengthening his physique by gymnastic exercises, and learning to use with equal skill his pencil and his gun. Supplied with funds by his mother's liberality, Heuglin went to Egypt in 1851, and till 1865 the north-eastern regions of Africa were the main scene of his labors. In 1852 he accompanied Dr. Reitz, the Austrian consul at Khartum, in his fatal journey to Abyssinia; in 1853, having been appointed Dr. Reitz's successor in the consulate, he visited Kordofan and the lower course of the White Nile; and in 1857, on his return after about two years' absence in Europe, he was commissioned by the grand-duke Ferdinand Maximilian of Austria to explore the countries along the west coast of the Red Sea. From the latter part of 1858 to the latter part of 1860 he was again in Europe; but in 1861 he was placed at the head of the Vogel search expedition, which included Munzinger, Steudner, Kinzelbach, etc., and was expected to make its way to Wadai. Having reached Mai-schecha, however, the explorers broke up into three parties, Heuglin turning along with Steudner and Schubert in the direction of Adoa, Gondar, and the Galla lands. At Khartum they joined Miss Tinne's party, and proceeded to Lake Rey and the Kosanga river, but Steudner died on 10th April, 1863, and Heuglin was compelled by sickness to retrace his steps. He returned to Europe in 1865. In 1870 and 1871 he made a valuable series of explorations in Spitzbergen and Novaya Zemlya; but 1875 found him again in North-East Africa, in the country of the Beni Amer and Habab. An invitation from the khedive took him abroad again in 1876, but receiving no definite appointment he returned to Europe. Later in the same year he was engaged in preparing for an exploration of the island of Socotra, when he was suddenly carried off by inflammation of the lungs. He was buried beside Mauch, the African traveller, and a statue has been erected over his grave.

His principal works are *Systematische Uebersicht der Vögel Nordost-Afrika's*, 1855; *Reisen in Nordost-Afrika*, 1852–53 (Gotha, 1857); *Syst. Uebersicht der Säugethiere Nordost-Afrika's* (Vienna, 1867); *Reise nach Abessinien, den Galla-Ländern*, etc., 1861–62 (Jena, 1868); *Reise in das Gebiet des Weissen Nil*, 1862–64 (Leipsic, 1869); *Reisen nach dem Nordpolarmeer*, 1870–71 (Brunswick, 1872–74); *Ornithologie von Nordost-Afrika's* (Cassel, 1869–75); *Reise in Nordost-Afrika* (Brunswick, 1877, 2 vols.). It is principally by his zoological, and more especially his ornithological, labors that Heuglin has taken rank as an independent authority. A list of the more important of his numerous contributions to Petermann's *Mittheilungen* will be found in that serial for 1877 at the close of the necrological notice.

HEUSCH, WILLEM or GUILLIAM DE, a landscape painter in the 17th century at Utrecht. The dates of this artist's birth and death are unknown. Nothing certain is recorded of him except that he presided over the guild of Utrecht, whilst Cornelis Poelemburg, Jan Both, and Jan Weenix formed the council of that body, in 1649. According to the majority of historians, Heusch was born in 1638, and was taught by Jan Both. But each of these statements

seems open to doubt; and although it is obvious that the style of Heusch is identical with that of Both, it may be that the two masters during their travels in Italy fell under the influence of Claude Lorraine, whose "Arcadian" art they imitated. Heusch certainly painted the same effects of evening in wide expanses of country varied by rock formations and lofty thin-leaved arborescence as Both. There is little to distinguish one master from the other, except that of the two Both is perhaps the more delicate colorist. The guild of Utrecht in the middle of the 17th century was composed of artists who clung faithfully to each other. Poelemburg, who painted figures for Jan Both, did the same duty for Heusch. Sometimes Heusch sketched landscapes for the battlepieces of Molenaer. The most important examples of Heusch are in the galleries of the Hague and Rotterdam, in the Belvedere at Vienna, the Städel at Frankfort, and the Louvre. His pictures are signed with the full name, beginning with a monogram combining a G (for Guilliam), D, and H. Heusch's etchings, of which thirteen are known, are also in the character of those of Both. After Guilliam there also flourished at Utrecht his nephew, Jacob de Heusch, who signs like his uncle, substituting an initial J for the initial G. He was born at Utrecht in 1657, learnt drawing from his uncle, and travelled early to Rome, where he acquired friends and patrons for whom he executed pictures after his return. He settled for a time at Berlin, but finally retired to Utrecht, where he died in 1701. Jacob was an "Arcadian," like his relative, and an imitator of Both, and he chiefly painted Italian harbor views. But his pictures are now scarce. Two of his canvases, the Ponte Rotto at Rome, in the Brunswick Gallery, and a lake harbor with shipping in the Lichtenstein collection at Vienna, are dated 1696. A harbor with a tower and distant mountains, in the Belvedere at Vienna, was executed in 1699. Other examples may be found in English private galleries, in the Hermitage of St. Petersburg, and the museums of Rouen and Montpellier.

HEVELIUS, Hevel, Hewel, Hewelke, or Hövelke, Johann (1611–1687), astronomer, was born at Dantzic on January 28, 1611, and died there on January 28, 1687 (see Astronomy, vol. ii. p. 659).

HEXHAM, a market-town of England, county of Northumberland, is situated on the south bank of the river Tyne, crossed there by a handsome stone bridge of nine arches, 20 miles west from Newcastle and 36 east from Carlisle, and on the line of railway connecting those towns. It is somewhat irregularly built, and consists chiefly of several narrow streets diverging from the market-place, a spacious square. Its defects in architecture and arrangement are, however, compensated for by its pleasant situation and the imposing remains of the old priory church. This church, begun by Wilfrid in 674, and completed by Acca, his successor, remained uninjured till 875, when every part of the monastery but the stone work was destroyed by the Danes. It was built of stones used in an earlier work, and many of them bear Roman inscriptions. Originally in dimensions and splendor it was unsurpassed on this side of the Alps, and doubtless had no small influence on ecclesiastical architecture in various parts of England. The building as renovated in the 12th century consisted of nave and transepts, choir and aisles, and a massive central tower; but the nave was burned by the Scots in 1296, and has never been rebuilt. The style is Early English with Transition details. The crypt, discovered in 1726, is a fine example of Saxon architecture, of which there appear also to be some traces in the choir. Among the interesting old monuments which have been collected in the transept is a sculptured stone slab of Oswulf, king of Northumbria, of the date 788. To the west of the church there are still some remains of the conventual buildings. Near the market-place there are two old castellated towers. A vessel containing about 8000 Saxon coins was discovered in the churchyard in 1832. The "Seal," formerly the park of the monks, is now used as a promenade, and from an eminence within its bounds a fine view is obtained. Hexham possesses a new town-hall and corn exchange, erected in 1866 in the Italian style, and a large board school. A hydropathic establishment has recently been opened. Leather gloves are the principal manufacture of the town; and it has tanneries, wool-staplers' yards, a brewery, and an iron and brass foundry. In the neighborhood there are extensive market gardens and nurseries. The population of the township in 1901 was 7,071.

Hexham is supposed by some to have been the Axelodunum of the Romans, but although in all probability it was a Roman station, the similarity in the names is too slight to establish the identity. By the Saxons it was called Hextoldesham and Halgulstad from two of the neighboring streams. Wilfrid, who founded the monastery and church in 673, received from Queen Etheldreda a grant of the town and a large surrounding tract of country. In 681 the southern portion of Bernicia was formed into the diocese of Hexham, which comprised the county of Durham and the greater part of Northumberland. In 821 Hexham was united to the diocese of Lindisfarne, after which it formed part of Durham, then of York until 1837, when it was restored to Durham. In 875 the town was plundered by the Danes and the monastery destroyed. In 1138 the monastery was plundered by the Scots, and in 1296 they again attacked the town and destroyed the nave of the conventual church. In the reign of Henry VIII. the last prior of Hexham was in 1536 hanged at the gate of the monastery for being concerned in the insurrection called the Pilgrimage of Grace.

See the old *History of the Church of Hexham* by Prior Richard; *Roman Hexham* and *Hexham Church* in *Archæologia Æliana*, new series, vol. v.; Wright's *History of Hexham*, 1823; *The Priory of Hexham, its Chroniclers, Endowments, and Annals*, edited for the Surtees Society by James Raine, 1864–65; Hewitt, *A Handbook to Hexham and its Antiquities*, Hexham, 1879.

HEYDEN, Jan van der, was born at Gorcum in 1637, and died at Amsterdam on the 12th of September, 1712. He was an architectural landscape painter, a contemporary of Hobbema and Jacob Ruysdael, with the advantage, which they lacked, of a certain professional versatility; for, whilst they painted admirable pictures and starved, he varied the practice of art with the study of mechanics, improved the fire engine, and died superintendent of the lighting and director of the firemen's company at Amsterdam. Till 1672 he painted in partnership with Adrian van der Velde. After Adrian's death, and probably because of the loss which that event entailed upon him, he accepted the offices to which allusion has just been made. At no period of artistic activity had the system of division of labor been more fully or more constantly applied to art than it was in Holland towards the close of the 17th century. Van der Heyden, who was perfect as an architectural draughtsman in so far as he painted the outside of buildings and thoroughly mastered lineal perspective, seldom turned his hand to the delineation of anything but brick houses and churches in streets and squares, or rows along canals, or "moated granges," common in his native country. He was a travelled man, had seen the Hague, Ghent, and Brussels, and had ascended the Rhine past Xanten to Cologne, where he copied over and over again the tower and crane of the great cathedral. But he cared nothing for hill or vale, or stream or wood. He could reproduce the rows of bricks in a square of Dutch houses sparkling in the sun, or stunted trees and lines of dwellings varied by steeples, all in light or thrown into passing shadow by moving cloud. He had the art of painting microscopically without loss of breadth or keeping. But he could draw neither man nor beast, nor ships nor carts; and this was his disadvantage. His good genius under these circumstances was Adrian van der Velde, who enlivened his compositions with spirited figures; and the joint labor of both is a delicate, minute, transparent work, radiant with glow and atmosphere, and most pleasant to look at. Almost all Van der Heyden's pieces are inscribed with his name alone, as if Van der Velde had been but a sleeping partner in his work. Like Heusch, he formed the first letters of his name into a monogrammatic interlacement. Very few of his pictures are dated. One, a street in a Dutch town, of 1666, is in the Hope collection in London. Two of 1667, a bridge on a canal, lined with houses casting their reflections into the water, and the town-house at Amsterdam, are in the galleries of the Hague and Florence. Another view of the dam and town-hall at Amsterdam, dated 1668, is in the Louvre. A church and houses in the museum of Dresden is inscribed 1673. In all there are seventy or more of Van der Heyden's works fairly accessible to the public—those which are least so being chiefly in English private collections. Eight capital examples are in the Hermitage at St. Petersburg, two of which are views in Cologne. Four are in the London National Gallery, four at Amsterdam and Dresden. Munich and Cassel have two apiece, and two very fine ones are in Buckingham Palace. The rest are in public and private galleries in Vienna, Paris, Frankfort, and Carlsruhe.

HEYDUKE. See Hajduk.

HEYLIN, Peter (1599–1662), an historical and polemical writer, born at Burford, Oxfordshire, 29th November, 1599, was the second son of Henry Heylin, gentleman, who belonged to an old Montgomeryshire family. Being of a studious turn of mind, Heylin was entered at Hart Hall, Oxford, in 1613; was of Magdalen College, 1615; B. A., July, 1617; M.A., 1620; B. D., 1629; D. D., 1633. In July, 1618, he began to read college lectures on cosmography (*i. e.*, geography) with such acceptance that his associates made him fellow of Magdalen. The lectures, under the title of *Microcosmos*, were published in 1621; and many editions of this useful book, each somewhat enlarged, subsequently appeared, until scarcely any scholar's library was without a copy. In 1625 he published his observations on a journey to France. This book—which was frequently reprinted—Southey termed "one of our liveliest books of travel in its lighter parts, and one of the wisest and most replete with information that was ever written by a young man." After obtaining the patronage of Laud, whose life he wrote, Heylin was made chaplain to Charles I. His legendary and learned *History of St. George of Cappadocia* procured for him the rectory of Hemmingford, Hunts; his hearty attachment to the High-Anglican party brought many other preferments; and his analysis of Prynne's *Histriomastix* was rewarded by the rectory of Islip. He was also made a prebendary of Westminster (9th November, 1631), treasurer to the chapter (1637), and subsequently sub-dean. Here he was the bitter opponent of the rule of Bishop Williams, the commendatory dean. With great ardor Heylen entered into the religious controversies which preceded the war, being equally hostile to the Puritan element within and without the church. He was consequently singled out for punishment by the committees of the Long Parliament, who deprived him of benefices worth £800, and heavily fined him. An amusing anecdote he tells affords proof of his unpopularity in London, and at the same time shows how his Cosmography was appreciated. As he passed along the street a fellow "shouldered" him with the remark, "Geography is better than Divinity." For seven years, he says, his name was in almost every libel. He retired to his Hampshire parsonage of Alresford until Waller's army disturbed him. Robbed there of his library, valued at £1000, and his property, he went to Oxford, where from 1st June, 1643, he edited *Mercurius Aulicus*, a vivacious but virulent news-sheet which greatly annoyed the Parliamentarians. His *Extraneus Vapulans*, written against L'Estrange (who wittily retorted that a prelate should be "no striker"), refers to his sufferings and hardships. The necessary quiet for his literary pursuits was ultimately found at Lacy's Court, Abingdon, whence were dated several books and pamphlets against those of his own communion whose opinions were not as unyielding as his, as also against the Presbyterians and others, controversies in which Ussher, Fuller, Baxter, and Harrington were concerned. His works, all more or less marred by political or theological rancor, were upwards of fifty in number; and they comprise histories of Episcopacy, of the Reformation, and of the Presbyterians, with a useful *Help to English History*. Some verses of merit also came from his active pen; and his poetical memorial of Bishop Waynflete was published by the Caxton Society in 1851. Heylin was a diligent writer and investigator, a good ecclesiastical lawyer, and had his learning always at command. His principles, to which he was honestly attached, were defended with ability; but his efforts to uphold the church passed unrecognized at the Restoration. His sight began to fail him; yet he rejoiced that his "old bad eyes" had seen the king's return. Upon that event he preached a jubilant sermon in Westminster Abbey to a great audience, 29th May, 1661. He died on 8th May in the following year, and was buried two days after under his sub-dean's seat.

Lives of Heylin were written by Dr. John Barnard, his son-in-law, and by George Vernon. Barnard's work was very carefully reprinted, with notes, in the *History of the Reformation*, published, 1849, by the Ecclesiastical History Society.

HEYNE, Christian Gottlob (1729–1812), one of the most distinguished critics and archæologists of the modern school of which Ernesti and Gesner were the founders, was born on the 25th of September, 1729, in a suburb of the city of Chemnitz in Saxony, where his father, who had been compelled by some religious persecutions to abandon his native country of Silesia, earned a precarious support for his family by exercising the trade of a weaver. It was only by the liberality of his godfathers that Heyne was enabled to obtain his primary instruction in the elementary school of Chemnitz, and afterwards to prosecute his classical studies in the gymnasium of that city. In 1748 he entered the university of Leipsic, with the professed intention of studying for the legal profession. There he was so scantily supported by those on whose assistance he relied that he was frequently in want even of the common necessaries of life, and was sometimes indebted for food to the generosity of a maid-servant in the house where he lodged. In this situation, without even the hope of future distinction, he continued to struggle on against every difficulty and disappointment in the acquisition of knowledge. For six months he is said to have allowed only two nights in the week to sleep, and he was at the same time forced to endure his godfather's reproaches for negligence in the prosecution of his studies. His distress had almost amounted to despair, when he procured the situation of tutor in the family of a French merchant resident in Leipsic. He was thus enabled to continue his studies, though with much interruption,—the emoluments of his appointment being sufficient to support him in what was at least comparative comfort. Under Ernesti he was initiated into the criticism of the classical authors; from the prelections of the celebrated Bach he acquired a competent knowledge of Roman jurisprudence; and by Christius, who lectured on archæology, his attention was strongly directed to the works of ancient art. Even after he had finished his studies at the university, he was exposed for many years to all the accumulated distresses of poverty and neglect. The first situation he was able to procure was that of copyist in the library of Count von Brühl in Dresden, with a salary of somewhat less than twenty pounds sterling, which he obtained in the year 1753. From the necessity of adding something to this scanty pittance, he was forced to employ himself in the drudgery of translation; and, besides some French novels, he rendered into German the Greek romance of Chariton. He published his first edition of *Tibullus* in 1755, and in 1756 his *Epictetus*. In the latter year the Seven Years' War broke out; Dresden was entered, and the Saxon archives seized; the Brühl ministry fell; and Heyne was once more in a state of absolute destitution. In 1757 he was offered a tutorship in the household of Frau von Schönberg, and there he first became acquainted with Teresa Weiss, whom he subsequently married. In January, 1759, he accompanied his pupil to the university of Wittenberg, at which more than a year was spent in the study of philosophy and German history, but from which he was driven in 1760 by the Prussian cannon. The bombardment of Dresden (to which city he had meanwhile returned) on July 18, 1760, destroyed not only his humble lodging but also all his worldly possessions, which included amongst other valuable papers an almost finished edition of Lucian based on a valuable codex of the Dresden Library. In the summer of 1761 he married, although still without any fixed means of support; and for some time he found it necessary wholly to suspend his literary pursuits that he might devote himself to the duties of the office of landsteward, to which he had been charitably appointed in the household of the Baron von Löben in Lusatia. He was enabled, however, to return to Dresden in the end of 1762, where he was commissioned by Lippert to prepare the Latin text of the third volume of his *Dactyliotheca*. At length, in the commencement of the year 1763, Heyne's merit met with its reward, and a new and illustrious career was opened to him. On the death of Johann Matthias Gesner at Göttingen in 1761, the appointment to the vacant chair had been first offered to Ernesti, who, however, declined leaving the university of Leipsic, but proposed Ruhnken of Leyden or Saxe of Utrecht for the appointment. Ruhnken likewise refused it, but having been strongly impressed with the taste and learning displayed by the editor of Tibullus and Epictetus, he advised Münchhausen, the Hanoverian minister and principal curator of the university of Göttingen, to bestow the professorship on Heyne, whose merit, though known to few, he was confident would do honor to the choice. The minister had the good sense to acquiesce in the recommendation of this great scholar, and Heyne, after some delay, became professor of eloquence in Göttingen. Though his appointments were at first few and his emoluments inconsiderable, these were gradually augmented in proportion as his usefulness was proved, and his growing celebrity rendered it an object

with the other Governments of Germany to secure the services of so distinguished a scholar. He refused the most advantageous and honorable overtures from Cassel, Berlin, and Dresden. As professor, principal librarian, member of the Royal Society, and chief editor of the *Gelehrte Anzeigen*, and still more by his publications, he greatly contributed to raise the university of Göttingen to the distinguished rank it still holds among the seminaries of Europe. After a long and useful career, graced with all the distinctions which in Germany are conferred on literary eminence, he died, full of years and honor, on the 14th of July, 1812.

Besides Tibullus (1755; 4th ed. by Wunderlich in 1817) and the *Enchiridion* of Epictetus (1756; 2d ed. 1776), he edited Virgil (1767–75; new ed. by Wagner, 1830–44), Pindar (1773; 3d ed. 1817), the *Bibliotheca Græca* of Apollodorus (1782; 2d ed. 1803), and the *Iliad* (1802),—all illustrated with copious commentaries. His *Opuscula Academica*, in six vols. (1785–1812), contain a series of more than a hundred academical dissertations, of which the most valuable are those respecting the colonies of Greece and the antiquities of Etruscan art and history. He left also a great number of papers on almost every subject of erudition, more especially on ancient mythology, among the *Commentationes Societatis Regiæ Gottingensis*. His *Antiquarische Aufsätze*, in two vols., comprise a valuable collection of essays connected with the history of ancient art. His contributions to the *Göttinger Gelehrte Anzeigen* are said by Heeren to have been between 7000 and 8000 in number. In the earlier part of his life he translated, or rather wrote anew, a great part of the *Universal History*. See Heeren, *Heyne's Biographie* (1813), which forms the basis of the interesting essay by Carlyle, originally published in the *Foreign Review* (1828), and now reprinted in his *Miscellanies*, vol. ii.

HEYWOOD, a manufacturing town of Lancashire, is situated on the Roch, and on the Lancashire and Yorkshire Railway, 3 miles east of Bury and the same distance southwest of Rochdale. It possesses several handsome churches and chapels, among which may be mentioned St. Luke's church, erected in 1860, with a tall spire and a peal of bells. The other principal buildings are the national school, the mechanics' institute, the new Conservative clubhouse, and the market-hall. A new park—the Queen's Park—purchased and laid out at the cost of £11,000 with money which devolved to Her Majesty in right of her duchy and county palatine of Lancaster, was publicly opened on the 2d of August, 1879. Heywood Hall in the neighborhood of the town was at one time the residence of Peter Heywood, who contributed to the discovery of the Gunpowder Plot. Heywood owes its rise to the enterprise of the Peels, its first manufactures having been introduced by the father of the first Sir Robert Peel. It is an important seat of the cotton manufacture, in connection with which it has upwards of fifty factories, and there are in addition power-loom factories, iron-foundries, boiler-works, and railway wagon works. Coal is wrought extensively in the neighborhood. The population in 1901 was 25,461.

HEYWOOD, John (*c.* 1500–1565), sometimes styled "the Epigrammatist," was born, it is not known in what year, at North Mims near St. Albans. He was educated at Oxford, and afterwards made the acquaintance of Sir Thomas More, who introduced him at court. His skill in music and his inexhaustible fund of ready wit made him a special favorite of Henry VIII., and afterwards of his daughter Mary. On the accession of Elizabeth, Heywood, who was a zealous Catholic, retired to Malines in Belgium, where he died in 1565. A collection of his works was published in 1562.

His longest single composition is the allegorical work, written in the octave stanza, entitled *The Spider and the Fly* (1556), in which the flies are the Roman Catholics and the spiders the Protestants, while Queen Mary is represented by the housemaid with her broom (the sword), executing the commands of her master (Christ) and her mistress (the church). It has been justly characterized by Warton as dull, tedious, and trifling. Of greater literary interest are the Interludes (*A Play between Johan the Husband, Tyb the Wife, and Sir Johan the Priest; A merry Play between the Pardoner and the Friar, the Curate and Neighbor Prat; The play called the four P's, a new and very merry Interlude of a Palmer, a Pardoner, a Potycary, and a Pedlar; A Play of Genteelness and Nobility; A Play of Love; A Play of the Weather*) which form a connecting link between the old moralities and the modern drama, and were extremely popular in their day. They generally represent some ludicrous incident of a homely kind in a style of the broadest farce, but in their way display considerable skill and talent. Other works of Heywood are a comic poem in long verse entitled *A Dialogue containing in effect the number of all the Proverbs in the English tongue compact in a matter concerning two marriages*; and three collections of *Epigrams*.

HEYWOOD, Thomas, a voluminous dramatist and miscellaneous author of the 16th and 17th centuries, was born in Lincolnshire and was educated at Cambridge, where he became a fellow of Peterhouse. The dates of his birth and death are alike unknown, and the few facts of his life that are preserved have been gleaned chiefly from his own writings. He is mentioned in the MS. book of Henslowe as having written a book or play for the Lord Admiral's Company in October, 1596; and from the same source we learn that in 1598 he was regularly engaged as a player and a sharer in that company. In the preface to *The English Traveller*, written in 1633, he describes himself as having had "an entire hand or at least a main-finger in two hundred and twenty plays." Of this number, which probably afterwards was considerably exceeded (for we find him still writing in 1640, and indeed his last published piece did not appear until 1655), only three and twenty survive; but they amply attest that had he chosen to concentrate his powers, he might easily have ranked with the Massingers, Fords, and others of his great contemporaries. "Heywood," says Charles Lamb, "is a sort of prose Shakespeare; his scenes are to the full as natural and affecting." His facility and variety are almost without a parallel, his fancy was inexhaustible, and his invention never at a loss; but he delighted to excess in what he called "merry accidents, intermixed with apt and witty jests," or in other words, in the broadest and coarsest farce. His best pieces, such as *A Woman Killed with Kindness*, *Fortune by Land and Sea*, *The English Traveller*, and *The Fair Maid of the West*, lie chiefly in the department of what has been called the domestic drama.

Besides his dramatic works, which were partly reprinted by the "Shakespeare Society," and were published in a complete edition of six vols. with notes and illustrations in 1874, he was the author of *Troia Britannica or Great Britain's Troy* (1609), a poem in seventeen cantos "intermixed with many pleasant poetical tales" and "concluding with an universal chronicle from the creation until the present time;" *An Apology for Actors, containing three brief treatises* (1612); *Γυναικειον or nine books of various history concerning women* (1624); *England's Elizabeth, her Life and Troubles during her minority from the Cradle to the Crown* (1631); *The Hierarchy of the Blessed Angels* (1635); *Pleasant Dialogues and Dramas selected out of Lucian*, etc. (1637); and *The Life of Merlin surnamed Ambrosius* (1641).

HEZEKIAH (חִזְקִיָּהוּ, יְחִזְקִיָּהוּ, חִזְקִיָּהוּ, יְחִזְקִיָּה, or חִזְקִיָּה "Jehovah makes strong;" Ἐζεκίας; *Ezechias*; the *Ha-za-ki-ya-hu* or *Ha-za-ki-a-hu* of the Assyrian inscriptions), one of the greatest and best of the kings of Judah, succeeded his father Ahaz when still a young man (at the age of twenty-five according to 2 Kings xviii. 2; and this is probably correct if the LXX. be followed in reading "twenty-five" instead of "twenty" in 2 Chr. xxviii. 1; *cf.* 2 Kings xvi. 2). The year of his accession was most probably 717 B.C.;[1] and he ruled for twenty-nine years with a vigor and a success that deeply impressed later historians; "he trusted in the Lord God of Israel; so that after him was none like him among all the kings of Judah, nor any that were before him" (2 Kings xviii. 5; *cf.* Ecclus. xlviii. 17–25). The very outset of his reign was marked by an emphatic reversal, both in foreign and in domestic affairs, of the policy which had been so disastrously followed by his weak and foolish predecessor. While Ahaz had shown distinctly paganizing tendencies in religion, Hezekiah was ardent in his zeal for the exclusive worship of Jehovah, which he sought to simplify, centralize, and refine even at the expense of abolishing many cherished institutions which had the sanction of ancient usage. "He removed the high places, and brake the pillars, and cut down the Asherah, and brake in

[1] Hales and Ussher gave respectively 727 and 725 B.C.; and these dates were accepted as close approximations by all subsequent chronologists until the decipherment of the Assyrian inscriptions, when it became apparent that the destruction of Samaria by Sargon and the Ægypto-Palestinian expedition of Sennacherib were separated by a wider interval than eight years, and therefore that 2 Kings xviii. 10 and 2 Kings xviii. 13 cannot both be right. In the present article the chronology of Schrader (art. "Sanherib," in Schenkel's *Bibel-Lexicon*, i.; comp. *Die Keilinschriften u. das Alte Testament*) is that which is substantially followed. A full exposition of the bearings of the cuneiform inscriptions on the chronology of the Bible must be postponed to the article on the history of Israel. See also Babylonia, vol. iii. p. 162.

pieces the brazen serpent that Moses had made; for unto these days the children of Israel did burn incense to it; and he [or, perhaps, they] called it Nehushtan" (*i. e.*, according to the A.V., "brazen;" but, if this was the popular name, it is probably derived from *nahash*, serpent; see 2 Kings xviii. 4). How great were the strength of conviction and the courage which were necessary to such reforms as these is incidentally shown by the appeal to conservative feeling which some years afterwards could still be made by a skilful diplomatist with at least some hope of success (2 Kings xviii. 22). The details of the reforming activities of Hezekiah, extending even to the northern kingdom, as given with characteristic fulness and minuteness by the compiler of the book of Chronicles, are not now accepted by the majority of critics as absolutely trustworthy, a prevalent opinion being that actions have been attributed to Hezekiah which ought really to have been assigned to Josiah, and that some at least of the chronology is imaginary; but it is obvious that the influence of such prophets as Isaiah and Micah must have been powerful enough to bring about many thorough-going changes even during the earlier reign. As in the internal religious affairs of the theocratic kingdom so in its relations with foreign powers Hezekiah innovated very conspicuously on the policy of his father, although not here entirely on the lines laid down by the great contemporary prophet. Confirmed in the consciousness of military strength by a successful war against the Philistines (2 Kings xviii. 8), and having no longer anything to fear either from Damascus or from Samaria, he began to cherish the hope (at least with Egyptian support and the active co-operation of Egyptian cavalry) of being able to shake off entirely the yoke of Assyria, and with this view he set about extensive fortifications and other engineering works in and about Jerusalem. "He made the pool and the conduit and brought the water into the city," "stopping the upper outlet of Gihon and bringing it straight by an underground way;" he also "built up all the wall that was broken, and raised thereupon towers" (2 Kings xx. 20; 2 Chr. xxxii. 5, 30; and *cf.* Isa. xxii. 8–11, which also has been referred by the sagacity of Ewald to this period). It is not clear from the sacred historians how far Judah was affected by the successful expedition of Sargon against Ashdod in 711 B.C., which is mentioned in Isa. xx. 1 (and in which possibly Sennacherib may have held the rank of a rabsaki or general); but Ewald's brilliant conjecture, to the effect that Isa. xxii. 1 *sqq.* alludes to hardships suffered by the people of Hezekiah at that time, is remarkably confirmed by the cuneiform inscriptions. It was not, however, until after the accession of Sennacherib (705) and the resolution of that monarch to direct one of his great expeditions against Egypt (*c.* 701), that matters were brought to a sharp and immediate crisis between Nineveh and Jerusalem. The capture of all his "fenced cities," Jerusalem excepted, coupled with the inactivity of Egypt, convinced Hezekiah of the uselessness of a struggle with the greatest military power of his century, in a way that Isaiah, with often repeated admonitions, had failed to do; and the payment of a large sum of money by way of tribute readily purchased a temporary relief. But when Sennacherib sent from Lachish his "tartan," or commander-in-chief, along with the "rab-saris," or head eunuch, and the "rab-shakeh," or chief of the staff (the rendering "chief cup-bearer" seems based on a wrong etymology), with a large force to demand the surrender of Jerusalem itself, it was felt by king and prophet alike that the time for resistance to the utmost had come. Probably the resolution thus formed was in part, at least, due to the fact that the main body of the Assyrian army was already finding it necessary to fall back before Tirhakah, the Ethiopian king of Egypt, from Lachish to Libnah; it was at all events justified, not only by the indecisive battle at Altaku near Ekron, but also by the pestilence (2 Kings xix. 35) which speedily compelled the withdrawal of Sennacherib with the remains of his army from Libnah to Nineveh. The relation between the accounts of this retreat given by Sennacherib himself, by the sacred historians, and by Herodotus (ii. 141) will be considered in the article SENNACHERIB. The sickness and recovery of Hezekiah, recorded in 2 Kings xx. 1–11 and (with additional details) in Isa. xxxviii., seems to have preceded the invasion of Sennacherib by three years at most; they were almost immediately followed by the arrival of the messengers of Merodach (not Berodach) Baladan, the son of Baladan, who for some six months, until repressed by Sennacherib, usurped the throne of Babylon about the year 703. The excessive courtesy shown to these ambassadors gave occasion, it is recorded (2 Kings xx. 17, 18), to a prediction by Isaiah of the Babylonian exile, which took place more than a century afterwards. Of the later portion of Hezekiah's reign no details have been preserved; but it appears to have been characterized by peace and prosperity. He was succeeded in 688 by Manasseh, his son by Hephzibah, born apparently about 702. Besides being a patron of literature (Prov. xxv. 1), Hezekiah was himself a poet; and his sole remaining production (Isa. xxxviii. 10–20), if somewhat deficient in originality, abounds in depth and tenderness of religious and poetic feeling.

HIBERNATION (frequently, but less correctly, written HYBERNATION) is the term employed by naturalists to denote the peculiar state of torpor in which many animals which inhabit cold or temperate climates pass the winter. In hot and dry countries, on the contrary, various animals pass into a similar condition during the hottest season of the year; and this state is called "Æstivation." Several of the animals which hibernate during the winter are liable to fall into a similar state at intervals during mild weather, and Dr. Marshall Hall has applied the term "Diurnation" to the day-sleep of bats, which he regards as precisely analogous to hibernation.

MAMMALIA.—Although comparatively few mammals hibernate, the phenomena of hibernation and similar conditions have been better studied in this class than in any other. Dr. Marshall Hall has laid down the principle that the amount of respiration is inversely as the degree of irritability of the muscular fibre. Every gradation may be met with between ordinary sleep, the imperfect or abnormal hibernation of some animals, and the profound hibernation of others, in which all the functions of life are almost suspended. Such a condition is always accompanied by reduced respiration, and increased irritability of the muscular fibre. If the respiration is reduced without this irritability being increased, death results from torpor and asphyxia, whereas, if the respiration is increased simultaneously with increased irritability (as when an animal is aroused too suddenly), death likewise results from too great stimulation of the vital powers. The well-known danger of suddenly awakening a patient from a state of somnambulism is doubtless due to a similar cause.

Hibernation, however, is a physiological condition, and not produced simply by cold, though it is favored by it, because cold induces sleep, which may afterwards pass into hibernation. It is an error to suppose that hibernating animals are capable of resisting any amount of cold, though their capacity of doing so must vary according to their species and to the climate which they inhabit. They always seek secure hiding-places where they may be protected from too great a degree of cold, as well as from interference. During hibernation the temperature of their bodies sinks to a point corresponding nearly to that of the surrounding atmosphere; but if they are exposed to an unusual amount of cold, they are first awakened by it, and then sink into a fatal torpor like other animals. Many hibernating animals perish in this manner during severe winters.

Respiration being almost suspended during hibernation, the maintenance of vitality depends almost wholly on the action of the heart, which will continue for a long time after an hibernating animal has been decapitated. Animals may also be placed in carbonic acid or under water for several hours, without injury, when in this condition, though they would die in a very few minutes if they were in their normal state.

Man.—Long-continued suspension of consciousness in man, whether voluntary or otherwise, is rare in temperate climates, but it is more frequent in India, where some religious ascetics are stated on unimpeachable authority to possess the power of throwing themselves into a state closely resembling hibernation for an indefinite period. Many curious cases have been recorded by Mr. Braid in his small treatise on *Human Hybernation*, published in 1850, the most celebrated of which is that of a fakir who was actually buried alive at Lahore, in 1837, in the presence of Runjeet Singh and Sir Claude Wade, and who was dug up and restored to consciousness several months afterwards, after every precaution had been taken to prevent any one from disturbing the grave in the interval.

Bats.—Dr. Marshall Hall says that the hibernating bat never wakes at all, except from warmth or excitement, and that the digestive functions are suspended to a far greater degree than in the dormouse or hedgehog. Respiration is also suspended, and when the animal is disturbed it quickly subsides again into total quiescence, after a few feeble respirations. It is to be regretted that Dr. Hall has not stated to which species of bat his remarks refer, as the habits of the various species differ. Earlier or later in autumn, according to the species, they retire to caves, hollow trees, and similar hiding-places, where they cluster together, hanging head downwards by their hinder claws, and clinging to each other, as well as to the walls and sides of their retreat, so that a great number can crowd themselves into an amazingly small space. Although such assemblies frequently consist of more than one species, yet the various species do not all retire to their winter quarters at the same period; the noctule is rarely seen abroad later than July, whereas the pipistrelle may be seen flying on mild evenings almost every month in the year. It is only natural to suppose that the hibernation of the former species is much more profound than that of the latter, which doubtless feeds in winter as well as summer; for though insects are far less numerous in winter than in summer, yet some species appear only at that season of the year.

Bear and Badger.—These animals retire to winter quarters in northern climates, and pass the greater part of their time in sleep; but the brown bear and badger do not fall into a state of genuine hibernation. When the bear retires for the winter, he is very fat, and it is said that the black bear will not hibernate if this is not the case. Digestion is suspended, and his intestines become stopped up with an indigestible mass chiefly composed of pine leaves, which is not discharged till spring. The brown bear of Europe and Siberia is very dangerous if disturbed during the winter; but the black bear of America can scarcely be aroused from his torpor, which there is thus reason to believe is a state of true hibernation, differing from that in which the former species passes the winter.

Hedgehog.—This animal hibernates more completely than almost any other. In the autumn it retires to a hole among rocks or under the roots of a tree, where it remains for the winter, seldom or never awakening till spring, and of course taking no food until then. If a sleeping hedgehog is disturbed, it merely stirs, and then coils itself up more closely; but if a hibernating hedgehog is interfered with, it takes a deep sonorous inspiration, followed by a few feeble respirations, and then by total quiescence. The tenrec, an allied animal found in Madagascar, sleeps for three months in its burrow during the hottest period of the year.

Rodentia.—Several animals belonging to this order hibernate more or less completely, among which we may mention the hamster, the porcupine, the dormouse, the squirrel, and the marmot. Several of these awake at intervals to feed, and therefore lay up a store of provisions before they retire, although they all become very fat before winter. Other species of this order hibernate less perfectly, or only occasionally, like the hare, which will lie beneath deep snow in a small cavity, just large enough to receive her body, for some weeks unharmed. But this is not true hibernation, as respiration is maintained during the whole time, a small air-hole being always kept open by the warm breath of the animal. In a similar manner sheep (though belonging to a very different order of animals) have sometimes been buried in snow-drifts in Scotland for several weeks without sustaining any injury. The dormouse not only hibernates in the strict sense of the term, but will sleep at intervals for several days together during mild weather. When a *Myoxus*, an allied animal inhabiting Africa, was brought to Europe, it hibernated as if this were its normal habit. Whether it æstivates in its native country is not known, but its hibernating in Europe shows a greater power of adapting itself to changed conditions of life than we should have been inclined to suspect.

Aves and Pisces.—It was formerly supposed that various species of swallows hibernated, and it was even asserted that the sand martin was accustomed to bury itself in the mud at the bottom of the water; but this has long been regarded as an exploded error. For the hibernation of fish, compare the article on Ichthyology.

Amphibia and Reptilia.—All the animals belonging to these classes hibernate in cold or temperate climates. Land tortoises bury themselves in holes in the ground, and fresh-water tortoises in the banks or at the bottom of lakes and rivers. Lizards and snakes retire to holes in trees, under stones, or among dead leaves, where many species congregate in large numbers, and pass the winter closely entwined, and in a still more torpid condition than that of the hibernating mammals, their digestion and respiration being entirely suspended. Many tortoises, crocodiles, and serpents bury themselves in mud in both South America and Africa, and æstivate in the hard-baked ground during the dry season of the year. When the viper is disturbed during the winter its bite is harmless; but this is not the case with the venomous serpents which æstivate in tropical countries.

Frogs generally hibernate in masses in the mud at the bottom of the water, and if awakened from hibernation by warmth can remain eight times longer under water without drowning than frogs in the breeding season. We should hardly expect the habits of such an animal as the frog to be greatly affected by domestication, but Professor Bell was acquainted with a gentleman living at Kingston, whose kitchen was built on the banks of the Thames, and whose servants made a pet of a frog which had his hole in the skirting. It was unnecessary for the frog to hibernate, and instead of doing so he came out of his hole every evening to bask before the kitchen fire for three successive winters. It is impossible to say how long frogs and toads may continue to retain a dormant life, if the mud in which they bury themselves should become hardened around them during hibernation. Too many circumstantial accounts of the discovery of live toads embedded in solid rock, and even in coal, have been published to allow us to dismiss them all as fabulous, notwithstanding the difficulty and obscurity in which this subject is still involved.

Mollusca.—Many species hibernate. The land-snails bury themselves in the ground, or conceal themselves under the bark of trees, in holes in walls, or even in the stems of large umbelliferous plants. They close the mouth of the shell with a calcareous plate, technically called an epiphragm, which they secrete by means of their mantle, and which is perforated by a small hole to admit the air. In winter they bury themselves with the head upwards, and do not grow at all during the winter; but while growing they bury themselves in summer, with the head downwards, at occasional intervals, for several days together, and then grow very rapidly. Snails are not considered in season at Paris till after the first frost, when they are closed with a white epiphragm. In dry weather, and during the heat of summer, snails also close their shells with an epiphragm, to protect themselves from drought, but this covering is thinner than that which they construct during the winter. In the British Museum is preserved the shell of a specimen of *Helix desertorum*, from Egypt, which revived after having

Helix Desertorum.

been gummed to a board for four years in the Museum, and lived for two years afterwards. Other instances of the revival of land-shells after a still longer period are equally well authenticated. Some species retire to winter quarters earlier than others, and their pulsation, which ranges from 30 to 110 during summer, ceases entirely in winter. Slugs also bury themselves in the ground, and become torpid during frosts or droughts, but it is doubtful whether their condition is that of genuine hibernation. The fresh-water mussels (*Anodonta*) hibernate before the close of autumn, and bury themselves in the mud till the beginning of spring. It is believed that many of the marine *Mollusca* also hibernate, but very little is known of their habits at present.

Insecta.—Most of the insects which pass the winter as larvæ or perfect insects hibernate during the period that they can obtain no food. Larvæ which are full grown in autumn frequently lie dormant during the winter, and do not assume the pupa state till spring. In the case of insects

which have more than one brood in the year, the last brood generally hibernates, sometimes retiring to winter quarters quite early in the autumn, while the perfect insects of the previous brood are still flying about, and while the weather is still fine and warm. Insects which hibernate in the perfect state do not pair till spring, and are probably not fully developed till after hibernation. Hive-bees probably do not hibernate, and it is well known that they require food during the winter. It is asserted that the aphides, on whose sweet secretion ants chiefly subsist in inclement weather, become torpid at exactly the same low temperature as the ants themselves.

Concluding Remarks.—The seeds of many plants, and the eggs of many of the lower forms of animal life, may remain dormant for years in cold or dry climates, until heat or moisture awakes them to vitality. Many plants die down in winter, the roots remaining in the ground, while many trees then shed their leaves, the sap retiring to the roots. Similar phenomena take place in tropical countries during the hot, dry season, wherever the amount of humidity in the atmosphere is insufficient to maintain a perennial vegetation during the year. These phenomena in the vegetable world are regarded as analogous to those of hibernation in animals, and the term "hibernation of plants" is sometimes applied to them.

Dr. Marshall Hall, in Todd's *Cyclopædia of Anatomy and Physiology*, art. "Hibernation;" Braid's *Observations on Trances or Human Hybernation;* Bell's *British Quadrupeds and British Reptiles;* Humboldt's *Views of Nature;* Gwyn Jeffrey's *British Conchology;* Tate's *Land and Fresh-water Mollusca;* Kirby and Spence's *Introduction to Entomology*, etc.

(W. F. K.)

HICKES, George (1642–1715), a learned English divine of the nonjuring party, and an eminent Anglo-Saxon scholar, was born at Newsham near Thirsk, Yorkshire, on June 20, 1642. In 1659 he entered St. John's College, Oxford, whence after the Restoration he removed first to Magdalen College and subsequently to Magdalen Hall. In 1664 he was chosen fellow of Lincoln College, and in the following year proceeded M. A. On his return from a Continental tour in 1673 he graduated in divinity, and in 1675 he was appointed rector of St. Ebbe's, Oxford; in the following year he as private chaplain accompanied the duke of Lauderdale, the royal commissioner, to Scotland; and shortly afterwards he received the degree of D.D. from the university of Glasgow. In 1680 he became vicar of All Hallows, Barking, London; and after having been made chaplain to the king in 1681, he was in 1683 promoted to the deanery of Worcester. At the revolution in 1688, having declined to take the oath of allegiance to William and Mary, he was first suspended and afterwards deprived,—he meanwhile affixing to the cathedral doors a "protestation and claim of right" that he was, and still did "continue to be, the only rightful and legal dean of this cathedral church of Worcester." After remaining some time in concealment in London, he was employed by Sancroft and the other nonjurors on a mission to the Continent on matters connected with the proposed action of his party relative to the continuance of their episcopal succession; upon his return he was himself consecrated by Lloyd, White, and Turner suffragan bishop of Thetford in 1694. His later years were largely occupied in controversies the interest of which has now almost wholly passed away; but to them we owe the two works which constitute his chief claim to an enduring reputation, the learned *Institutiones Grammaticæ Anglo-Saxonicæ et Mœso-Gothicæ* (1689), and *Linguarum veterum Septentrionalium Thesaurus grammatico-criticus et archæologicus* (1703–1705). In 1713 he united with Bishops Campbell and Gadderar to consecrate Jeremy Collier, Samuel Hawes, and Nathaniel Spinkes to be bishops in the nonjuring church. He died December 15, 1715.

Even apart from the two works already mentioned, Hickes was a very voluminous and laborious author. His earliest performances, which were anonymous, were suggested by contemporary events in Scotland that gave him great satisfaction,—the execution of Mitchel on a charge of having been implicated in the murder of Archbishop Sharp, and that of Kid and King, Presbyterian ministers, "for high treason and rebellion" (*Ravillac Redivivus*, 1678; *The Spirit of Popery speaking out of the Mouths of Phanatical Protestants*, 1680). In his *Jovian* (an answer to Johnson's *Julian the Apostate*, 1683), he endeavored to show that the Roman empire was not hereditary, and that the Christians under Julian had recognized the duty of passive obedience. His *Two Treatises*, one "On the Christian Priesthood" and the other "On the Dignity of the Episcopal Order," originally published in 1707, have been more than once reprinted, and form three volumes of the *Library of Anglo-Catholic Theology* (1847). In 1705 and 1710 were published *Collections of Controversial Letters*, in 1711 a collection of *Sermons*, and in 1726 a volume of *Posthumous Discourses*. Other treatises, such as the *Apologetical Vindication of the Church of England*, are to be met with in Gibson's *Preservative against Popery*.

HICKORY. The hickory trees are natives of North America, and belong to the genus *Carya* of botanists. They are closely allied to the walnuts (*Juglans*), the chief or at least one very obvious difference being that, whilst in *Carya* the husk which covers the shell of the nut separates into four valves, in *Juglans* it consists of but one piece, which bursts irregularly. The hickory trees are of lofty growth, and are held in high estimation, both on account of their durable timber, and from the excellent nuts which some of the species produce. The timber is both strong and heavy, and remarkable for its extreme elasticity, but it is not much used either for shipbuilding or for architectural purposes, as it decays rapidly when exposed to heat and moisture, and is peculiarly subject to the attacks of worms. It is very extensively employed in manufacturing musket stocks, axle-trees, screws, rake teeth, the bows of yokes, the wooden rings used on the rigging of vessels, chair backs, axe-handles, whip-handles, and other purposes requiring great strength and elasticity. Its principal use in America is for hoop-making; and when it is remembered how large a proportion of the productions of the United States is packed in barrels, some estimate may be formed of the consumption of hoops and of the consequent demand for hickory wood, which is the only American wood found perfectly fit for that purpose.

Fig. 1.—Shell-bark Hickory (*Carya alba*) in flower (¼ nat. size). 1, Female flower (nat. size); 2, portion of male inflorescence (nat. size).

The wood of the hickory is of great value as fuel, on account of the brilliancy with which it burns and the ardent heat which it gives out, the charcoal being heavy, compact, and long-lived. The species which furnish the best wood are *Carya alba* (shell-bark hickory), *C. tomentosa* (mocker-nut), *C. olivæformis* (pecan or pacane nut), and *C. porcina* (pig-nut), that of the last-named, on account of its extreme tenacity, being preferred for axle-trees and axe-handles. The wood of *C. alba* splits very easily and is very elastic, so that it is much used for making whip-handles and baskets; the whip-handles are greatly esteemed for their suppleness, and considerable numbers of them are annually imported into England. The wood of this species is also used in the neighborhood of New York and Philadelphia for making the back bows of Windsor chairs. The timber of *C. amara* and *C. aquatica* is considered to be of inferior quality.

Most of the hickories form fine-looking noble trees of from 60 to 90 feet in height, with straight, symmetrical trunks, well-balanced ample heads, and bold, handsome, pinnated foliage. When confined in the forest they shoot

up 50 or 60 feet without branches, but when standing alone they expand into a fine head, and produce a lofty round-headed pyramid of foliage. They have, observes Downing, all the qualities which are necessary to constitute fine graceful park trees, and are justly entitled to a place in every considerable plantation. The most ornamental of the species are *C. olivæformis*, *C. alba*, and *C. porcina*, the last two also producing delicious nuts, and being worthy of cultivation for their fruit alone.

The husk of the hickory nut, as already stated, breaks up into four equal valves or separates into four equal portions in the upper part, while the nut itself is tolerably even on the surface, but has four or more blunt angles in its transverse outline. The hickory nuts of the American

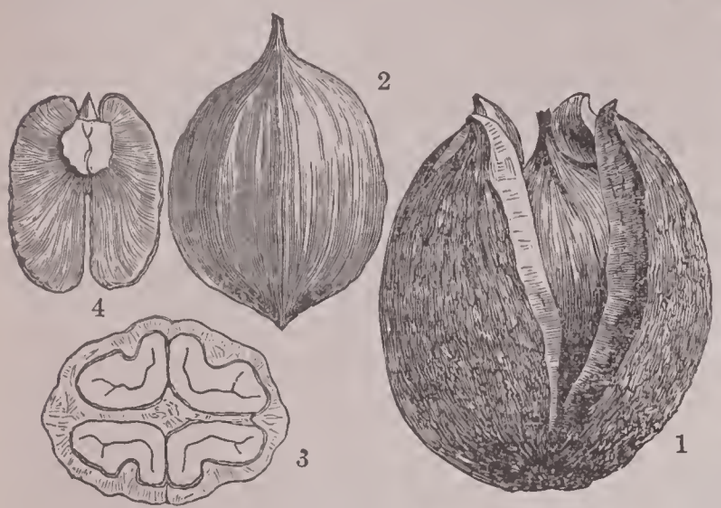


Fig. 2.—1, Fruit of *Carya alba;* 2, hickory nut; 3, cross section of nut; 4, vertical section of the seed. All natural size.

markets are the produce of *C. alba*, which is called the shell-bark hickory because of the roughness of its bark, which becomes loosened from the trunk in long scales bending outwards at the extremities and adhering only by the middle. The nuts are much esteemed in all parts of the States, and are exported in considerable quantities to Europe. The pecan-nuts, which come from the Western States, are from an inch to an inch and a half long, smooth, cylindrical, pointed at the ends, and thin-shelled, with the kernels full, not like those of most of the hickories divided by partitions, and of delicate and agreeable flavor. The thick-shelled fruits of the pig-nut are generally left on the ground for swine, squirrels, etc., to devour. In *C. amara* the kernel is so bitter that even the squirrels refuse to eat it.

HICKS, Elias (1748–1830), founder of the Hicksites, one of the two great sections into which the Society of Friends in America has since 1828 been divided (see Quakers), was born at Hempstead, Long Island, on March 19, 1748. During the earlier part of his life he followed the business of a carpenter and housebuilder; but this occupation he latterly exchanged for that of farming. Reared in a Quaker family, he began, when about twenty-seven years of age, to "have openings leading to the ministry," and to be "deeply engaged for the right administration of discipline and order in the church." In the intervals of business, accordingly, he began to visit the meetings and families of Friends throughout an extensive range of country; and soon he established a very considerable reputation as an efficient and popular itinerant preacher. His first literary effort seems to have been made no earlier than 1811, when he published *Observations on Slavery;* those doctrinal divergences from the received orthodox creed of the Friends, by which his name was brought into the prominence it now possesses, appear not to have become visible until 1820, when he wrote a *Doctrinal Epistle* (published in 1824), which was followed by much controversy, and resulted in 1828 in the formal separation from the Hicksites of their more orthodox Quaker brethren. The points involved were justly considered to affect the fundamental doctrines of the Christian religion, such as those of the Trinity, the Incarnation, and the supreme authority of Scripture. Hicks died at Jericho, Long Island, on February 27, 1830. See *Journal of the Life and Labors of Elias Hicks* (Philadelphia, 1828).

HIERAPOLIS. Of the many cities in the Greek world bearing this name the following are the most important.

1. A city of Syria Cyrrhestica, situated on some hills about 16 miles south-west from the junction of the Euphrates and the Sajur. Besides the natural strength of its position, it was important as lying on the line of intercourse between Northern Syria and Mesopotamia, and was always a great trading city. Its early history is quite unknown. It is not mentioned during the Assyrian wars in this part of Syria (see Sayce, *Academy*, October, 1876). Abul Faráz asserts that Josiah was defeated there by Pharaoh Necho (611 B. C.) on his march towards Carchemish; but according to 2 Chron. xxxv. 20 the battle took place at Carchemish, which lay on the Euphrates a little further north on the site of the modern Jerablûs or Jerabîs; and probably Abul Faráz confounded the two cities. The same confusion perhaps has caused the statement of Ammianus that Hierapolis was identical with Ninus Vetus on the Euphrates. Jerablûs is clearly a corruption of Hierapolis, by which name therefore Carchemish must at some time have been styled by the Greeks; but it is surprising to find two great cities of the same name so near one another. No proof exists that Hierapolis was an important city before the time of the Seleucidæ, and Professor Sayce suggests that it then succeeded to the trade and name of the older city, which had now decayed. Its original name is given in Greek as Βαμβύκη, which points back to a form Bambyg or Mambug, while the Syrian form is given by Pliny as Mabog, *i. e.*, Mabbog for Mambog. The romance of trade by which this name has become naturalized in many European languages deserves a passing notice. As the city lay on the highway to the East, cotton and silk were important branches of its trade. Probably cotton plantations existed there in old time; and after the cultivation of silk was introduced to western Asia in the time of the Sassanian kings, large groves of mulberry trees surrounded the city. The name Mambe was afterwards confounded with the Persian word pambe, silk; and the Greek form Βαμβύκη also was similarly mixed up with the word *βόμβυξ*,[1] which originally denoted the fly supposed to spin on trees the cotton or silk (for the two substances were confused by the Greeks and Romans) which men then gathered off the trees (Virg., *Georg.*, ii. 121). Hence the "Bombycinæ vestes" of the Roman writers; while the city itself is called "Bombycina urbs." In Asia cotton seems to have been known as a distinct article, and was named after the city which was the chief seat of its manufacture, as muslin is from Mosul. By the crusaders the stuff and the name were carried to Europe, and the latter exists in English in the form "bombazine." The Syrian goddess Atargatis, called by the Greeks Dercето, a personification of the nature power worshipped under different names over the whole of western Asia, had one of her most famous temples in the city; and perhaps Mambe may have been a local name of the goddess. Hence in the 3d century B. C., when, under the Seleucid kings, Bambyce became a great Greek city and the most important station between Antioch and Seleucia, it was called Hierapolis or Hieropolis. The latter form is found on coins, the former is used in classical literature. The coinage of Hierapolis begins under the Seleucidæ. The autonomous coins, probably for commercial reasons, imitate closely the coins of Antioch. The temple was plundered by Crassus on his Parthian expedition (53 B. C.). Under Diocletian or Constantine, Hierapolis became the capital of the new province of Euphratensis, a name which soon gave place to the older name Commagene. As paganism decayed, Hierapolis ceased to be the sacred city, and recovered its ancient name; at the same time its importance and population declined. In the time of Julian, who concentrated there the Roman troops for the fatal Parthian campaign, it was still one of the greatest cities of Syria; but under Justinian, who made some attempt to restore it, great part of its area was a desert, and the once strong fortifications were so decayed that the place was not defensible against the Parthian king Chosroes. At the Arab conquest it passed into the hands of the caliphs. Haroun-al-Raschid (786–808) restored it and strengthened its walls, and it is mentioned about 1150 by Edrisi as a strong city. As the empire of the caliphs dwindled, Mambedj became a frontier post in the struggle between Christians and Mahom-

[1] Βόμβυξ is borrowed from the Persian word (Benfey, *Wurzellex.*, ii. 113), though the form it has taken in Greek is influenced by the word βομβέω, to buzz. It is used by Aristotle, etc., to denote a gnat found in Asia Minor, which has certainly nothing to do with silk.

etans, and its possession carried with it the rule in this part of Syria. The emperor Romanus Diogenes captured it in his gallant struggle against the Turks (1068). Recaptured by the Seljuk Turks, it soon afterwards fell into the power of the crusaders, until it was stormed by Saladin (1175). It was for some time the headquarters of the Mongol host under Hulagu Khan; and, as with many other Syrian cities, its desolation dates from this time. The ruins which still exist called Kara Bambuche or Buyuk Mambedj, have been described by Pococke and others, and most carefully by Chesney (*Euphrates Expedition*, i. 420).

Strabo (xvi. p. 748) confuses this Hierapolis with Edessa in Mesopotamia. A very full account of the city to supplement the brief outline here given may be found in Ritter, *Erdkunde*, x. 1041–65.

2. A city in Phrygia, at the junction of the Lycus and Meander, on the road from Apamea to Sardis. In it there were warm springs which had and still have a remarkable power of forming incrustations. Its name Hierapolis is due to the sanctity conferred on it by these hot springs, and by the Plutonium, a small cave under a projecting rock, from which there constantly emanated a dark vapor deadly to man and beast (Strabo, xiii. 629; Vitruv., viii. 3; Apuleius, *De Mundo*, p. 65). In reference to this we find sometimes on its coins Pluto carrying off Proserpine. The water was also much used for dyeing. Nothing is known of the origin of the city; from the legend ἀρχηγέτης on coins, with a radiate head of the sun-god, Eckhel concludes that a Greek foundation was made under the guidance of Apollo; but a native city may have already existed there. The native name of the sun-god was Λαιρβηνος, which often occurs on coins; he was probably a Phrygian form of the Greek Zeus. The goddess of healthful drinking, Euposia, is also seen on coins. Cybele also, who is found on the coins, was one of the chief deities of the place. Little is known of the history of the city. The philosopher Epictetus was born there; and there St. Paul founded a church (Coloss. iv. 13). The very considerable ruins which still exist, called Pambuk Kalessi ("Cotton Castle"), have been described by Pococke, Leake, etc. The ancient theatre and gymnasium are in a state of remarkable preservation.

HIERARCHY. From ἱεράρχης, meaning a steward or guardian of holy things, is derived ἱεραρχία, naturally signifying the office of such a steward or guardian (not a "ruler of priests" or "priestly ruler;" see Boeckh, *Corp. Inscr. Gr.*, No. 1570), but most commonly used in ecclesiastical language to denote the aggregate of those persons who exercise authority within the Christian Church,—the patriarchate, episcopate, or entire threefold order of the clergy. The word, which does not occur in any classical Greek writer, owes its present extensive currency to the celebrated writings of Dionysius Pseudo-Areopagita, which, originating probably in the age of Justinian, exerted during the 9th and following centuries so remarkable an influence on the current of theological speculation, both in the Eastern and in the Western Church. Of these the most important are the two which treat of the celestial and of the ecclesiastical hierarchy respectively. Defining hierarchy as the "function which comprises all sacred things," or, more fully, as "a sacred order and science and activity, assimilated as far as possible to the godlike, and elevated to the imitation of God proportionately to the Divine illuminations conceded to it," the author proceeds to enumerate the nine orders of the heavenly host, which are subdivided again into hierarchies or triads, in descending order, thus: Seraphim, Cherubim, Thrones; Dominations, Virtues, Powers; Principalities, Archangels, Angels. These all exist for the common object of raising men through ascending stages of purification and illumination to perfection. The ecclesiastical or earthly hierarchy is the counterpart of the other. In it the first or highest triad is formed by baptism, communion, and chrism. The second triad consists of the three orders of the ministry, bishop or hierarch, priest, and minister or deacon (ἱεράοχης, ἱερεύς, λειτουργός); this is the earliest known instance in which the title hierarch is applied to a bishop. The third or lowest triad is made up of monks, "initiated," and catechumens. To Dionysius may be traced, through Thomas Aquinas and other Catholic writers of the intervening period, the definition of the term usually given by Roman Catholic writers—"cœtus seu ordo præsidum et sacrorum ministrorum ad regendam ecclesiam gignendamque in hominibus sanctitatem divinitus institutus"[1]—although it immediately rests upon the authority of the sixth canon of the twenty-third session of the council of Trent, in which anathema is pronounced upon all who deny the existence within the Catholic Church of a hierarchy instituted by divine appointment, and consisting of bishops, priests, and ministers.[2] This definition, however, relates only to what is called the "hierarchy of orders," to which hierarchy, it must further be borne in mind, belong the lesser orders of sub-deacon, acolyth, exorcist, lector, and doorkeeper (to which that of singer is sometimes added); though these are to be regarded as institutions of ecclesiastical authority only, while the other three are of divine right, and therefore pre-eminently "holy." The "hierarchy of jurisdiction," as distinguished from that of "orders," is represented by the Roman pontiff alone, who enjoys supreme authority over all bishops, even when these are assembled in general council. This supreme authority he holds by divine right as the successor of Peter, who received immediately from Christ the primacy of honor and of jurisdiction over the universal church.[3] Between the pope and the bishops occur the metropolitans or archbishops and the patriarchs; but these intermediate grades are not regarded as essential, and, for the present at least, the rank of patriarch may almost be said to be, in the Roman communion, purely titular. The Greek Church, like the Roman, recognizes a threefold clerical order, distinct *jure divino* from other Christians, of bishops, priests, and deacons. The five patriarchs, of equal dignity, hold the highest rank in the episcopate; and the episcopal body united in a general council represents the church and infallibly decides, under the guidance of the Holy Ghost, all matters of faith and ecclesiastical life. The Anglican Church acknowledges the superior and divinely conferred authority of the episcopal order, but, seeking its hierarchical doctrine in the records of a comparatively early period of church history, holds the substantial equality of all bishops, and, while acknowledging the validity, does not maintain the necessary infallibility, of their decisions when met in general council. Thus in form of government the Roman Church may be said to be a hierarchical monarchy, the Greek in some sense a patriarchal oligarchy, and the Anglican an episcopal aristocracy. For historical and other details relating to the growth and development of the hierarchical system the reader is referred to the articles Apostle, Archbishop, Bishop, Cardinal, Church, Clergy, Council, Diocese, Episcopacy, Exarch, Patriarch, Pope, etc.

Some kind of hierarchy, both of orders and of jurisdiction, may, from the nature of the case, be looked for in every religious system that has attained any considerable degree of visibility and external organization. The ancient Jewish and Egyptian hierarchies, for example, find parallels in Parsism and Mahometanism; while in some regions Buddhism has attained a degree of complexity in its ecclesiastical government strikingly suggestive of many features of the present Roman hierarchy.

HIERAX, or Hieracas, a learned ascetic who flourished about the end of the 3d century at Leontopolis in Egypt, where he lived to the age of ninety, supporting himself by caligraphy and devoting his leisure to scientific and literary pursuits, especially to the study of the Bible. He was the author of Biblical commentaries both in Greek and Coptic, and is said to have composed many hymns. He ultimately became leader of the so-called sect of the Hieracites, an ascetic society from which persons living in the married state were excluded, and of which one of the leading tenets was that only the celibate could enter the kingdom of heaven. This doctrine was based on a somewhat too literal interpretation of the parable of the ten virgins; on other points, however, Hierax followed Origen in allegorizing Scripture; thus he thought that the narrative of the fall and the doctrine of the resurrection ought both to be taken in a spiritual sense. It is upon this apparently Manichæan view of matrimony, taken along with his denial of the resurrection and of a visible paradise, and his assertion that infants, as incapable of "striving lawfully," cannot inherit the kingdom of God, that his reputation as a heretic chiefly depends.

HIERO, the name of two rulers of Syracuse.

Hiero I., displacing his infant nephew, succeeded his famous brother Gelon as tyrant of Syracuse in 478 B. C.

[1] Perrone, *De Locis Theologicis*, pt. i., sec. i., cap. 2.

[2] Si quis dixerit in ecclesia catholica non esse hierarchiam divina ordinatione institutam, quæ constat ex episcopis, presbyteris, et ministris: anathemasit.

[3] Perrone, *De Locis Theologicis*, pt. i., sec. i., cap. 1, 2, 3.

His rule was more tyrannical than Gelon's had been, and his jealousy of his more popular brother Polyzelus (who was at the head of the army, and had married Gelon's widow Demarete, daughter of Theron of Agrigentum) ended in an open quarrel, in which Theron sided with Polyzelus. The brothers, however, were reconciled, and Hiero married Theron's sister. From the slight information extant regarding Hiero, his influence seems to have been very great. He removed the inhabitants of Naxos and Catana to Leontini, and peopled Catana, which he renamed Ætna, with Dorians. He was also an important factor in the history of Agrigentum, of Rhegium, and of Locri; and he saved the Greeks of Campania from the Etruscans, whose naval power he destroyed by his great victory at Cumæ (474 B. C.). Though despotic in his rule, he was a hearty patron of literature, and numbered among his friends such names as Æschylus, Bacchylides, Epicharmus, Simonides, and Pindar—the last of whom celebrated his victories in the Grecian games. He died at Catana in 467 B. C.

Hiero II., king of Syracuse, was the illegitimate son of a Syracusan noble, Hierocles, who claimed descent from Gelon (see Gelon). His birth must have taken place before the year 306 B. C. On the departure of Pyrrhus from Sicily (in 275 or end of 276 B. C.), the Syracusan army and citizens alike marked their approval of Hiero's military and popular qualities by placing him at the head of the troops, and he materially strengthened his position by marrying the daughter of Leptines, the leading citizen. A body of Campanian mercenaries, who had been employed by King Agathocles of Syracuse, had taken the designation of Mamertines, and occupied Messana. From this stronghold they harassed the Syracusans. Hiero led his army against them, and in the engagement that ensued he abandoned to the enemy his mercenary troops, whose fickle disposition he distrusted, and retreated with the rest of his soldiers to Syracuse. There he raised a native force, with which he drove the Mamertines into the corner of the island, defeated them in a pitched battle, and was prevented from capturing Messana only by Carthaginian interference. His grateful countrymen then chose him king (270 B. C.). In 264 he again returned to the attack, and the Mamertines called in the aid of Rome. Hiero at once joined the Punic leader Hanno, who had newly landed in Sicily; but being defeated by the consul Appius Claudius, he withdrew to Syracuse. Pressed by the Roman forces, he was in 263 compelled to conclude a treaty with Rome, by which he was to rule over the south-east of Sicily and the eastern coast to Tauromenium. From this time till his death in 216 he remained the fast friend of Rome, rendering frequent and valuable service during the First Punic War by supplying men, material, and provisions. Presents were sent him in acknowledgment of these good offices; but the strong desire of the Romans to occupy Sicily prevented his receiving any accession of territory at the close of the war. When the Second Punic War broke out, he was faithful as ever, joined his fleet to that of Sempronius, and offered supplies of food and clothing. At home, he was a wise and just ruler. He retained the republican senate, and governed as a constitutional monarch. Munificent in his gifts to foreigners—witness his presents to Olympia, to the Rhodians, to King Ptolemy, and above all to the Romans—and in the erection of public buildings within his own domain, he was exceedingly simple in his personal tastes; he wore a citizen's dress, and was not attended by guards. So wise were his financial arrangements that they were retained by the Romans after the reduction of Sicily. He kept up a powerful fleet for defensive purposes, and employed his famous kinsman Archimedes in the construction of those engines that, at a later date, played so important a part during the siege of Syracuse by the Romans. His only son, Gelon, predeceased him, and he was succeeded by his grandson Hieronymus.

HIEROCLES, a Roman proconsul, first of Bithynia and afterwards of Alexandria, flourished during the reign of Diocletian (284–305 A. D.), and is said to have been the instigator of the fierce persecution of the Christians under Galerius Cæsar in 303. He was a man of considerable intellectual culture, and wrote a work entitled *λόγοι φιλαλήθεις πρὸς τοὺς Χριστιανούς* in two books, in which he endeavored to persuade the Christians that their sacred books were full of contradictions, and that in moral influence and miraculous power Christ was inferior to Apollonius of Tyana. For our knowledge of the nature of this treatise, which has not come down to our times, we are dependent on Lactantius (*Instit. Div.*, v. 2), and still more on Eusebius, who is the author of a refutation entitled *ἀντιῤῥητικὸς πρὸς τὰ Ἱεροκλέους*.

HIEROCLES, a Neo-Platonic writer of the 5th century A. D., was apparently a native of Alexandria. He was born most probably about the beginning of the 5th century, studied under the celebrated Neo-Platonist Plutarch at Athens, and taught for some years in his native town. He seems to have been banished from Alexandria and to have taken up his abode in Constantinople, where he endured some persecution for his religious opinions. His death must be referred to the closing decade of the 5th century, probably about 490. The only complete work of his which has come down to us is the commentary on the great Pythagorean *Carmen Aureum*, but several other writings, specially one on Providence or Foreknowledge, are quoted or referred to by Photius and Stobæus. The commentary contains several remarkable utterances, and is written with much elegance. Philosophy is there regarded in its practical aspect, as a discipline for purifying or elevating the mind by inculcating virtue and leading to truth. The most curious doctrines contained in the work are those bearing on providence and the human soul. The activity of the Divine Being, the supreme God, although eternal and all-reaching, is viewed as extending specially or immediately only to spiritual existences, or rather to the genera of such existences. The individuals are not directly the objects of divine operation, but are left to natural chance or law. In more modern phraseology there is only, according to Hierocles, general, not particular, providence. As against divine foreknowledge, perfect freedom of individual will is maintained. All that is preordained is but the connection between volitions and their natural consequents. As regards the human soul, the teaching of Hierocles in the main resembles Neo-Pythagoreanism. He states the doctrine of transmigration and pre-existence, holds that there is an ethereal body which is purified by trial along with the soul, and regards the world as the means by which judgment upon the past actions of the individual spirit is carried out.

The earliest edition of the commentary is the Latin translation by Aurispa in 1474; the Greek text was first given by Curterius in 1583. The fragments of the works on Providence and Fate were published in 1593 by Morellus. Later editions of all that is preserved appeared in 1654–5, 1673, and 1709. The commentary alone has been edited by Ashton (1742), by Wolf (1710), by Gaisford in his edition of Stobæus (1850), and finally by Mullach (1853). The jest-book entitled *ἀστεῖα* (edited by Schier, 1768, and Eberhard, 1869), though frequently attributed to this author, is certainly the work of a later hand. The most complete information regarding Hierocles is to be found in Mullach's edition, and in the relative portions of his *Fragmenta Phil. Græcorum*, 1860, i. 408 *sq.* *Cf.* Zeller, *Phil. d. Griechen* (2d ed.), iii. 2, pp. 681–7.

HIEROGLYPHICS. — Introduction. — The term hieroglyphics is used, with others, by Greek and Latin writers to describe the sacred characters of the ancient Egyptian language in its classical phase. It is used by the moderns for various systems of writing in which figures of objects take the place of conventional signs. This article is limited to an account of Egyptian hieroglyphics, with some notice of the derived systems called hieratic and demotic.

It is no longer necessary in an article like the present to give a history of the interpretation of hieroglyphics and a sketch of the grammar of ancient Egyptian. What students need is a statement of the main results as to the Egyptian characters themselves and a systematic bibliography.

The written language of the ancient Egyptians remained the same from the date of the earliest monuments (Third Dynasty) until the age of the Ethiopian kings (B. C. cir. 700), when a vulgar dialect expressing the common speech is first found in written documents. Then, if not earlier, the older phase of the language became the classical Egyptian, sometimes called the sacred dialect, to distinguish it from the vulgar dialect. The classical Egyptian was used almost as late as the fall of paganism generally for all documents but legal and commercial ones, for which the vulgar dialect was used.[1]

It is necessary to observe that although Egyptian is not proved to be a Semitic language, it contains in its oldest known form undoubted Semitic elements, both in structure and roots. The constant comparison with the Semitic languages which is here necessary is therefore not merely employed for the sake of the analogies that may be discovered, but on the ground of partial affinity, which, however, must not be strained.

It must also be borne in mind that the grammar of ancient Egyptian is in its infancy. We know many of its principal facts, but we do not know them accurately. For instance, we know the forms of many tenses of the verb, and can perhaps place these tenses in groups, as past, present, and future, but we cannot define the different senses of the various tenses of each group. Similarly, in Coptic we do not always know the shades of difference within a group of tenses. It may be that in Coptic these shades have disappeared through the decay of the language, but it would be rash to affirm this of the classical Egyptian. Thus this essential part of the grammar will not be understood until the verb has been thoroughly worked downwards from the oldest texts through the classical language, then through the demotic, and then the Coptic, and again in inverted order from the Coptic upwards. The same labor has to be performed for the whole grammar in each of the three phases of the language, before we can speak with any certainty of Egyptian grammar. This is said in no disparagement of the admirable work already done, but as a necessary caution to the student.

The following sections are abridged (to p. 720, end of section on "Secret Writing"), with additions and modifications, which are noted by their being included in parentheses, from M. de Rougé's *Chrestomathie Égyptienne*, Abrégé Grammatical.

The Systems of Writing.

The elements of Egyptian writing are composed of a certain number of actual objects, natural or artificial, imitated by drawing or engraving.

Egyptian writing falls into three systems—(1) hieroglyphic, (2) hieratic, (3) demotic or enchorial, the hieratic being a simplified form of hieroglyphic, and the demotic of hieratic. The complete designing of hieroglyphics required skill and time. They thus came to be reduced in writing to the simplest forms which retained the leading characteristics. These were called by Champollion linear hieroglyphics. The linear forms not lending themselves with sufficient readiness to very rapid writing, a further abbreviation was made, by which the forms became almost conventional, — the original type usually ceasing to be immediately recognizable: this cursive system Champollion called hieratic. The demotic writing is a new abbreviation of the hieratic: it gradually departs so far from the original types as to appear to consist of arbitrary signs.

Hieroglyphics are written either in horizontal lines or vertical columns, and are ordinarily read from the right. The heads of animals and the like show from what direction to begin reading. Hieratic and demotic are written from right to left in horizontal lines. In very early times hieratic is sometimes written in vertical columns.

(The hieroglyphic is a lapidary system, the hieratic and demotic purely systems for common writing. Consequently the hieroglyphic is the most difficult of the three to read, as the engraver or painter paid great attention to the symmetrical appearance of each group of signs, and grammatical forms were hence often omitted. In hieratic and demotic the signs follow each other without interruption of the natural order, and the grammatical forms are usually given, and even more fully.)

Characters in Relation to their Use in Writing.

Egyptian writing is composed of a mixture of signs of two distinct classes—(1) ideographic, each sign representing an idea; (2) phonetic, representing a sound, either (α) a simple articulation (alphabetic) or (β) a complete sound, *i. e.*, a complete syllable (syllabic). The two classes were combined according to fixed rules in writing words.

Ideographic Signs.

This class may be best divided into (α) representative signs and (β) symbolic (tropical).

The representative signs exactly express the idea of the object of which they present an image, as a star.

The symbolic (tropical) signs represent an idea by he aid of certain analogies which the mind sees between the symbol and the idea attached to it. A simple symbol presents a single object, as the sun ⊙, when used in the symbolic sense "day." A symbol is complex when uniting more objects than one to convey to the mind a single idea, thus a star suspended beneath a celestial vault represented "night." Under complex signs should be placed figures of divinities in which the human form has special headdresses or insignia.

The value of ideographic signs may be discovered in various ways. The representative signs only need that the thing represented should be determined. The symbolic signs are often (rather, sometimes) explained by classical authors; they may also be explained by careful study of bilingual documents, as the Rosetta Stone (and the Decree of Canopus). The sense, and more certainly the reading, can be discovered by an exact knowledge of the words written by phonetic combined with ideographic signs, and above all by the variants allowed in writing the same words with signs of different classes.

(The result may be thus tabulated:

Ideographic Signs.		Phonetic Signs.	
Representative.	Symbolic.	Alphabetic.	Syllabic.

Dr. Brugsch in his *Gram. Hiér.* (p. 3) gives the following scheme:

Phonetic Signs.		Ideographic Signs.	
Alphabetic.	Syllabic.	Special.	General.

Here the ideographic signs are classed, not according to their nature but according to their use, which will be later noticed. M. de Rougé's seems the more logical classification.)

Phonetic Signs.

As the phonetic signs represent either (α) a simple articulation or (β) a complete sound, *i. e.*, a complete syllable, the hieroglyphic method comprehends (α) an alphabet and (β) a syllabary.

Champollion held that the alphabet originated from giving to each object the phonetic value of the initial of its name: thus the mouth "ro" would become "r." This probable principle cannot now be tested for a great

[1] As early as the time of the Empire differences of dialect due to difference of speech in Upper and Lower Egypt had crept into correspondence (Brugsch, *Gram. Hiér.*, 93). Ultimately vulgar forms and constructions are distinctly traceable in the sacred language (Id. l. c.; cf. Id., *Geogr. Inschr.*, i 94, 95). There are also natural changes due to development or decay or both, and artificial changes due to fashion. Modifications of grammatical forms and the growth of style are instances of natural changes, and the direct borrowing of Semitic words by the scribes of the Ramessides, and, what is still more remarkable, the actual Semiticization of Egyptian words, are examples of artifical changes (Maspero, *Hist.*, 337, 338).

part of the alphabet, probably in consequence of the loss of many archaic words.

The alphabet of the Greek and Roman periods presents a great number of homophones for each articulation. The more we advance towards antiquity the more the method simplifies, and the alphabet of primitive times admits but a very small number of homophones. Dr. Lepsius (*Lettre à Rosellini*) first scientifically treated this distinction.

Articulations of the Egyptian Language.

The determination of the exact number of articulations which the scribes distinguished in the Egyptian language presents great difficulties. Comparison with the articulations of languages which occur in bilingual texts cannot give sufficiently precise results, for the shades of sound are far from being the same in the languages thus placed in juxtaposition. The Romans and Greeks had many letters which, though quite distinct in their languages, the Egyptians confounded in their transcriptions. On the other hand, there were some Egyptian articulations preserved in the Coptic language which had no special representative in Greek or Latin; hence certain letters derived from the demotic were added to the Greek alphabet on its adoption by the Copts. (It must also be remarked that the Greek and Roman rule was an age of literary decay and ruin for classical Egyptian, in the depression of which little effort seems to have been made to represent accurately foreign sounds. The student must not be misled by the greater accuracy at this time in rendering the vowels, which was merely due to the decay of the system of writing, by which the Egyptian vowels usually following certain consonant signs came to be disregarded.) Happily those Egyptian articulations which were unknown to the Greeks and Romans have at least analogues in the Semitic languages. Moreover, the many transcriptions of Semitic words (made while the Egyptian was in full vigor), joined to the traditions of the Coptic language (which has ceased for a hundred years to be a living speech), enable us to appreciate sufficiently those articulations unknown to the Greeks and Romans (and this indication may be followed in the cases of the rest of the letters).

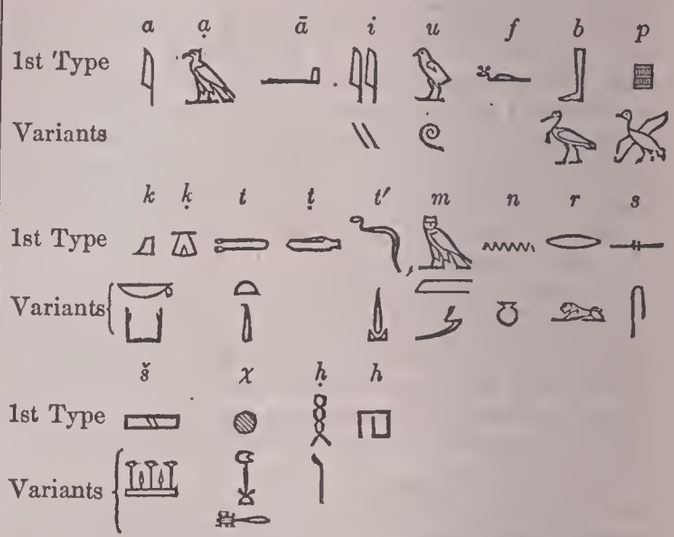
The words common to Egyptian and Semitic in the earliest known condition of the Egyptian language must be omitted from comparison; the more exact transcriptions of the scribes of the Ramessides (Dynasties XIX., XX.) must take precedence of the looser ones of the earlier period of the Empire (Dynasty XVIII.). Coptic, having long existed in a languishing state and under the influence of Arabic, whence the coloring of the latest dialect, the Bashmuric (Revillout ap. Rossi, *Gram. Copto-Ger.*, 30, n. 1), and certain peculiarities of the present pronunciation, is not an absolutely safe guide.

It might be thought that the study of the various modes in which words are written would furnish an exact table of homophones, and give us at once the list of distinct articulations; thus we might suppose that variants showing two characters might enable us to assume their identity, as when in reading Greek we assume that θ is the same as ϑ. But in Egyptian, as in other written languages, there are certain licensed irregularities of orthography, and also oscillations between the different shades of sound in the same class of letters when used for the same word: a small number of variants between two letters therefore does not prove their perfect homophony. Hence certain differences of opinion among Egyptologists, according to the weight, greater or less, which they give to this or that series of variants. Thus the number of letters under the "t" group differs with different scholars.

Without denying that there may have been some shades of sound in the different signs here called homophones, as in the sounds represented by the English "th," the chief guide should be the estimate the Copts made of the elements of their language, when they adopted the Greek alphabet, completing it for their purpose by adding six special letters taken from demotic writing.

The Egyptian Christians in adopting the Greek alphabet, which had vowels with fixed sounds, made their writing undergo a radical change: up to that time they had only vague vowels which were, as in the Semitic alphabets, simple aspirations, susceptible of being colored by the sounds of different vowels (but this vague character must be limited by the vowels falling, as in Semitic, into three groups of sounds; the vagueness was therefore not unlimited. This characteristic of the old Egyptian influenced the Coptic, which presents in the vowels varieties of orthography of the same word, these varieties, however, usually falling within the three ancient groups. It is only in the Coptic helping vowel that absolute vagueness is found, like that of the primitive "shĕva" of Hebrew).

Following these indications we find 15 leading articulations in Egyptian: The shades of sound which may be most certainly distinguished would indicate an alphabet of 21 divisions. They are transcribed by letters taken, one, χ, not to be confused with the Coptic ⲭ, excepted, from the Latin alphabet, according to the principles of the Standard Alphabet. Cf. Lepsius, *Standard Alphabet*. The simple letters used by the Egyptians in the earliest times to write these articulations are as follows:



During the Pharaonic periods ten homophone letters were added: one is very ancient; some appear under the Ramessides; others under the Saïtic Twenty-sixth Dynasty. Probably they were introduced in order to render it easier to fill spaces in sculptured inscriptions.

It must be observed that all simple letters can in writing radical forms be replaced by syllabic signs.

These articulations have now to be examined under natural classes: their interchange has to be noticed, their use in the transcription of Latin, Greek, and Semitic words, and the rules according to which Egyptian words are transformed into Coptic words in the two chief dialects, the Sahidic and Memphitic. (This branch of the subject is of great importance for comparative philology, as our endeavor should be to ascertain as nearly as we can the fundamental sounds of ancient Egyptian, and then to compare these sounds with those of languages to which it has relation.)

Soft Aspirate and Vague Vowels.

The Egyptian vowels have two distinct uses—(1) as aspirates, or initials in the syllable, and (2) as vague vowels, either final or medial.

The Copts have marked no difference of aspiration between the initial vowels of syllables in their language, which correspond to ancient words beginning with , , or .

When these signs are employed as vowels, or "matres lectionis," it does not appear that one of them was used by preference for one sound more than another: they remain vague in the full force of the term. This vague "a" is unlike the ʾ of prolongation of the Arabs, which (though otherwise susceptible of being colored by all the vowels) then becomes a true *a*. (Notwithstanding this vagueness it is safest to transcribe this group by *a*, as there were special signs for the semi-vowels *i* and *u*, and the helping vowel which we write *ĕ* was not written. The *a* must, however, be considered a symbol, vague to the extent of the Hebrew א when not vowelled.)

The final vague vowels do not vary much between themselves in the ancient texts; the orthography of each word was very stable, and, besides, the choice of the final vowel depended much on the preceding consonant, each sign having a vague vowel which it seems to prefer. (See the Section on "Expletive Vowels and Complements of Simple Letters," and observe the usage of syllabic signs.) They sometimes interchange, and are even replaced by the vowels *u* and *i*, which as finals share their vague character. This system lasted to the latest periods of demotic writing. (Coptic shows the same instability of *a* and the kindred vowels.)

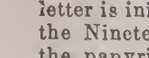
The three signs of the soft aspirate sometimes interchange: and serve equally as initials in Greek and Roman names, as well as in Egyptian words. The group of two a's, *aa*, was ordinarily written , *aạ*, and is found as variant of initial.

is used with a marked preference to transcribe the Semitic א.

On the contrary seems preferentially used to express long vowels, or such as were emphatically pronounced. In the Semitic transcriptions it corresponds habitually to ע, when that letter is initial. But it was not the same articulation. Under the Nineteenth and Twentieth Dynasties, and particularly in the papyri, a great degree of exactness was sought in the transcription of Semitic words. The scribes often then expressed the ע by the syllabic , which has the value of *ăạ*. It seems that the arm alone did not offer them an approximation which they judged sufficient.

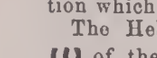
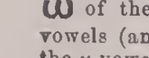
The Hebrews transcribed by ע in many words. The Ⲱ of the Copts answers oftener to than to the other vowels (and this seems a convincing proof that the signs of the *u* vowel had no stable sound.

There are also some cases of permutation between *a* and the aspirate *h*, analogous to the variants between ה and א (but we must be careful not to confound true variants with a root in Egyptian augmented by a preformative *h*).

When the vowel *a* should form a syllable by itself it is often followed by the sign , which indicates the voice, by the representation of a man, his hand to his mouth. Transcriptions of proper names thus beginning, as  , Apophis, show

a pp i

that should ordinarily be pronounced *a*.

The final vague vowels could be omitted in writing; numerous variants show there was no rule in this matter; but the hieratic preserves them more habitually. In writing the medial vowel of a syllable of two (or three) consonants, it was very ordinarily placed after the consonants and not between them; this is true of *a, ạ, ā, u, i*. Thus the name of the divinity  , χensu, is constantly transcribed by χωνς in proper names. There is a striking instance of this orthography in the word  , *ani* for *aïn*, transcription of the Hebrew עין "eye" and "fountain."—List of cities of Syria taken by Thothmes III.

U and *i* could be initial semi-vowels or vague vowels; *u* initial answers in many Coptic words to the diphthongs ⲟⲩⲱ, ⲟⲩⲉ, etc., without being followed in writing by a second vowel: here it is an initial semi-vowel. *U* necessarily carried with it its aspiration; there are some variants with the aspirate , *h*, which recalls *v*. The two signs , , interchange readily, and may be considered to be absolute homophones, but was much more frequently used in the earliest times.

U, considered as a vowel, was vague, and in a larger measure than the Hebrew ו, for we find it transcribed even by *i* and by *e*. It interchanges with *i* in Egyptian words, and sometimes even with *a*. In Hebrew we remark frequently the same oscillation between the sounds *u* and *i* in the kĕri kĕtib of the Biblical text. In Coptic this vowel has generally produced ⲟⲩ, ⲟ, Ⲱ, but very often also ⲉ and the other vowels or diphthongs; the group , *au*, answers to ⲉ, *e*, in the Coptic and the Greek transcriptions; it would be thus equivalent to אֵ in the Masoretic system.

Of the two signs for *i*, and , the second is evidently short-hand for the first. *I* initial should always be considered to be a semi-vowel with the value *ia, iu:* in this use we ordinarily find , which better fills the initial space; serves oftener for *i* vague final. Thus the verb *i*, "to go," was written with vague *a* initial for the aspirate, and , or , as final vowels , , or , the legs determining the idea of movement: it is transcribed *ai;* in Coptic ⲓ, ⲉⲓ, "to go," "come." We also find the variant , *u*, which is regular in consequence of the vagueness of the vowels. (The two forms are traceable in Coptic.) The signs and interchange as much as their forms permit, which fit very differently into the composition of groups.

I, semi-vowel, does not vary with any other letter; it is only found in a very small number of Egyptian words, but it is much used in the Semitic transcriptions; the Coptic derivations are initial ⲓ and ⲉⲓ.

I, the vague vowel, interchanges with *u* and *a, ạ, au, ai*. The Greek transcriptions oscillate principally between *i, e, ei*. The Semitic transcriptions have a much wider range, which comprehends nearly all the vowel sounds.

(The unwritten aspirate or short vowel is not noticed in this place by M. de Rougé. It will be seen, under the Section on "The Transcription of Vowels Omitted," that he does not admit the transcription of an unwritten vowel except as a makeshift, or in other words, that he does not allow the Egyptians to have had a vowel sound never written. The existence of the supposed vowel seems, however, certain on these grounds. Some syllabics never take a vowel except for an unusual form, —the root and the ordinary derivatives never being vowelled, and a vowel only appearing in what is obviously a derivative formed by lengthening the vowel. Further, the Coptic has such a vowel marked by peculiar forms \ or — above a letter, or in the latter case above a letter or syllable, indicating that the sound, here generally ⲉ, was omitted in writing by the ancient Egyptians; and still more remarkably the Coptic use is sometimes found where the older writing would lead us to expect it. In ancient Egyptian the use of this helping vowel is implied, as an aspirate in a syllable written with a consonant alone, as *n*, *m*, *r;* in Coptic ⲛ̀, ⲙ̀, ⲣ̀, and as a medial vowel in a syllable of two consonants, as *tm*, "not," in Coptic ⲧⲙ̀ⲙⲟ. In Coptic, as already mentioned, it is generally read ⲉ, ĕ, but had this been its constant sound it would have been represented by ⲉ, and would of course have been needless. It is safest to read the old Egyptian helping vowel ĕ. It resembles the Hebrew Shĕva, as including its variants Hateph-Pathah, Hateph-Segol, and Hateph-Kames.

M. de Rougé's section on this subject seems wanting in his usual clearness. This is, however, due to the inherent difficulty of the subject. The Egyptian vowels, except when used as semi-vowels, are undoubtedly vague. Thus, in the writing of Semitic words under the Ramessides, while the consonants are most carefully represented, the vowels affected by those consonants are frequently used, and the apparent pronunciation is distorted. Consequently, though we have no difficulty in separating the vowels into the *a, i*, and *u* group, adding the helping vowel, or short ĕ, because the use of the *i* and *u* vowels as semi-vowels gives them and the third vowel (*a*) thus limited a certain definite character, yet, when we have to treat of vowels pure and simple, the distinction of these classes vanishes. Thus the idea of fixed vowels, with however wide legitimate extension, is constantly rising in the inquiry to be as constantly suppressed by the vagueness of their use. It must, therefore be held that the transcriptions we adopt do not give the accurate pronunciation, inasmuch as the vowel constantly, but not always, depended upon the consonant preceding, and vowel complements are even added where they were not pronounced. This is proved by Greek transcriptions, as will be seen later. On the other hand, the vowelling of Greek and Latin proper names shows that the vagueness of the vowels was not absolute, for the Egyptian scribes in the decay of the old style, no longer bound by the ancient usage of complements, employed the vowels with such accuracy as their limitation in sounds permitted, subject to the carelessness of the age. Of course these vowels could not accurately represent the Latin five or the Greek seven. Perhaps it may be suggested, in conclusion, that some idea of the Egyptian vowel system may be formed by a comparison with unpointed Hebrew.)

Labials.

While approaching *ph* or *f*, is distinct, for the Copts who adopted ⲫ as necessary for the aspirated *p* of the Memphitic dialect, also considered the needful, of which their ϥ is the demotic sign in a modified form. In some words is employed in a variant of *u*. On account of this function it has been transcribed by *w* instead of *f*. In consequence of this use it was sometimes omitted: thus , *sni*, for , *snef*, "blood," Coptic ⲥⲛⲟϥ. (M. de Rougé calls this letter, so used, a vowel or variant of *u*, and in the example just cited characterizes it as a short vowel, but it seems more analogous to ו after a vowel, when not quiescent, in the present or ordinary Hebrew pronunciation.) In Greek words does not render ϕ; the Egyptians used either ⲡ, *p*, or the combination ⲡⲫ, *ph*. But in the transcription of Se-

mitic words we sometimes find for . In Coptic, besides , this letter sometimes becomes and .

Like the Hebrew the Egyptian *b* comprised the two shades of sound *b* and (*bh* or) *v*, at least in the less ancient periods. The Copts seem also to have known the two sounds, though their one has been generally transcribed by *v*. The transcriptions of the Greeks do not aid us, for their β was probably sounded *v*. The evidence of the Semitic words is perhaps more precise in the system of transcription of the (hieratic) papyri of the Nineteenth Dynasty. , *b*, is rendered either by *p* or by the group , *bp*; (*bh*) by alone: the ordinary sound of *b* should therefore approach *v*. In the hieroglyphics they were often content with , *b*, homophone of , for . (The weight of this reasoning partly depends upon the antiquity of the Masoretic punctuation, which is, however, supported by the double rendering of the Egyptians.)

The compound *bp*, introduced for Semitic words, is found later employed in hieratic for Egyptian words, no doubt to characterize the pronunciation *b*, , better than by alone, or the group , which serves as its variant in these same words. The signs and sometimes interchange; oftener replaces alone; they also exchange, but rarely, with *p* and *f*. The ancient *b* produced regularly the Coptic , and by affinity , , , , and .

The two signs of *p*, and , are complete homophones. The Memphitic dialect aspirated *p*, and used in many words where the Sahidic used . Here the Sahidic has been more faithful to the ancient pronunciation: in fact φ Greek was sometimes rendered by the group , *ph*, and the Hebrew by , *f*. This ancient Egyptian letter was then *p*; it also corresponds exactly to . It was further used to transcribe approximately , as already remarked.

It produced regularly in Coptic the Sahidic and the Memphitic . Affinities occasionally introduced or . The ancient *p* also presents some instances of varying with *b*.

Palatals.

This class of letters lends itself to great varieties of pronunciation which render them difficult to understand; it is in their nature to modify themselves considerably by the simple change of the vowel which follows them. The Greek and Roman transcriptions would lead us to consider the four signs , , , and as perfect homophones. But we are led to another opinion, if we consider the transcriptions of Semitic words, and the Coptic derived words.

The Semitic transcriptions afford the following results: 1, and (answering to) (*gh*) are almost always rendered by ; 2, corresponds to , and to ; but this second rule is not so faithfully observed as the first.

In the Coptic language there are here two distinct types: 1, K Sahidic, aspirated as in the Memphitic; 2, Sahidic corresponding to Memphitic, but sometimes identical.

Taking the Copts as guides we distinguish two palatals, which we mark as *k* and *ḳ*. did not exist in their writing, but in some rare cases which do not correspond to a special ancient letter: in a small number of words where it is derived from , *k*, it is produced by the presence of the nasal which precedes; thus , I, from .

In studying more closely the three signs , , , we are easily convinced of the perfect homophony of with . The equality of and may seem more doubtful; variants exist, but they are not frequent. However, we find the group , where the first letter only doubles the second, as we have seen in the group , and we are thus authorized to connect intimately , , and , and transcribe them by *k*.

To this articulation correspond regularly, in Coptic, K Sahidic and Memphitic, and less frequently, and as rare exceptions.

The rule of derivation is different in what concerns , and it is there above all that we recognize the distinct type preserved in the Coptic . The sign , which we transcribe *ḳ*, shows some ancient cases of variants with the preceding signs, and the Greek transcriptions do not give us sufficient reasons for making a distinction. The Semitic transcriptions are more decisive; the , as already noticed, is quite specially set apart to render , and answering to . The Coptic derived forms strengthen this first result; they quite regularly class themselves under the Sahidic , answering to the Memphitio , or under the in both dialects. The exceptions are as follows, in order of frequency:—1, Sahidic, K Memphitic; 2, K Sahidic, Memphitic; 3, K in both dialects; 4, Sahidic, Memphitic.

The graphic origin of the Coptic is doubtful. It is incorrect in our judgment to derive it, as hitherto, from the demotic , coming from , hieratic of : the suffix of the second person K has been rendered as far as the latest periods, almost contemporary with the Coptic, by this demotic sign; consequently we ought to find it in Coptic under the form if this letter came from that sign; on the contrary, K is used for this pronoun. may have come from the demotic form of , through the hieratic.

Dentals.

The exact appreciation of the Egyptian dentals is hard. It seems certain that the three homophones , , , answer to a *t*, and that , , are represented in Coptic by the special articulation . The sign seems to have the character of an intermediate shade of sound. In the Greek and Roman names, τ, θ, and δ are transcribed by all the signs without distinction (the Roman being transcribed through Greek forms). In the Semitic transcriptions and are rendered by , , , and more rarely ; is transcribed by with a marked preference; and answer exclusively to and its homophones (including a later sign).

The Coptic offers two certain types, , becoming Memphitic and ; the trace of a third variety seems also preserved in the syllabic . We are thus led to distinguish three consonants *t*, *ṯ*, and *t'*.

The three signs , , , *t*, conduct themselves as perfect homophones. The Greek and Roman names show them to be used for τ, θ, δ; but the hierogrammats when they sought a more scrupulous transcription of θ used the group , *th* (cf. , *ph*), which shows that originally the Egyptian *t* did not lend itself to the aspirated sound. The Leyden MS. with Greek transcriptions thus places θαν in correspondence to an Egyptian word written *Ṯaḥan*, in which the first *a* is a "mater lectionis," of no value in pronunciation. In Semitic words , , , served to transcribe regularly and , sometimes also , but more rarely.

We observe no preference for transcriptions of ; this letter, which is not frequently found, corresponds even to , *ṯ*, in the name of Potiphar. We may conclude that the special sound of the had no existence in old Egyptian. The Coptic derived forms have but one type for and its homophones; the Memphitic aspiration changes it to ; following the rules of affinity we find some cases of derivation with .

We pass at once to the third dental, *t'*, of which the differential characteristics are more marked; perhaps the intermediate consonant may be more easily defined afterwards. The two signs, , , which we transcribe *t'*, interchange in many Egyptian words; they are both varied with the very common syllabic , *t'ḳ* (which became an alphabetic sign though retaining its vowel, like our *q*); they act in exactly the same manner in the transcriptions and in the Coptic derived words. The hierogrammats employed them, but very rarely, to transcribe the Greek τ and δ, and the Greeks felt some difficulty in transcribing this articulation; thus we find *t* rendered by τ and δ, or by σ; thus *Sa-n-t'aḥo* is rendered by Sensaos, and *Ḥar-ant'-atef* by Arontotes and Arendotes.

In the cartouche of Cambyses the Persian articulation *z*, *j* of Rawlinson, , is found; it is transcribed by , *t'*, but not constantly; variants show a simple *t*, . Therefore there was not a perfect identity between the Egyptian *t'* and the Persian *z*. The Hebrews had two sibilants more or less

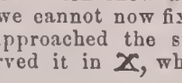
shading off into cerebrals, ⲓ and ϫ; they are constantly transcribed by ⲧ, *t'*, and its homophones, and not by *t*; but we do not remark a preference in favor of this or that sign for either of the two Semitic letters, and this confusion shows that there was but an approximative correspondence.

The Coptic derived forms from the ancient *t'* are classed according to two rules:—they are written either (1) with ϫ in the two dialects, or (2) with ϫ Sahidic, corresponding to ⲥ Memphitic,—the dialect of Upper Egypt showing a higher exactness. The exceptions show us—1, ⲧ Sahidic, ⲑ Memphitic; 2, ⲥ Sahidic, ϫ Memphitic; 3, ϣ; 4, the palatals; *i. e.*, all the letters which show a kind of affinity with this dental, of which we cannot now fix the pronunciation beyond saying that it approached the sibilants and the cerebrals. The Copts preserved it in ϫ, which comes from the hieroglyphic , through the hieratic , becoming in demotic : this was developed and made regular by the Copts. The Copts cannot now give precise information as to the pronunciation of ϫ; in the last century, an attempt was made to indicate it by *sj*. Dr. Brugsch proposes for the ancient letter *z*, and Dr. Birch *j*; it seems to us that the conventional *t'* is more suitable to the Egyptian variants of the articulation, which constantly make it approach , *ṯ*.

In the eyes of the ancient Egyptians the letter , *ṯ*, was a near neighbor of ⲧ, *t'*; it could even be considered as a homophone if we had only the evidence of the variants; for variants between ⲧ and are numerous, and found in the earliest texts. The variants between and , , , are rare enough, and belong above all to the late periods. But the Semitic transcriptions indicate the principle of a distinction. Far from using it to render ⲓ and ϫ, is connected with ⲧ with a very marked preference. From the Nineteenth Dynasty, when the system of these transcriptions appears to have been made regular, on account of the many relations established with the neighboring nations by conquests and emigrations (into Egypt), this preference became so constant that it led Dr. Brugsch to transcribe by a *d*.

The exceptions to this rule place the beside ⲃ and ⲡ, rather than the cerebrals.

In Coptic the derivatives of , *ṯ*, do not act like those of ancient words usually written with *t'*. We find the derivatives of regularly under the dentals ⲧ, ⲑ, ⲇ, sometimes also under ϫ, but in very small number. The verb *ṯu*, "to give," ordinarily written , becomes in Coptic ⲇ. This sign, which the earlier Copts pronounced *di*, was considered a simple ligature for ⲧ and ⲓ. But Dr. Brugsch has remarked that ⲇ resembles the demotic , corresponding to , "to give," too much for the likeness to be due to chance; there was here a recollection of the softened sound peculiar to , and the Copts took the ⲇ from demotic with their other special letters.

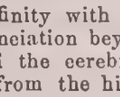
Evidently these two groups of documents may induce us to mark the as a special letter, but this letter could not be a *d*. In fact, the Copts excluded ⲇ from their native words, and the hierogrammats indicated that the was not a true *d*: when they would transcribe more exactly the Latin *d*, which they found in foreign names, they employed a double letter, *nt*. We notice this in variants of the cartouche of Darius for the Persian *d*, and for the Latin *d* in the surname  , *nt(a)kik(u)s*, for Dacicus, inserted in the cartouche of Trajan. This wholly artificial orthography aids us to appreciate a peculiarity of the Egyptian dentals, that after the nasal the pronunciation softened in the direction of *d*. This explains many Greek transcriptions which show the δ, as Ζβενδετης, which represents *Nes-bi-n-ṭeṭ*.[1] The *d* being out of the question we select *ṯ* as near the point of view of the Egyptian variants where replaces ⲧ.

Liquids.

The three signs , , and exactly answer to *m*; the transcriptions are uniform, always μ Greek and מ Semitic.

[1] Cf. the Gnostic word Sabitat, which does not differ from the other but by the absence of the flexion *n*, and retains the *t*.

The Coptic derived forms are almost always ⲙ, some rare exceptions presenting ⲛ, ⲃ, ⲡ. One must be very careful in Coptic not to confound a radical ⲙ with that which comes from ⲛ by assimilation before a labial, as in the Sahidic particle ϩⲙ, coming from ϩⲛ, "in," before the article ⲡ. It is also to be remarked that one often finds in Coptic the ⲙ added to an ancient root as a kind of final, which slightly modifies its signification: thus, ⲟⲩⲱϩ, "to add;" ⲟⲩⲱϩⲙ, "to repeat;" ⲥⲱⲣ, "to strew;" ⲥⲱⲣⲙ, "to wander," etc. (cf. also the Hebrew ם added to the root). This peculiarity has not yet been noticed in the ancient language.

N was regularly transcribed ⲛ and ⲁ; an undoubted exception shows the change of ל into *n* in the word  , *Ṣanaḥem*, "grasshopper," סְלְעָם. The example justifies us in searching for ל under the transcription *n*, which is more easily explained as the ancient Egyptians originally had not any sign to express the articulation *l*.

The Coptic ⲛ transcribes the ancient *n*, but in course of time the liquid *l*, ⲗ, had gained a footing in the pronunciation; a part of the Coptic words in which it figures derive it from the ancient *n*; thus, , *nes*, "tongue," became ⲗⲁⲥ.

The nasal presents many peculiarities worthy of remark in the Egyptian writing and language. It influenced certain consonants, in the direction of modifying the pronunciation; thus it softened *t*, as in the group *nt* for writing *d*. The *s*, preceded by a nasal, seems to have been also analogously modified; for the Greeks transcribed the particle , *nes*, which begins certain proper names, by *z*, as we have seen in Ζβενδετης. The similar action of *n* on *k*, which was thus modified enough for the Sahidic dialect to have sometimes rendered it by ϧ, has been previously observed. *N*, as already remarked, sometimes became *l*, the Coptic ⲗ; the combination *nr* must have more frequently given occasion to the pronunciation *l* through the softening of *r*; *nr* is often written , where represents a sounding *n*. The group , which has the value *na*, is a syllabic: the *a* is of no force in the pronunciation. In illustration of the modification of *nr* (where the *n* was originally sounding), the Coptic root, ϧⲟⲗ, "outside," may be cited; it comes from the Egyptian , *bunar*, of the same sense.

The Egyptian grammarians evidently considered the nasal a simple accident of the vowel, to be indicated or omitted at will in writing: thus the same person's name is written *kanra*, and , *kăra*. In such cases a bar above the vowel may be used to note the omission of the nasal. Thus the particle may be transcribed *q̃*, when we find it written under the form , which it would be difficult to recognize without this note in transcription. The examples of this curious peculiarity are frequent; it is a grammatical view analogous to the "anusvara" of the Indians; it is known that the omission of the nasal has also been remarked in the ancient monuments of classical epigraphy.

The Egyptians used very readily the nasalized vowel: they sometimes introduced it into Semitic words which they adopted, or even only transcribed: thus they wrote , *Šašanḳ*, the name of the king called in the Bible שִׁשַׁק, *Šišaq*, a name apparently of Semitic origin. (Here the nasal helps to express the sound of the Hebrew ק.)

The Coptic possesses the two letters ⲣ and ⲗ; it is difficult to ascertain if the ancient dialects of the Egyptian language knew the distinction of these two liquids, but it is certain that the hieroglyphics admitted but one type, represented by the signs and , which serves indifferently to transcribe ρ and λ Greek, and ל and ר; only at certain times we remark a preference given to the lioness for transcribing *l*, but without regularity, and it is not until the last stage of demotic

writing that the letter derived from this sign seems to attach itself regularly to the liquid *l*. In Egyptian words is rare; it is sometimes joined to , as a doubled letter , like the groups , , etc. It is frequently employed in the transcription of Semitic words. In the Bible the Egyptian liquid is rendered by ר in all the words given, never by ל: thus the ancient articulation was *r*.

The Coptic derived forms are divided between ⲣ and ⲗ.—See also above for the combination *nr*.—The Bashmuric dialect is characterized above all by the exclusion of ⲣ (and use of ⲗ in its stead, from the influence of Arabic).

This liquid approached the semi-vowels in its nature; hence it was sometimes permissible to omit it in writing, like the nasal: thus , *ka*, for , *kar*, , *nes*, for , *neser*, "flame." By a frequent exception final *r* (and *l* in Bashmuric) is obliterated in Coptic words; thus the particle , *er*, has become ⲉ.

Sibilant.

The two signs for *s* are homophones. The Greek transcriptions have always σ, and the Semitic render *s* by ס or שׂ; an exception which is common enough makes the Egyptian *s* equivalent to שׁ, but probably this is only apparent. We know how easily the pronunciation varies between *s* and *š* in the Semitic languages. The celebrated story of the word Shibboleth שִׁבֹּלֶת (Judges xii. 6) shows that even among the Hebrews the pronunciation varied according to the tribes. The pronunciation of Ephraim, which doubtless followed that of the different peoples situate north of Palestine, shows why we find sometimes an Egyptian *s* in relation to שׁ Hebrew, particularly in the names of Syrian towns or nations. (This should be qualified, for Ephraim was in middle rather than northern Palestine, and it is possible that שׁ was always anciently *sh*.) The Coptic derivatives of the Egyptian *s* fall under ⲥ, but there are many exceptions to this rule, the ancient *s* sometimes becoming ϣ, and more rarely ⲥ; it seems to have passed into ⲧ in some roots. We also find the sibilant written in Coptic MSS. by ⲍ; but the instances are so few as to be unauthoritative. It has been already remarked that ζ was used by the Alexandrian Greeks to transcribe the combination *ns*.

Hushing Letter (*Chuintante*).

(The term M. de Rougé uses is important as distinguishing this letter from the sibilant. We can only suggest the English "hushing" as here equivalent.)

The letter *š* (*ch*, French) having no representative in the Greek alphabet, the Copts preserved the demotic , regularized as ϣ: it comes from the hieratic , hieroglyphic . Tho Greeks ordinarily rendered *š* by σ, sometimes by χ and σχ. The exact sound of *š* is found in Persian and the Semitic languages; it is constantly rendered by in the names of Persian kings; we also find in the cartouchos of Darius and Artaxerxes. For the Hebrew שׁ we find equally a little oftener than .

The Coptic derivatives are very regular; thoy use ϣ; some exceptions show the ancient *š* passing into ϫ, ⲥ, and rarely ⲍ, and ⲧ.

The transcriptions and derivations show us that from a very ancient time and were homophones; but perhaps we cannot affirm that it was so from the origin of Egyptian writing. Dr. Hincks conjectured that had the value of σχ. This idea rests on—(1) the fact that presents a certain number of variants with , χ; (2) that it seems to double itself with an initial *s*, without change of value, so that we sometimes find instead of alone. On the other hand, there has not yet been noted a variant between and . It is then possible that primitively marked some intermediate shade of sound of which the trace was afterwards lost in pronunciation. Perhaps we may attribute to this oscillation the most ancient orthography of *seχa*, "to write," Coptic ⲥϧⲁⲓ, which in the earliest times was written . The sign in question must, however, be classed as homophonous with .

Aspirated Guttural.

The aspirated guttural, here rendered by the Greek χ, is represented in the alphabet by and . These letters sometimes interchange, and are found grouped as a double letter , a reduplication analogous to those noted above. is a third homophone, of a little rarer use but very old. The Greek transcribed this aspirated guttural by χ; this was but an approximate value, for the Copts, who adopted the ϫ for the aspiration of ⲕ in the Memphitic dialect, judged it necessary also to take their ϧ from the demotic alphabet, in which the represented , hieratic of . It was used side by side with χ and in the same dialect. The Copts noted carefully shades of sound which appear to us very near.

Tho cartouches of the Persian kings render the Persian *kh* by and by ; these two signs answer to ח of Hebrew words, but we must here draw a distinction. We know that the ח comprises two shades of sound which Arabic distinguishes by ح, خ; the hieroglyphic transcriptions establish the antiquity of this distinction in the pronunciation; for they render the ח sometimes by or , the Egyptian χ, and sometimes by , *ḥ*, as will be shown later.

The Coptic derivatives of the ancient χ are of two classes. In tho first the Memphitic dialect faithfully observes the ancient orthography, preserving the ϧ; we find in the same words a Sahidic ϩ. In a second class of words the ancient χ is softened, and we find a ϫ in the two dialects. The exceptions, conforming to the laws of affinity, are the Memphitic ϫ, the ⲥ, and the ⲕ.

Aspirates.

Tho Copts borrowed but one aspirate, ϩ, from the demotic alphabet. The Semitic transcriptions indicate, however, two shades of sound, at least as marked as those which are found in French in the letter *h*. The Greeks, who had lost the habit of writing the aspiration H of their ancient alphabet, equally omitted (in most cases, but note Ὧρος as well as Ὡρος for *ḥer*) to transcribe the Egyptian *h*, at least when they had not occasion to indicate it by an aspirated letter, as φίβις for *p-hib*, "the ibis." As to the hierogrammats, they sometimes used their *h*, , to indicate the breathing at the beginning of Greek words which they transcribed, or in seeking to render aspirated letters by the combination *ph*, , *th*, , for φ, θ.

The Hebrew ה, as already stated, answered to two shades of sound; these also existed in Egyptian, so that the Semitic transcriptions take the following progressive order: 1, ה = , *h*; 2, ח, = , *ḥ*; 3, ח, خ, = , χ. It is therefore needful to distinguish these two aspirates in the point of view of the transcription of foreign (Semitic) words, for they have a considerable importance for the determination of these words. The distinction of , *h*, and , *ḥ*, the latter being a strengthened aspirate, would be less useful for Coptic, for this distinction had been lost, the Copts having taken from the demotic the sign of the strong aspirate ϩ, coming from , hieratic , demotic .

The Coptic derivatives have almost all preserved faithfully the ϩ in tho two dialects. The exceptions are rare; they introduce the Memphitic ϧ, the ϣ, and tho ⲕ; it is also possible for the aspiration to be obliterated and the Coptic to present an initial vowel. The rare variants which may be remarked in the Egyptian texts between the aspirates and the other letters are limited to χ, or to tho initial vowels.

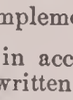
Syllabic Signs.

An ideographic sign could be employed in four different ways. Of this the sign , the symbol of "life," may be taken as an illustration.

1. It could be used alone, , to indicate the idea of "life" and the different words conveying this idea ("life," "to live," "living").
2. The same sign could be written after the phonetic

expression of one of the words signifying life, thus , *ānχ*, Coptic ⲱⲛϧ, "life." Here the sign takes no part in the pronunciation; it simply determines the idea which we should attach to the word *ānχ* preceding it: in this use it is called, following Champollion, a determinative.

3. The same sign could be accompanied by all or by a part of the letters used to write the word *ānχ*: the letters thus used have been termed phonetic complements: their choice (as to number) is ordinarily ruled by the necessities of design, in which the squareness of the group was much considered. Thus we find ordinarily , with the second and third complement; but and would be equally in accord with rules. A group of this kind is said to be written in the mixed manner.

4. The same sign, once attached to a word such as *ānχ*, could be used in writing for the phonetic value of this word with a complete loss of the primitive sense. This is exactly a rebus in principle. Thus , *ānχ*, "ear;"  , "oath," Coptic, ⲁⲛⲁϣ. A determinative often indicates to the reader, as in the first example, this radical change in the use of the sign. In this case the sign is said to be employed as a syllabic. (The Assyro-Babylonian syllabary is remarkable as affording a double system of this kind, arising from the original Akkadian sounds of a sign and the later Assyro-Babylonian ones. The difference is in the extensive polyphony of this syllabary.)

Probably in principle all hieroglyphics were susceptible of use as syllabics; but in fact, it was necessary for this—1, that a symbol should represent a word composed of a simple syllable, and, 2, that we should find this syllable in different words. The list of the most usual syllabics of known value, in the Pharaonic period, amounts to considerably over three hundred.

It is therefore not enough to have established the fact that a certain syllable corresponds in reading to a symbol, for us to consider the symbol as being properly a syllabic. We must also have found it sometimes more or less turned from its ideographic value and corresponding to a simple sound, to write which it takes the place of the letters of the alphabet. Thus the essential character of the syllabic is the abstraction made of the ideographic value for its use as a sound pure and simple. It is only as syllabics and determinatives that the ideographs belong to grammar. Those that do not play these parts have their proper place in the dictionary.

Syllabics, as well as ideographs, can be written alone or with phonetic complements in the mixed manner; the choice (and arrangement) of the complements depended on the needs of the designer. Thus we find , *sem*, grouped thus, , etc., the legs , here determining movement.

The second phonetic complement is found frequently; the first is more rare, and there are syllabics for which it has not yet been discovered. The writer seems to have had full liberty in this matter. From these facts it is evident that we cannot retain Champollion's term, "initial signs," nor adopt Lepsius's division, in his *Lettre à Rosellini*, into "initial signs" and signs intended for the middle of a group. Bunsen's division into syllabic signs and mixed signs is equally untenable.

A sign could wholly lose its ideographic value, although written as a determinative. Thus the word , *tar*, determined by a shoot (?) of palm, signified "season," "time;" but to write the syllable *tar*, in another word, as *htar*, "horses," it was not necessary to drop the determinative , and the whole group , *tar*, could be retained; thus: , *htar*, Coptic ϩⲧⲟ, "horse." This peculiarity may embarrass the interpreter, particularly in texts carelessly written, where the determinative of the idea is often omitted or incorrectly given. (Mr. le Page Renouf distinguishes this use of the determinative by the term determinative of sound from the ordinary use as determinative of sense.)

Syllabics are divided into two classes—1, an articulation and one or more vowels; 2, two articulations (usually with a medial helping-vowel unexpressed. All are, no doubt, monosyllables; although a syllabic like *sꜣa* has the appearance of a dissyllable; here, either the first *a* has no force, or the two indicate a long vowel).

The first class of syllabics, an articulation and a vague vowel, is scarcely distinguishable from the letters of the alphabet. The distinction is thus determined: 1, the simple letters were used as phonetic complements; 2, the syllabics do not seem to have been used quite indifferently for all kinds of words. We frequently find allusions, relations direct or remote, which have originally induced their choice for the purpose of writing this or that radical. (This is strictly analogous to the principle of the syllabary of Assyro-Babylonian in its Akkadian and Somitic developments, though in its application that principle led to wide polyphony, in consequence of an ideograph taking different sounds according to the cognate senses in which it was used.)

It is also possible that the syllabics were sometimes employed to give an idea of the sound of the vowels. But if they had this use primitively, they did not retain it, for we cannot establish this property in a constant manner in the hieroglyphic transcriptions of Greek or Semitic words. (It is indeed the converse use of the vowel most affected by a consonant or of the syllabic with its vowel which is our chief embarrassment in the reading of Semitic transcriptions.)

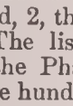
There were also some signs corresponding to three articulations which could be used as syllabics. Here the cases of homophony are much more rare; we have to do with different acceptations rather than different radicals, but the ideal bond between these different acceptations may escape us now. (These are still monosyllables.)

Polyphony.

There are characters which have various pronunciations. There are three kinds of polyphones:—

1. A sign can answer to various words which belong to the same class of ideas; thus the calf's ear, , answers to the words , *mest'er*, , *ānkh*, and , *at*, which seem to have all signified the ear or some special part of this organ. The words , *sem*, and , *seṭem*, "to hear," are two new values, on the same principle. One might add to this first class the very near values produced by variants of pronunciation or writing for the same word, such as *ṯa*, *ṯaꜣ*, *ṯꜣ*, *ṯꜣ*, *ṯꜣt*, *ṯꜣt*, *ṯꜣṯu* for , and the forms more or less developed of a single root, but these are rather extensions of a word than true instances of polyphony.

2. The same sign might have been chosen as symbol of a certain number of ideas without any true bond between them, at least to our view: thus answers to the phonetic , *usex*, "largeness," to , *āb*, "offering," and , *ḥent*, "regent" (fem.).

3. A sign may have become syllabic and be used for several purely phonetic values taken from the words in which it figures, on the two principles explained. Thus in the syllabary, the sign  , which symbolizes the idea "gift," answers to two roots, *ṯu* and *mā*; these give in their turn to the values , *ṯu*, and , *mā*, even in words where the idea of gift no longer exists.

Such is the series of facts which has produced Egyptian polyphony. The number of figures suitable to design and with which one could reasonably charge the memory being limited, we should expect to find polyphony more or less developed in every system of writing originally ideographic. The syllabic polyphony of Assyrian seems to have been produced by wholly analogous circumstances, though the change from the original language habitually veils the connection of values.

Polyphony is a source of great difficulty, and science has still much to do to fix the different phonetic values of the polyphones. Often our decision is made on the evidence of phonetic complements, and in hieratic it is seldom that this aid is wholly omitted. Thus is easily recognized as *mā*. But our ignorance is not always thus aided.

and the choice of the suitable word sometimes can only be indicated by a profound study of analogous texts.

The following list gives an abridgment of De Rougé's lists of syllabics, and contains the most common signs, the important polyphones being indicated by asterisks, and their principal varieties of sound being given in the fourth column. The method is varied from that of the *Chrestomathie*.

TABLE OF THE MOST COMMON SYLLABIC SIGNS.

SIGN.		SOUND.		SIGN.		SOUND.	
A 1*		*aā*	*uu*	2		*t'er*	
2		*ăạ*		M 1		*mạ*	
3		*ạb, ab*		2*		*mā*	
4		*ab*		3*		*mā*	*ṭu*
5		*ap*		4		*mā*	
6*		*aṭ*	*sĕm, sĕt, sĕṭ*	5*		*mā*	*nĕḥ*
7		*am*		6*		*mĕt*	*kạ, bāḥ*
8		*am*		7		*mĕn*	
9*		*ăm*	*kạ, kĕm, ḳĕm, nĕḥ*	8		*mĕr*	
10		*an, ān*		9		*mĕr*	
11		*ānχ*		10		*mĕs*	
12		*as*		11		*mĕḥ*	
U 1		*uạ*		N 1		*nạ*	
2		*uạṭ'*		2*		*nu*	*nĕn*
3		*un*		3		*nĕfĕr*	
4		*ur*		4		*nĕb*	
5*		*uạs*	*sĕm*	5		*nĕb*	
6		*uạḥ*		6		*nĕm*	
F 1		*fu*		7		*num*	
B 1		*baạ*		8		*nĕn*	
P 1		*pĕr*		9*		*nĕn*	*nạ, am, χĕm*
2*		*pĕḥ*	*ḥĕk*	10*		*nạs*	*ṭep*
K 1*		*kĕs*	*ḳạ*	S 1		*sạ*	
K 1*		*ḳạ*	*kĕs*	2		*sạ*	
T 1		*tạ*		3		*sạ*	
2		*tu*		4		*sạ*	
3		*tĕp*		5		*saa*	
T 1		*ṭĕb*		6		*su*	
T' 1		*ṭ'ạ*		7*		*sĕb*	*ṭau*
				8		*sĕtĕp*	

TABLE OF THE MOST COMMON SYLLABIC SIGNS.—*continued.*

SIGN.		SOUND.		SIGN.		SOUND.	
9		*sĕm*		7*		*χĕr*	*ḥĕp*
10		*sĕn*		H 1		*ḥạ*	
11		*sĕr*		2		*ḥā*	
Š 1		*šu*		3		*ḥā*	
2		*šĕṭ*		4		*ḥu*	
3		*šĕn*		5		*ḥu*	
				6		*ḥĕk*	
X 1		*χạ*		7*		*ḥĕk*	*pĕḥ*
2		*χu*		8		*ḥĕt, ḥĕṭ, ḥĕt'*	
3		*χĕt*		9		*ḥĕtĕp*	
4		*χĕn*		10*		*ḥĕm*	*pĕḥ*
5*		*χĕnt*	*fĕnṭ*	11		*ḥĕr*	
6		*χĕr*		12		*ḥĕs*	

DETERMINATIVES.

Champollion described as determinatives certain ideographic signs which were placed after words phonetically expressed. The use of each of these signs is more or less extended. The greater part are used for one radical, or at least for one and the same idea. For such determinatives the proper place is the dictionary. But there is a class of determinatives placed after different words, often many in number, and therefore called generic determinatives. The determinative is attached to the radical, and has nothing to do with the grammatical use of a word as noun or verb. (M. de Rougé gives a list of above a hundred as necessary for the student of Egyptian grammar, leaving out those of more restricted use.) Science has not yet wholly accomplished its task in this section. (Necessarily the exact definition of the range of a determinative requires a careful induction from its use.)

(The table which follows is but slightly abridged from M. de Rougé's, after comparison with Dr. Brugsch's in his *Grammaire Hiéroglyphique*, where a somewhat fuller but less logical list is given, apparently founded on that of the French savant. The reason for here giving a larger proportion of determinative than of syllabic signs is that the senses of the determinatives when logically arranged, as by M. de Rougé, present a key to the whole construction of the Egyptian system of ideographic signs, and afford us a remarkable insight into the genius of the language.)

TABLE OF GENERIC DETERMINATIVE SIGNS.

SIGN.		VARIANTS.	REPRESENTING	DETERMINING IDEAS.
1			ceiling	sky, ceiling; to raise, superiority
2			ceiling with star	night, obscurity
3			sun	sun, light; divisions of time
4			star	star, constellations; gods; divisions of time
5			hilly country	country, mountains; nations
6			oval	islands, oases, maritime countries
7			?	cities, villages
8			country divided	nomes, districts, fields

TABLE OF GENERIC DETERMINATIVE SIGNS—*continued.*

SIGN.		VARIANTS.	REPRESENTING	DETERMINING IDEAS.
8a			same?	territories and their portions, dikes; mud
9			waves	water, liquid, seas, rivers; to wash; freshness; level
10			flaming censer	fire, heat; zeal
11			man (squatting)	proper names; pronouns and participles
12			man acting	more general, often used in Saitio period for the more special determinatives following the next
13			man and woman	human race, its divisions, classes; participles pl.
14		Varied by many attributes	man with long beard	gods, august persons, kings
15			personage enthroned holding whip	ancestors, princes, kings
16			similar, kneeling	similar; defunct persons, manes
17			man squatting, his hand to his mouth	actions of the mouth, eating, speech; thought
18			man raising hands	adoration, invocation, prayer
19		Varied according to race of prisoner	man bound	enemies, prisoners; perverse
20			man stamping and striking himself	impiety, perversity; enemies
21			man, slain	enemies; to strike; death, massacre
22			man, his right hand raised	exclamation, invocation
23		(seated)	man, arms raised	height; grandeur; joy
24			man, with staff	chief, great, distinguished
25			same, leaning on staff	old age; to end
26		(seated, holding oar)	man, holding club (or oar)	force in general, violence
27			child, hand to mouth	infancy, youth; to suckle, education; renewing
28		(the same, horizontal)	mummy	embalming; manes; rites; images, types, forms
29			funeral couch without or with mummy	mummies; death, disease; embalming; to lie down, rest

TABLE OF GENERIC DETERMINATIVE SIGNS—*continued.*

SIGN.		VARIANTS.	REPRESENTING	DETERMINING IDEAS.
30		varied by many attributes	woman squatting	woman, goddess; fem. pronouns and participles
31			head of man in profile	head; superiority
32			curl	hair; black, colors in general; grief; turns
33			human eye, iris, pupil	to see, to awake, to know; enemy
34			eye weeping	tears, grief
35			nose, calf's head	to breathe, smell; joy, pleasure
36			tooth	eating; speech; hard objects, stones, etc.; regions, directions, everything relating to the earth and fields
37			hand holding small club	all actions implying the use of any force
38			hand, the palm below; foot of bird lying down	arms, shoulders, sides; directions; gentle actions, rest, gentleness, accord, songs
39			a breast and two arms, arms and vase, arms	to embrace, unite, to squeeze, enclose; event, fortune
40			extended arms	negation, prohibition; adytum
41			phallus	male, generation; pollution; to pour out; parts of generation, in front; veins
42			bont leg	leg, foot, knee, etc.; walk; diminution and enlargement; measures of length
43			same and knife	to carry off, leap over, surpass, diminish, annihilate, violate
44			legs walking	locomotion
45			the same reversed	return, send back, repel
46			lion's hind part	behind, to follow; to revolt, refuse; force, violence
47			Typhonian animal	revolt, violence, disorder; tempests, storms
48			calf's face, head	nose, nostrils; lungs to smell, breathe, sleep; pleasure; to separate, shut up, revolt
49			head of ox on support (?)	throat, gullet, lungs; etc.; to eat; breathe
50			piece of skin	quadrupeds: objects in leather
51			bone with flesh?	members in general
52			Nile-duck	birds; flying insects

TABLE OF GENERIC DETERMINATIVE SIGNS—*continued.*

	SIGN.	VARIANTS.	REPRESENTING	DETERMINING IDEAS.
53			wagtail	smallness; vile, wicked
54		(varied)	wing	wings, feathers; to fly, rise
55			egg	egg; oviparous animals; race, descent; feminine
56			crocodile	crocodiles of different kinds, divinities connected therewith; to conceal oneself, to spy; destruction
57			kind of fish	fishes, fishing; impurity, prohibition
58			serpent	reptiles, worms; sacred serpents; names of certain genii
59			kind of tree	trees of all kinds
60			dry branch?	different kinds of wood; objects made of wood
61			palm-shoot?	season, year, time; youth; to renew
62			bunch of flowers	plants, flowers; objects composed of plants
63		(varied according to kind of grain)	grains	cereals of different kinds; to labor, to harvest; measures
64		(varied)	bushel pouring out grain, vase full of grain	cereals of different kinds; harvest; tribute; to measure, bushel
65			ground-plan of room	abodes; places in general
66			rampart	walls, fortifications, enclosures
67			the same, falling	to stagger, crumble, destroy
68			steps	stair, to mount; to approach; foot of a monument
69			fortified enclosure	names of fortified cities (written within the determinative)
70			basin	waters, rivers, seas, canals, basins; to irrigate, cultivate
71			canal, or road	ways, journeys; separation, to chase; times, periods
72			block of stone	stones, bricks, different kinds of rocks; objects in stone; mineral substances
73			boat	ships, boats; navigation; voyages, journeys

TABLE OF GENERIC DETERMINATIVE SIGNS—*continued.*

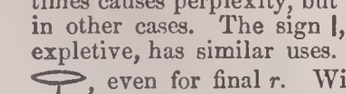
	SIGN.	VARIANTS.	REPRESENTING	DETERMINING IDEAS.
74			sail	sails; air; to breathe; freshness, pleasure; winds and their geographical directions
75			roll of papyrus	writings, books; designs, paintings; calculations, quantities; to know, thought, etc.
76			tie of a roll	to write, books; knowledge; to tie, close, finish
77		(varied)	cover of mummy-case; different forms of case	mummy-case, embalming; abode, divers places
78			post	to wander, journey, land; foreign peoples and names; impiety, etc.
79			graver, or plane?	to lessen, polish; ivory, bone; to clean, embalm, etc.
80			knife, or sword	to cut, prick, etc.; kill, beat; separate; whet
81			loaf	bread; victuals; provisions of all kinds; riches
82			basket with diamond-shaped object	festivals; joy, pleasure
83			basket	largeness; victuals and offerings carried in basket
84			vase with cover	oil; wax; perfumes; salt provisions
85		(especially for wine)	vase, or double vase	perfumes, fats, ointments; wine; liquids in general
86			vase	midst; repose; heart; feelings
87			saltier	crossing; mixture; multiplication; flexion, reflexion; transitive verbs
88			knot or packet	stuffs, dresses; bands, etc.
89			oval band (or seal?)	oval, orbit; name (names of royal personages written within determinative)
90			ring or circle	renewal; a time; totality; circle
91		(often confused with 92)	rings	metals; precious solids; resins, etc.
92			round grains	sand; powder; flour
93			packet	to envelop, embalm; develop, count
94			same, with jet of liquid	smells (good and bad) and odoriferous objects; filth, corruption

The Reading of Ideographic Signs.

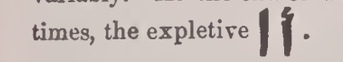
The Egyptians used not only simple letters and syllabic signs, but also ideographs, to write words. The reading of these ideographs is obtained in divers ways. It is often furnished by the analysis of proper names of which there are transcriptions, though the result is sometimes approximative. Another method is the study of variants, when a phonetic form of a word replaces the ideographic sign, in the same text. Often also the ideograph is written as a determinative after the phonetic equivalent. (Hence the great importance of publishing collations of known texts, a work to be recommended to new students.)

When a word is written by a single ideograph, and above all when it is a substantive, it is most commonly distinguished by the marks , , or their combinations , . Thus is the letter *š*, , *še*, the basin.

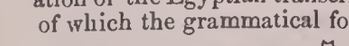
The Combination of Signs of Different Kinds in Writing Words.

In texts which show a certain development, and above all in hieratic manuscripts, where the signs are always more abundant, many words are written phonetically and followed by one or more determinatives. In such a case, the determinative which is most general is written last: thus  , *ḳanen*, "to become weak, feebleness"—Copt. ϭⲛⲟⲩ, soft,—where the phonetic letters are followed by the determinatives for (1) repose, feebleness, (2) crossing, bending, (3) evil, unfortunate. A word expressed by an ideograph may be followed by a generic determinative. (The same is the case when a word is written phonetically with its ideograph as a first determinative, of course special.)

Expletive Signs.

There are a few expletives which were not pronounced, and had a purely graphic use. The most important is the roll , the determinative of writing, knowledge, etc. It is sometimes used as a sign of separation or as disjunctive. The signs , , , , are often used as pure expletives, adding nothing to the idea or the sound. or is frequently added to a determinative; it is almost the rule, when the space needs it: as  , *mennefer*, Memphis. In such cases the expletive ordinarily follows the gender of the substantive, for masc., for fem. The phonetic value of , *t*, as feminine final, sometimes causes perplexity, but its expletive character is clear in other cases. The sign , which (like) is not always expletive, has similar uses. It is written after , thus , even for final *r*. With it forms the group , not only for the substantive *ḥar*, *ḥa*, "face," but also for the particle *ḥer*, "upon," etc. In hieratic, is attached to many characters, probably to distinguish them from very similar ones; thus for is clearly distinguished from for . It is thus used as a diacritical sign, though very variably. At the end of words we find, above all in late times, the expletive .

Expletive Vowels and Complements of Simple Letters.

Although the vowels were often omitted, sometimes they are added in a wholly expletive manner, which their vagueness can only aid us to understand. This is easily proved from certain words transcribed, such as *θαν*, the Egyptian , *taḥaṇ*. In any other system the first *a* would produce a separation of syllable between *t* and *h*, transcribed here by *θ*. (It should be remembered, however, that the Greek could not represent a sound like t'han otherwise than by *θ*. The Egyptian vowel may here represent a disjunctive.) The same remark applies in the consideration of the Egyptian transcriptions of divers foreign words, of which the grammatical form is well known. Thus the Hebrew מִרְכָּבָה is written  , *mārḳabuta*, and the name of the Hebrew harp נֵבֶל, is written , *kenaanaur*. It has been remarked that each consonant had a kind of favorite complement, and that this complementary sign should often be treated as an expletive in reading. It has been proposed to admit for these letters inherent vowels, but this idea seems exaggerated: the alphabet is not a syllabary, for most of the letters unite with the different vowels. The knowledge of the ordinary complements of each letter is useful, especially in reference to transcriptions.

, *f*, seems to take \\, but , *fa*; , *fā*; , *fu*, are common. has as favorite final *u*, or indifferently: we also find , *ba*; , *bū*; , *bi*; but , *bạ*, is rare: *bạ* is expressed ordinarily by ; we find , or , equally. thus has as favorite complement.

It is the same with *p*, , which has for complement *u*, , , and we find the syllables , , ; but *pạ* was written , or . In the spelling of , which is often found for the article *pi*, the variant , *pại*, introduces the complementary , *ạ*.

For , *k*, we find all the combinations , , , , , but the favorite vowel seems to have been , *ạ*. We observe equally the use of all the vowels after , except, perhaps, , *ā*, which we have not remarked. The complementary vowel seems to be , or \\, according to the writers. , *ḳ*, shows a decided preference for , but we also find , , . With , *k*, we observe , , , , but is more frequent; sometimes the expletive is added, even when is not a substantive.

, *t*, somewhat prefers : it is joined to , , , , or \\ , *t*, takes , , as complementary vowel; but it is not repugnant to any other combination of vowels. ordinarily takes , or , much more rarely and . , *ṭ*, is most often followed by : and are used; some texts show \\ as expletive of . , *t'*, seems also to be completed by \\. The syllables , , , are not rare, but *t'ạ* is rendered by , the eagle being the favorite complement of : this sign also forms the groups , .

We cannot establish any special complement for *m*; the ordinary syllabic combinations are , , , , . The transcriptions show that is often expletive after . The eagle is more readily attached to , as ; next in frequency is . often takes as expletive , . It is also combined as , , .

For , *n*, the complementary vowel seems to be . , , , are more used than , for this syllable was ordinarily written as final, and by the syllabics , , as initial.

, *r*, is completed by the expletive , forming the group

, hieratic . is the favorite syllabic of ; we also note often , , , but is extremely rare. also often takes the expletive , hieratic , and is joined to the final vowels without exception.

, *s*, is often completed by expletive; the name of the band seems to have been *set*. is frequent after , but , , , , are used. is found; but syllabic homophones were used more readily for this syllable. In other cases the vowel was suppressed, as = , *sąk*. is also completed by , and follows exactly the same rules as . The name of the letter was undoubtedly , *ses*, "bolt."

, *š*, most readily takes , , . prefers , without excluding the others. , *χ*, takes as expletive, and we find very often : , , are more rare, the last syllable being almost always written with , or the group . The eagle is evidently the complement of : thus the syllables , , have as ordinary variants , *χąi*, , *χąu*. is ordinarily followed by consonants; its vowel is ; with the expletives , it is the substantive *χā*.

, *h*, takes as complement; we also find , , in which often causes variants, as in the case of , *χ*. To the harder aspirate, *ḥ*, was rarely added except with the introduction of , as , or , *ḥą*. alone united with , , , ; its ordinary expletivo is . for *ḫ* is rare: we have only found it followed by consonants or the vowel *u*. The syllabic , *ḫu*, much used for *ḫ*, has for expletive .

These remarks are of much use when one desires to fill up *lacunæ* of small extent in Egyptian texts. They explain usages, on which one general remark may be added, that the vowel , *ą*, did not unite itself readily to a certain number of letters; hence the introduction of an intermediate letter and the pleonastic forms , , etc., for *pą*, *χą*, etc. (It must also be remembered that, on the one hand, the expletive vowel cannot in all cases have full weight in roots which are always monosyllabic, on the other, that we can scarcely deny it some force. Was it used to modify the consonant as when a local pronunciation of *g* in English is written by grammarians *gv* as *gvarden*? In transcriptions the expletive vowel appears, but for philological purposes must be disregarded, and the same is sometimes true of the complementary vowel. In English *q*, our only syllabic, always requires *u* as its complementary vowel: consequently when it is used for its ancestor the Semitic koph, as in *qoran*, an uneducated person would read and even write *quoran*.

On applying these observations to the orthography of *mārkąbuta* for מִרְכָּבֶת and *kanąanaur* for כְּנַעַר, it is immediately evident that the deviations from the Semitic are due to the Egyptian vowel-system. In the word *mārkąbuta*, the *u* is the favorite complement of the *b*, and the final *t* requires a vowel. In *kenąanaur* the doubled *n* is resolved into two syllables: it could have been written with the disjunctive sign between the two "*n*"s and a final vowel.

It has been shown that the transcriptions of the scribes of the Ramessides from Semitic into Egyptian were very accurate so far as the consonants were concerned. It is equally evident that this was scarcely possible and practically was not the case with the Semitic vowel sounds. This remark should be borne in mind in all comparisons of Hebrew and Semitic.)

The Transcription of Vowels Omitted.

The vowels, particularly the complementary ones noticed above, were omitted at will in writing, and must often be added in transcription. This is easy when a definite fuller form of a word is known. But there are many words for which the variants give different vowels, and many others for which a vowelled variant has not yet been found. Most Egyptologists here use *e* for the absent vowel, which must only be regarded as a conventional sign for a gap to be filled. (There are, however, cases in which a very common word is never vowelled: here we may safely assume a very short vowel best represented by *ĕ*, as already noticed.)

Abbreviations and Exceptions.

Abbreviations were rare; ideographs and syllabics rendered them needless. But there are cases in usual formulæ; as , *nuter a*, for , *nuter atef*, "divine father," the title of an order of priests. In the formula , *ānχ ut'ą senb*, "life, balance, health," a kind of good wish added to kings' names and rendered in the Rosetta Stone *ὑγίεια*; is *ānχ*, *t'ą* is an abbreviation, for we find the complete word , *ut'ą*, in the same formula; but the for is of a more trenchant character.

There are some words of which the writing is exceptional, due to causes which may sometimes be traced. Thus , which should according to rule be transcribed *senkti*, was a variant of *seti*. The syllabic , *set*, received as hieratic abbreviation , the last line being exactly like the , of that time: thus it resembles the hieratic group for the three letters , and the scribes took occasion to trace in hieroglyphics for *set*. This is an imitation of the cursive style taken into the monumental, of which there are a certain number of cases.

Secret Writing.

Intentionally accumulated exceptions in certain texts compose what Champollion has called the Secret Writing. The most ancient traces we have found are of the Eighteenth Dynasty. In this system we remark—(1) objects rare or unused in ordinary writing; (2) syllabic signs used as simple letters; (3) phonetic values obtained by turning the signs from their ordinary ideographic values; (4) variants between the values of neighboring sounds. Thus every deviation was made from the usual principles of writing by which it was possible to produce exceptions. This is an enigmatic system intended to be unintelligible to the ordinary reader. The causes of this method are of interest, for from them originated the new values which strangely complicate the hieroglyphic writing of the time of the Greeks and Romans (the secret writing thus passing in a certain degree into the common writing).

The Use of Hieroglyphics in Grammar.

Although, as already stated, an outline of ancient Egyptian grammar is not given in this article, it is necessary to explain how hieroglyphics were used for grammatical purposes.

In expressing roots or derivatives, whether pronominal, verbal, or of particles, both phonetic and ideographic signs could be employed, either apart or in combination. There is, however, in all but verbal roots a marked preference for phonetic expression, with again a preferential use of alphabetic signs.

The masculine and feminine of nouns are marked, especially when they were ideographically written, by and : the former was not pronounced; it is doubtful whether the latter was, and if so in what cases (De Rougé, *Chrestomathie*, ii. 7, 8).

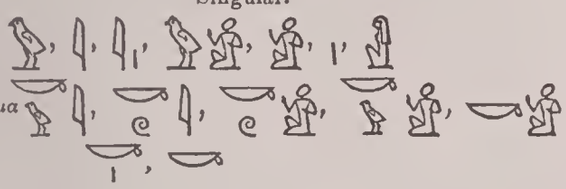
The plural of nouns, pronouns, and the pronominal affixes

which were also used to indicate the persons of verbs, is indicated by the abstract symbol, . In the case of nouns it may be replaced by a phonetic ending or the trebling of the word when written ideographically or even phonetically. The principle of expressing the dual, which is proper to nouns, appears to have been the same, though as to this there are difficulties.

The pronouns and cognate words, including the article, are mostly written alphabetically. The affixed personal pronouns, which are identical in form with a very few exceptions, whether used as possessives, as inflexional verbal suffixes, or as direct complements, or in other words, in their genitive, subjective, and objective uses, afford instructive instances of the different modes of writing. It may be observed that in Egyptian these are the primitive forms of the personal pronouns. The following table is taken from M. de Rougé's *Chrestomathie*, ii. 42, with the omission of some late forms.

Affixed Personal Pronouns.

Singular.

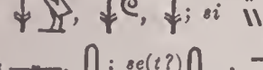
1. *u, a* 

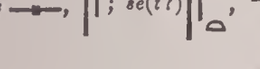
ku, kua

2. m. *k*

f. *t*

3. m. *f*

su 

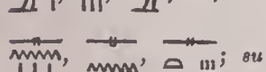
f. *s* 

Plural.

1. *na*

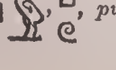
2. *ten*

3. *u*

sen 

It will be remarked that all the phonetic forms but one are written with alphabetic signs, that the introduction of ideographs, either as determinatives or independent symbols, gives the common first person singular a feminine in writing but not in sound, and farther confuses this feminine and the true feminine of the second person singular when represented by the same symbol only. The principle of writing an ideograph to determine the use of the pronoun, phonetically expressed or only represented by that symbol, is carried farther in the first person singular than the table shows, there being special signs for a god, etc.

In the case of the articles and the pronouns of more common use alphabetical signs are employed with ideographic signs for the pronouns when the necessity occurs. Syllabic signs are used for some of the less common pronouns, and ideographs for substantives employed as pronouns. The fuller forms of pronouns are produced by alphabetic signs; the same is usually the case with the compounds that introduce no new element.

The verbal root, identical with that of the noun, is expressed in every mode in which hieroglyphics can be used. It is, however, otherwise with the derivative forms, the inflexions, and the substantive verb, which in its various expressions is really an inflexional word employed in tense-formation. The derivative forms are produced by prefixes which are always alphabetic or by repetition of the radicals (reduplication, sometimes afterwards apocopated). The inflexions are formed by the pronominal affixes for the persons and other prefixes and affixes, these affixes being almost always placed before the pronominal ones, for the moods and tenses; here again the expression is alphabetic with the exceptions afforded by the pronominal affixes as already shown. The forms of the substantive verb are phonetic, either alphabetic,  , *pu*, rarely , *pa*, , *pui*, , *ar*; , *au*; , *tu*; or syllabic , *un*; , *xeper*, , *ari*. This mode of writing leads to the identity of some forms of this verb and of other parts of speech: thus *pa* is the same in form as the definite article, and *pui* with the affixes as the possessive article, and *pu* as the demonstrative article. These identical forms are here cited as evidence of the result of the use of alphabetic writing.

The radical particles show the same phenomena. The prepositions are expressed phonetically, the majority, including nearly all the most common, alphabetically. The simple adverbs, including the negatives, are written phonetically, with perhaps about an equal use of alphabetic and syllabic forms. The few interjections are written alphabetically. In consequence of this mode of writing, particles of different sense are sometimes identical in form. Thus , *ĕm*, is both "in" and "not," but most apparent instances of this kind are due to the use of a particle as both preposition and conjunction or adverb.

The bearing of these results on the problems of the formation of the Egyptian hieroglyphic writing, and the growth and origin of the language is significant.

The earliest Egyptian writings, which are hieroglyphic, show a predominant use of ideographic signs. The phonetic signs gradually grow in importance until the full development of the character and language. We are thus led to ask whether there was a period in Egyptian writing when it was wholly ideographic, the supposed first stage of all such systems, when the figure of each object conveyed its name or names and nothing more.

A stage of pure picture-writing would express a language in the condition which is supposed to have been the earliest in the case of all monosyllabic languages, the condition before grammar. It is precisely to such a condition that the linguistic phenomena of Egyptian seem to point. For its simple necessities ideographs alone would be sufficient, and the phonetic signs wanted for grammatical machinery would be introduced when a higher condition was reached.

It may be farther inquired whether the growth of Egyptian was wholly internal, or whether it was influenced from without; in other words, whether there is any reason to assign the roots which serve the purposes of grammar, and even the verbal roots, to more than one source. The basis of the inquiry by which this question might be answered lies in the undoubted identity of the personal pronouns in Egyptian and Semitic. The inquiry is beyond the scope and limits of this article. It requires an exhaustive comparison of the Egyptian vocabulary, including the structural words, and of the system of grammar, with the Semitic and with the families of language which geographical and ethnological considerations would lead us to include in the category of possible cognates to the Egyptian. The leading results of a limited examination may, however, be stated. In the verbal roots a certain small number occur apparently common to Egyptian and Semitic. Of these roots a good proportion are proper to civilization, and thus belong to a stage above that of barbarism. In the pronominal roots the personal pronouns are undoubtedly Semitic, whereas the articles seem to be identical in source with a non-Semitic form of the substantive verb. The roots of particles fall into two classes, those which are purely metaphysical, probably including Semitic equivalents, though in the case of practically uniliteral forms the comparison is hazardous, and such as have become particles by the diversion of substantives to a tropical sense.

It would thus appear that the Egyptian language was originally purely monosyllabic without inflexion and written by ideographic signs, that the first stage towards inflexion was the use of substantives in tropical senses for prepositions and adverbs, the primitive ideographic signs being still sufficient for the purposes of writing, and that the second stage was attained by borrowing from Semitic, so far as was necessary, grammatical forms and particles, with perhaps some verbal roots needed in a civilized condition, and that at this time phonetic signs became absolutely necessary. The importance of the phonetic signs for expressing grammatical forms would tend to their prevalent use for the whole category, except where the radical sense was dominant in the tropical, as in our own use of the word "head" in such prepositional phrases as "at the head of" the table, the army, the administration, etc. This view is put forward as a mere hypothesis, to be sustained or refuted by the study which the subject deserves. The importance of the question is great as its solution will mainly tend to determine whether the Egyptian belongs to an early stage of Semitic, as has been conjectured on very insufficient grounds. In the previous remarks it is assumed that such a view may at present be set aside, otherwise we could not speak of borrowing from Semitic.

The Supposed Derivation of the Phœnician from the Egyptian Alphabet.

M. de Rougé endeavored to show that the Phœnician alphabet was derived from the Egyptian in its hieratic form. The hypothesis has been accepted by M. François Lenormant in his *Essai sur la Propagation de l'Alphabet Phénicien*, 2d ed., of which the first Plate presents a comparative table of hieratic and archaic Phœniciau letters. The method leaves nothing to be desired. The conclusion is, however, scarcely established. It must be remembered that the Egyptian alphabet presents one or more alternative forms of more than half its letters. Most of these correspond to a single Phœnician letter. Thus there is in half the Phœnician alphabet a choice between two or more hieratic forms. This diminishes the effect of the comparison. Again the hieratic forms vary, like all cursive forms of writing, with the hand of each scribe. Consequently the writer who desires to establish their identity with Phœnician can scarcely avoid straining the evidence. Any one who will compare M. Lenormant's plate with M. de Rougé's hieratic alphabets in the *Chrestomathie*, Pls. I. seqq., will see that the signs chosen for comparison by M. Lenormant do not agree throughout with any of the three types given without that object by M. de Rougé. It may be remarked in illustration that if we endeavored to connect the demotic in its latest form with the Arabic Koofee in its earliest, which is of course absurd, it would be possible, by selecting the demotic variety nearest in form to the typical Koofee of coin-inscriptions, to show a very good apparent agreement of many letters. Any one may try the experiment with the Koofee alphabet in Soret's *Numismatique Musulmane*, Pl. I. and M. de Rougé's demotic in the *Chrestomathie* (l. c.), taking care to use only one type where it was repeated by the Arabs for other letters, and in the case of their alphabet to compare only the isolated or final forms. The result would show the great caution needed in the inquiry.

There are two objections to the proposed derivation of the Phœnician alphabet which must have great weight against any but the strongest evidence of resemblance. The Egyptian letters represent objects the names of which begin with these letters; similarly the Phœnician letters had names indicating an origin from a hieroglyphic system on the same principle of acrophony. It would be supposed if the Phœnician letters were derived from the Egyptian ones that their names would describe the original signs. This, however, is not the case in a single instance. Aleph signifies an ox and not an eagle, Beth a house and not a bird, Gimel a camel and not a basket, and so, as far as we know, to the end. It is difficult to imagine the complete loss of the original form, and the naming of letters from a supposed resemblance to another form, which form can scarcely be traced in the most archaic Phœnician. Yet, if the derivation from hieratic be true, we are tied to this archaic form on account of its apparent similarity to the hieratic, and any deviation to explain the Semitic names of the letters would weaken, if not destroy, the foundation of the theory.

Again, it is very noteworthy that the oldest monuments of the Phœnician alphabet are to be found not in Egypt but in Palestine and Assyria. These are the Stele of Mesha, king of Moab, and the inscriptions on the Nemrood bronze lion-weights. These weights take us a step farther in the argument, for they show us on official documents of a palace of Assyrian kings the use of this alphabet, side by side with the Assyrian character, as a kind of demotic or perhaps commercial writing, of necessity well-known in Assyria itself. Of course it is not to be supposed that the languages expressed were the same, but they were so closely allied that their joint use in Assyria was natural, and particularly to a nation accustomed to the Turanian Akkadian. This appearance of the Phœnician alphabet in Assyria would suggest that it had its origin rather from Assyrian than Egyptian writing. Is there, however, any evidence that any such alphabet was derived from cuneiform?

Among the systems of writing which present a sufficient similarity to the Phœnician, and its descendant the Greek, to justify our conjecturing their common derivation, though not necessarily their later connection, is the Cyprian. This is radically different from the Phœnician in being syllabic, and thus having a much larger list of characters, but the formal resemblances suggest the same source. In the case of the Cyprian, Dr. Deecke has endeavored to show the source to be the Assyrian cuneiform in its later form. His arguments are very strong; here it is only necessary to mention the syllabic character of the Cyprian, the agreement in form of many signs, without the readjustment of their elements suggested as theoretically possible by the Median and Armenian variants, and the striking fact that the Cyprian is found in two inscriptions written in cuneiform, each stroke having the Assyrian typical shape (Deecke, *Der Ursprung der Kyprischen Sylbenschrift*, Strasburg, 1877).

This probable solution of the Cyprian problem suggested to Dr. Deecke the comparison of the Phœnician alphabet with Mesopotamian cuneiform. The result, published in the *Zeitschrift der Deutschen Morgenländischen Gesellschaft* (xxxi. 102 seqq.), is well worthy the attention of scholars. The inquiry was founded on the comparison of forms and sounds in cuneiform. The forms were much less numerous than the extent of the list of signs would lead us to expect, for the great majority of these signs are far too complex to have been the prototypes of such simple signs as the Phœnician letters. The sounds on the same side present no little difficulty, as the adoption by the Babylonians and Assyrians of the Akkadian system of writing produces a confusion of kindred sounds, and excludes some proper to the Semitic alphabets. A further difficulty arises from the polyphony of the Assyro-Babylonian cuneiform signs, whether ideographic or syllabic, which gives a variety of sounds to the same group and thus greatly diminishes the degree of probability in an agreement. These signs are all conventional transcriptions of original hieroglyphics. These hieroglyphics can sometimes be traced in the rare hieratic forms, and even occasionally in the regular cuneiform types. When we know the original form we can sometimes select the radical sound, but where we find more than one cognate sense with a different sound, the selection becomes difficult, if not impossible. Supposing such a sign to be represented by the English figure 1, standing for "one" and "first," the discovery of the radical sound would be apparently hopeless. It would be obviously so if the sign also stood for "beginning" and "union." The result seems satisfactory to the extent of about one-third of the Phœnician alphabet, signs like the Phœnician having like sounds. This result would have little force did it not seem to be supported by the meaning of some of the signs as compared with the names of the Hebrew letters of which we know the meaning, seventeen in number. But the difficulty in discovering the original radical sound and sense in cuneiform shakes this conclusion. Consequently the five agreements which might be accepted were we certain of the original Assyrian sound and sense cease to have much weight. There are also some probable agreements which, of course, have still less strength. It is, however, to be noted that the syllable *ḥad*, etc., taken as the origin of Heth, and *ṭip*, as that of Teth, have forms in the hieratic cuneiform agreeable to the meaning of the words from which these syllables are supposed to be abbreviated, *ḥaṭṭu*, a "graver," and *dibbu*, a "writing-table." This explanation of the signs Heth and Teth, consecutive, be it remembered, and without certain renderings, in the Hebrew alphabet, is very remarkable as a confirmation of the theory. For the present it is no more than a theory, but perhaps it is as probable as the derivation of the Phœnician alphabet from Egyptian hieroglyphics, through the hieratic types.

It is of course possible that the old Semitic alphabet had an origin independent of Egyptian hieroglyphics or the conventional hieratic forms of Assyro-Babylonian cuneiform. The discovery of a new hieroglyphic character in the Hittite inscriptions, containing, in a list of greater extent, certain of the forms indicated by the names of the Hebrew letters, is a new factor in the problem, and must be defined before its true value can be ascertained. All that can be said at present is that the Hittite characters wear the aspect of an Egyptian origin. Considering the geographical position of this mode of writing, its *prima facie* evidence is in favor of M. de Rougé's derivation of the Phœnician alphabet from Egyptian.

Bibliography.

The following list is an outline of the bibliography of the subject:—

Dictionaries.—Brugsch, Dr. H., *Hieroglyphisch-Demotisches Wörterbuch*, the fullest and best Ancient Egyptian Lexicon; Bireh, Dr. S., "Dictionary of Hieroglyphics," in Bunsen's *Egypt's Place*, vol. v.;

Pierret, P., *Vocabulaire Hiéroglyphique;* Champollion, le Jeune, *Dictionnaire Égyptien*, now out of date, but valuable for the history of interpretation; vocabularies in various works, as Chabas, F., *Papyrus Magique Harris*, and *Zeitschrift für Aegyptische Sprache und Alterthumskunde.*

Special Dictionaries.—Brugsch, H., *Dictionnaire Géographique de l'Ancienne Égypte;* Pierret, P., *Dictionnaire d'Archéologie Égyptienne;* Lieblein, J., *Dictionnaire des noms [propres] hiéroglyphiques.*

Grammars.—Rougé, Vicomte de, *Chrestomathie Égyptienne*, Abrégé Grammatical, complete except as to the particles, the best Egyptian grammar; Brugsch, H., *Grammaire Hiéroglyphique* (Hieroglyphische Grammatik), only second to De Rougé's, and complete; Rossi, F., *Grammatica Copto-Geroglifica*, a useful work, based on Peyron's *Grammatica Linguæ Copticæ*, and De Rougé's *Chrestomathie Égyptienne*, combining the elements of Hieroglyphics and Coptic; Birch, S., "Hieroglyphic Grammar," in Bunsen's *Egypt's Place*, vol. v.; Le Page Renouf, *Elementary Grammar of Ancient Egyptian*, with Dr. Birch's *Egyptian Texts* (Archaic Classics). These two works are the best grammar and reading book for beginners; Champollion, *Grammaire Égyptienne*, out of date, but valuable for history of interpretation.

Texts.—Lepsius, Dr. R., *Denkmäler aus Aegypten und Aethiopien*, the great corpus of Egyptian transcriptions, without commentary or translation. Many of the most interesting texts are translated in the works of other scholars. Rosellini, I., *I Monumenti dell' Egitto e della Nubia; Monumenti Storici; Monumenti del Culto; Monumenti Civiti;* this smaller work contains some texts, particularly the historical inscriptions of Ramses III. (called by Rosellini Ramses IV.), which are not in Lepsius's *Denkmäler;* Champollion, le Jeune, *Monuments de l'Égypte et de la Nubie*, a similar work similarly useful. The "Notices Descriptives" are specially interesting. Of generally later date than the *Denkmäler* are the works of Aug. Mariette (*Choix de Monuments du Sérapéum; Abydos, Description des fouilles; Dendérah; Monuments divers recueillis en Egypte et en Nubie; Deir el Bahari; Les listes géographiques des Pylones de Karnak*), and of H. Brugsch (*Geographische Inschriften altägyptischen Denkmäler; Recueil des Monuments Égyptiens; Monuments géographiques; Monuments de l'Égypte*); Dümichen, J., *Die Flotte einer Aegyptischen Königin;* Greene, J. B., *Fouilles à Thèbes;* Rougé, Vic. J. de, *Inscriptions Hiéroglyphiques copiées en Égypte pendant la Mission Scientifique du Vic. E. de Rougé* (Études Egyptologiques); Bergmann, E. von, *Hieroglyphische Inschriften;* Brugsch, H., *Inschrift von Rosetta;* Lepsius, R., *Das Bilingue Dekret von Kanopus;* Reinisch, L., and Roesler, R., *Die zwei sprachige Inschrift von Tanis;* Pierret, P., *Glossaire Égyptien-Grec du Décret de Canope* (Études Egyptol.); Lepsius, R., *Auswahl der wichtigsten Urkunden des Aegyptischen Alterthums;* Pierret, P., *Recueil des Inscriptions Inédites du Louvre* (Et. Ég.).

Texts of the Ritual and Cognate Works.—Lepsius, R., *Todtenbuch der Aegypten*, and *Aelteste Text des Todtenbuchs;* Rougé, E. de, *Rituel funéraire;* Leemans, C., *Papyrus Égyptiens funéraires hiéroglyphiques; Id. hiératiques;* Guieysse, P., *Rituel funéraire Égyptien*, chap. 64, textes comparés, traduction et commentaire; Renouf, Le Page, *Traduction d'un chapitre du rituel funéraire* (a prayer from the Egyptian Ritual); Lefébure, E., *Le Mythe Osirien* (I., Les Yeux d'Horus; II., Osiris; Et. Ég.); Lefébure et Guieysse, *Le Papyrus funéraire de Soutimes;* Pierret, P. (Devéria, T.), *Papyrus de Neb-qued;* Pierret, P., *Manuscrits Religieux* (Et. Ég.), and *Recueil d'Inscriptions Inédites du Louvre* (Le Livre de ce qui est dans l'Hémisphère inférieur, M. Devéria's translation, etc., Et. Ég.); Lanzone, R. V., *Le Domicile des Esprits;* Birch, S., *Papyrus of Nas-khen;* Naville, E., *La Litanie du Soleil; Textes relatifs au mythe d'Horus, Edfou;* Brugsch, H., *Sai an Sinsin;* Chabas, F., *Papyrus Magique Harris.*

Historical Papyri, etc.—Birch, S., *Select Papyri in the Hieratic Character, British Museum; Inscriptions in the Hieratic and Demotic Character, British Museum; Hieratic Papyrus of Ramses III., British Museum;* Eisenlohr, A., *Die grosse Papyrus Harris;* Prisse, E., *Facsimile d'un Papyrus;* Chabas, F., *Les Papyrus Hiératiques de Berlin; Voyage d'un Égyptien; L'Egyptologie*, I. (Les Maximes du scribe Ani); Eisenlohr, A., *Ein mathematisches Handbuch der alten Aegypten;* Lincke, A., *Correspondenzen aus der Zeit der Ramessiden;* Lieblein, J., *Deux Papyrus Hiératiques au Musée de Turin;* Maspero, G., *Études Égyptiennes, Romans et Poésies du Papyrus Harris*, No. 500; Mariette, A., *Les Papyrus Égyptiens du Musée de Boulaq;* Pleyte, W. et Rossi, *Papyrus de Turin;* Wiedemann, *Hieratische Texte aus den Museen zu Berlin und Paris;* Ebers, G., *Das hermetische Buch über die Arzeneimittel der alten Aegypter.*

Demotic.—Brugsch, H., *Grammaire Démotique*, and *Hieroglyphisch-Demotisches Wörterbuch;* Leemanns, C., *Papyrus Égyptiens Démotiques & Transcriptions Grecques;* Revillout, E., *Le Roman de Setna.*

Translations.—Birch, S. (editor), *Records of the Past:* Chabas (ed.), *Mélanges Egyptologiques;* Lepsius, R., Brugsch, H. (edd.), *Zeitschrift für Aegyptische Sprache und Alterthumskunde.*

It is obviously impossible to specify the many valuable translations and dissertations which have been produced by Dr. Birch, Dr. Brugsch, M. Chabas, Dr. Dümichen, M. Devéria, Dr. Lepsius, M. Mariette, M. Maspero, M. Pierret, M. E. de Rougé, and other scholars. Many of these works contain Ancient Egyptian texts either in part or entire. (R. S. P.)

HIERONYMITES, Hieronymiani, or Sancti Hieronymi Eremitæ, an order of monks, originally hermits, who resolved to adopt the cenobite life under the patronage of St. Jerome and the rule of St. Augustine. The order first arose in the 14th century in the neighborhood of Toledo, through the influence of a Franciscan Tertiary named Vasco, and Fernando Pecha, chamberlain of Pedro the Cruel. It soon received papal sanction (from Gregory XI. in 1373), and made considerable progress in Spain and Portugal, where its chief seats were at Guadalupe and Yuste (both in Caceres, the latter being the scene of the cloister-life of Charles V.), and at the Escorial, the palace-monastery of Philip II. near Madrid; afterwards it gained a footing in America also. From about the close of the 16th century it rapidly decayed, and now it is wholly extinct. The dress of the order consisted of a coarse white frock with tan-colored scapulary and cowl. About 1375 an order of nuns of St. Jerome was originated by Maria Garcias de Toledo, and for a time was highly popular. As branches of the Hieronymite order must be reckoned the Congregation of the Eremites of St. Jerome of the Observance, which, originated by Lupus Olivetus, third general of the Hieronymites, was sanctioned by Martin V. in 1426, and still subsists in some parts of Italy as the Congregation of St. Jerome of Lombardy, and the Pauperes Eremitæ Sancti Hieronymi, a congregation founded by Peter of Pisa in 1377, which obtained some foothold in Tyrol and Bavaria, as well as in Italy, and subsisted until 1688. See Reinkens, *Die Einsiedler des heiligen Hieronymus*, Schaffh., 1864.

HIGDON, or Higden, Ranulf, was a Benedictine monk of the monastery of St. Werberg in Chester, in which he lived, it is said, for sixty-four years, and died "in a good old age," probably in the year 1363. He was buried, we are told in a note prefixed in the 16th century to the MS. of his work belonging to the library of Christ Church, Oxford, "in St. Werberg's Church (now Chester Cathedral), on the south side of the church near the choir, not far from the door which leads into the churchyard; an arch was made for him in the wall, and on the wall is the inscription, 'Non hic sub muro, sed subter marmore duro.'" This monument, extant in the 16th century, seems now to have entirely disappeared. Higdon was the author of a long chronicle, one of several such works based on a plan taken from Scripture, and written for the amusement and instruction of the society to which the compiler belonged. Its chief interest perhaps lies in the fact that it closes the long series of general chronicles, which were soon put completely out of date by the invention of printing. It is commonly styled the *Polychronicon*, from the longer title *Ranulphi Castrensis, cognomine Higdon, Polychronicon (sive Historia Polycratica) ab initio mundi usque ad mortem regis Edwardi III. in septem libros dispositum.* The work is divided into seven books, in humble imitation of the seven days of Genesis, and, with exception of the last book, is a summary of general history, a compilation made with considerable style and taste. It seems to have enjoyed no little popularity in the fifteenth century. The Christ Church MS. says that Higdon wrote it down to the year 1342; the fine MS. at Christ's College, Cambridge, states that he wrote to the year 1344, after which date, with the omission of two years, John of Malvern, a monk of Worcester, carried the history on to 1357, at which date it ends. According, however, to its latest editor, Higdon's part of the work goes no further than 1326 or 1327 at latest, after which time it was carried on by two continuators to the end. Gale in his *Quindecim Scriptores* published that portion of it, in the original Latin, which comes down to 1066; an English translation of the whole was made by John of Trevisa, and printed by Caxton at his press in Westminster in 1482, with the addition of an eighth book. There is also an anonymous English translation of the work. The whole is being at this time carefully edited by Professor Lumby, B. D., under the authority of the Master of the Rolls; six volumes have appeared, 1865–1876.

HIGHGATE, a suburb of London, county of Middlesex, is situated on an eminence on the great north road, 5½ miles N. W. of the London general post-office. From various points on the hill, which reaches a height of 426 feet, striking views are obtained of London and its suburbs. The village is composed chiefly of a good class of houses surrounded by villas and gardens; and there are a number of mansions of historical interest in the neighborhood, among which may be mentioned Arundel House, in which Bacon died in 1626, and Lauderdale House, once the residence of Lord Lauderdale, one of the "Cabal" of Charles II., now used as the convalescent home of St. Bartholomew hospital. The principal buildings are the church of St. Michael, erected in 1832, in the Perpendicular style, containing a monument to Coleridge, who had his residence in Highgate for nineteen years; the new building erected in 1868 for the grammar school founded by Chief-Justice Cholmeley in the time of Elizabeth; the Roman Catholic monastery called St. Joseph's Retreat, a splendid and spacious structure in the Italian style, recently erected; the London diocesan penitentiary, the infirmary, the small-pox and vaccination hospital, the Alexandra orphanage, and the Whittington almshouses. Near the foot of the hill is the Whittington stone, erected in 1821 in place of the old one, which was removed in 1795. In 1809 a scheme was projected to avoid the steep ascent at Highgate by means

of an arched tunnel, but after the work had proceeded about 130 yards the whole fell in on 13th April, 1812. A road was, however, formed in the line of the intended tunnel, passing under an arch over which the ancient road, Hornsey Lane, is continued. The North London cemetery, in the neighborhood, contains the graves and monuments of a great number of celebrities. Highgate is supposed by some to have received its name from the gate erected by the bishop of London for the purpose of receiving toll from the passengers by the road which at this point entered his park; but it is possible that gate is here used according to its old signification, and that the name simply means high road. The road was constructed in the 14th century, and the toll-house was built on the site of an ancient hermitage. In the time of stage coaches a custom was introduced of making ignorant persons believe that they required to be sworn and admitted to the freedom of the Highgate before being allowed to pass the gate, the fine of admission being a bottle of wine, which was discussed at the conclusion of the ceremony. The population of the parish in 1871 was 6437, and of the township 5331.

HIGH PLACE is the rendering invariably given in the authorized English version of the Old Testament Scriptures to a Hebrew word בָּמָה of uncertain derivation but with much plausibility connected by Gesenius with the Indo-Germanic root which appears in the Persian *bam* (roof, summit), and in the Greek *βωμός* (compare *βῆμα*, Doric *βᾶμα*). By the LXX. the word is sometimes left untouched (*βαμά* in 1 Sam. ix. 13 and elsewhere); the prevalent rendering of the plural, when a translation is hazarded at all, is in the Pentatench *στήλαι*, in the historical books *τὰ ὑψηλά*, *τὰ ὕψη*, and in the prophetical writings *βωμοί*. The Vulgate invariably gives either *excelsa* or *fana*. The habit so widely diffused among primitive peoples of selecting the tops of mountains, or at least elevated sites, as suitable from their comparative isolation from the world and their supposed nearness to the sky for the erection of altars and sacred pillars, is so obviously natural as to require no explanation. Along with that of worshipping under trees or groves (see GROVE), it was fully participated in by the Israelites from an early period, and continued to assert itself down to a very late date, as is abundantly shown by the frequency with which *bamah* and other words (*har*, *gib'ah*, *ramah*) signifying height occur in connection with their public and private worship, whether Jehovistic or idolatrous. Thus one of our earliest notices with regard to Abraham after his departure from Haran is that after setting up a sanctuary at Sichem at the oak of Moreh, he "removed unto a mountain on the east of Bethel, and there builded an altar unto the Lord" (Gen. xii. 8). It was on a mountain (Ebal) that the first altar to Jehovah was raised by Joshua after the conquest of Canaan had begun (Josh. viii. 30; *cf.* Deut. xxvii. 4, 5); and many other "high places," some of them (*e.g.*, Beth-Shemesh, or Ir-Heres, and Ashtaroth Karnaim) apparently taken over directly from the Canaanites, speedily obtained recognition as sanctuaries. A few of these, such as Shiloh, early became important pilgrimage centres, but this was not regarded as inconsistent with the right of each town or village-community to have its own high place, or with the view that Palestine as a whole was the "house" or peculiar territory of God, and that it was therefore lawful on suitable occasions to erect new and extempore altars or high places within its limits. For example, we find in 1 Sam. x., xi. repeated references made to the *bamah* of Samuel's native village as if it were a thing of course; from 2 Sam. xv. 32 (Hebr.) we gather that even in David's time the top of Mount Olivet was a place "where God was wont to be worshipped;" while at a later period we read of Elijah repairing the altar on Mount Carmel that had been broken down, and complaining of the violation of God's covenant of which those persons had been guilty who had thrown down the altars and slain the prophets (1 Kings xviii. 30; xix. 10, 14). And we read of new altars, generally on high places, being set up by Gideon (Judg. vi. 26, 27), by Manoah (Judg. xiii. 19, 20), and repeatedly by Saul (1 Sam. xiv. 35). The comparatively late author of the books of Kings expressly states, on the one hand, that before the days of Solomon the people "sacrificed in high places because there was no house built unto the name of the Lord" (1 Kings iii. 2), and, on the other hand, that after that king the high places were removed neither by Asa (1 Kings xiv. 15), nor by Jehoshaphat (xxii. 44), Joash (2 Kings xii. 3), Amaziah (xiv. 4), Uzziah (xv. 4), or Jotham (xv. 35). The still later author of the books of Chronicles, indeed, states of Asa (2 Chr. xiv. 5) and Jehoshaphat (xvii. 6) that they did take away the high places "out of all the cities of Judah;" but this apparent contradiction can best be explained if we assume that the chronicler is alluding only to those high places where heathen deities were worshipped or idolatrous practices allowed, while the earlier author had in view the Jehovistic high places which, during many of the earlier reigns at least, were not discountenanced either in the northern or in the southern kingdom. In reading such a passage as Amos vii. 9, it would be a mistake to interpret it as meaning that the multiplicity of *bamoth* was regarded as wrong in itself; the prophet's zeal is directed not against the places but against the cultus and the false value that was attached to it. Hezekiah is the first monarch of whom in the earlier record we read that with some risk to his popularity he removed the high places and altars of Jehovah, and "said to Judah and Jerusalem, ye shall worship before this altar in Jerusalem" (2 Kings xviii. 4 compared with xviii. 22). But it was not until the reign of Josiah that the high places were finally repressed, not on the ground of direct prophetic revelation, but on that of a strict written law. Even then, however, a distinction was made between the "high places" of the southern kingdom, sacred to Jehovah, and those of the northern, dedicated to a mixed worship; the priests of the former were brought to Jerusalem, and, though not allowed to officiate at the altar there, were permitted to share the priests' portion along with their brethren, while those of the latter were put to death (2 Kings xxiii. 8, 20). As for the altars built upon the high places, their construction appears to have been regulated by the law provided for the case in Ex. xx. 24, 25; very often *Maççeboth* or pillars were erected beside them (see Ex. xxiv. 4; Josh. xxiv. 26; *cf.* Isa. xix. 19; Hosea iii. 4); and sometimes they were enclosed in "houses" or "temples" (1 Kings xii. 31, xiii. 32; Amos vii. 13). For the bearing of the facts contained in this article on the criticism of the Pentateuch and of its legislation, see PENTATEUCH.

HIGHWAYS. A highway is a public road over which all persons have full right of way—walking, riding, or driving. See ROADS. Such roads in England for the most part either are of immemorial antiquity or have been created under the authority of an act of Parliament. But a private owner may create a highway at common law by dedicating the soil to the use of the public for that purpose; and, apart from any special dedication, the using of a road for a number of years, without interruption, will support the presumption that the soil has been so dedicated, and the road will be to all intents and purposes a public highway. At common law the parish is required to maintain all highways within its bounds; but by special custom the obligation may attach to a particular township or district, and in certain cases the owner of land is bound by the conditions of his holding to keep a highway in repair. Breach of the obligation is treated as a criminal offence, and is prosecuted by indictment. Bridges, on the other hand, and so much of the highway as is immediately connected with them, are as a general rule a charge on the county; and by 22 Henry VIII. c. 5 the obligation of the county is extended to 300 yards of the highway on either side of the bridge. A bridge, like a highway, may be a burden on neighboring land *ratione tenuræ*. Private owners so burdened may sometimes claim a special toll from passengers, called a "toll traverse."

Extensive changes in the law of highways have been made by the recent Highway Acts, viz., The Highway Act, 1835 (5 and 6 Will. IV. c. 50), and the amending Acts of 1862 and 1864. It is no longer possible for a private owner, by dedicating a highway to the public, to make the charge of maintaining it a burden on the parish in all cases. To create a new highway of this character he must give three months' notice of his intentions to the parish surveyor, and a meeting of vestry must then be called to consider whether the proposed highway is worth the expense of maintenance. Should the vestry decide against it, the charge of maintenance will not fall on the parish, unless the justices of the peace at the next highway sessions decide otherwise.

The leading principle of the Highway Act, 1835, is to place the highways under the direction of parish surveyors, and to provide for the necessary expenses by a rate levied

on the occupiers of land. Two or more parishes may unite to form a district under a district surveyor, and large parishes may appoint more than one surveyor. It is the duty of the surveyor to keep the highways in repair; and if a highway is out of repair, the surveyor may be summoned before justices and convicted in a penalty not exceeding £5, and ordered to complete the repairs within a limited time. The surveyor is likewise specially charged with the removal of nuisances on the highway, or any obstruction or injury rendering it less commodious to the public. A highway nuisance may be abated by any person, and may be made the subject of indictment at common law. The Act contains provisions simplifying the process by which a highway may be widened, enlarged, diverted, or stopped. The amending Acts, while not interfering with the operation of the principal Act, authorize the creation of highway districts on a larger scale. The justices of a county may convert it or any portion of it into a highway district to be governed by a highway board, the powers and responsibilities of which will be the same as those of the parish surveyor under the former Act. The board consists of representatives of the various parishes, called "way wardens," together with the justices for the county residing within the district. Salaries and similar expenses incurred by the board are charged on a district fund to which the several parishes contribute; but each parish remains separately responsible for the expenses of maintaining its own highways.

The Highway Act of 1835 specifies as offences for which the driver of a carriage on the public highway may be punished by a fine, in addition to any civil action that may be brought against him—riding upon the cart, or upon any horse drawing it, and not having some other person to guide it, unless there be some person driving it; negligence causing damage to person or goods being conveyed on the highway; quitting his cart, or leaving control of the horses, or leaving the cart so as to be an obstruction on the highway; not having the owner's name painted up; refusing to give the same; and not keeping on the left or near side of the road when meeting any other carriage or horse. This rule does not apply in the case of a carriage meeting a foot-passenger, but a driver is bound to use due care to avoid driving against any person crossing the highway on foot. At the same time a passenger crossing the highway is also bound to use due care in avoiding vehicles, and the mere fact of a driver being on the wrong side of the road would not be evidence of negligence in such a case. When there is a public crossing in a street, the driver is bound to use special care; and the expression has been used that a crossing is the special property of the foot-passengers.

The "rule of the road" given above is peculiar to the United Kingdom. Cooley's treatise on the *American Law of Torts* states that "the custom of the country, in some States enacted into statute law, requires that when teams approach and are about to pass on the highway, each shall keep to the right of the centre of the travelled portion of the road." The same appears to be the general rule on the continent of Europe.

The excessive use of the highway by acts which in moderation are lawful becomes a nuisance if it interferes with the public enjoyment of the roadway. Thus when a carrier, having warehouses on a public street, occupied one side of the street in loading and unloading his wagons several hours at a time, so that foot-passengers were incommoded and no carriage could pass on that side, although there was room for two carriages on the opposite side, this was held to be a nuisance; and Lord Ellenborough held it to be a nuisance for stage coaches to stop in the street for three-quarters of an hour taking up and setting down passengers, for the "king's highway was not to be used as a stable-yard." In the same way, at common law a tramway laid along a highway is a public nuisance, although it may be shown to be a common convenience. The construction of tramways is now authorized by 33 and 34 Vict. c. 78.

The Acts 24 and 25 Vict. c. 70, and 28 and 29 Vict. c. 83, regulate the use of locomotives on turnpike and other roads. No engine, so constructed as to be a public or private nuisance, is protected by these Acts. When horses had been frightened by a traction engine, and the jury found that it was likely to frighten horses and that the defendant knew it, he was held liable in damages.

Turnpike Acts.—Many of the more important highways are placed under the management of boards of commissioners or trustees. The number of local and general turnpike acts is very great. No fewer than thirty-three general acts are mentioned in the index to the statutes—the first and principal Act being 3 Geo. IV. c. 126. The trustees are required and empowered to maintain, repair, and improve the roads committed to their charge, and the expenses of the trust are met by tolls levied on persons using the road. The various grounds of exemption from toll on turnpike roads are all of a public character, *e. g.*, horses and carriages attending the sovereign or royal family, or used by soldiers or volunteers in uniform, are free from toll. In general horses and carriages used in agricultural work are free from toll. By the Highways and Locomotives Act of 1878 (41 and 42 Vict. c. 77) disturnpiked roads are to become "main roads," and half the expense of maintenance is to be paid out of the county rate. Ordinary highways may be declared to be "main roads," and "main roads" may be reduced to the status of ordinary highways.

In Scotland the highway system will in future be regulated by the Roads and Bridges Act, 1878, which comes into operation at the latest on the 1st of June, 1883, but may be adopted sooner in any county. From and after the commencement of the Act in each county, the management and maintenance of the highways and bridges shall be vested in the county road trustees, viz., the commissioners of supply, certain elected trustees representing ratepayers in parishes, and others. One of the consequences of the commencement of the Act is the abolition of tolls, statute-labor, causeway mail, and other exactions for the maintenance of bridges and highways; and all turnpike roads shall become highways, and all highways shall be open to the public free of tolls and other exactions. The county is to be divided into districts under district committees, and county and district officers are to be appointed. The expenses of highway management in each district (or parish), together with a proportion of the general expenses of the Act, shall be levied by the trustees by an assessment on the lands and heritages within the district (or parish).

Highway, in the law of the States of the American Union, generally means a lawful public road, over which all citizens are allowed to pass and repass on foot, on horseback, in carriages, and wagons. Sometimes it is held to be restricted to county roads as opposed to town-ways. In statutes dealing with offences connected with the highway, such as gaming, negligence of carriers, etc., "highway" includes navigable rivers. But in a statute punishing with death robbery on the highways, railways were held not to be included in the term. In one case it has been held that any way is a highway which has been used as such for fifty years. (E. R.)

HILARION, St., abbot, the first to introduce the monastic system into Palestine, was born of heathen parents at Tabatha, about 5 miles to the south of Gaza, about the year 288, was sent when very young to Alexandria to be educated, and there became a convert to the Christian religion. Attracted by the fame of St. Anthony, he went to visit that saint in his solitude, and forthwith became a disciple. Returning to Palestine with some companions while still but a lad of fifteen, he gave away all the property he had inherited by the recent death of his parents, and then withdrew into loneliness in the desert between the sea and the marshes on the Egyptian border. In this solitude he observed the most rigid asceticism, and (to quote the quaint remark of Butler) "thought himself at liberty to practise certain mortifications which the respect we owe to our neighbor makes unseasonable in the world." Twenty years of patient continuance in the way of life he had chosen for himself were rewarded, we are told, with miraculous gifts and with rapidly growing fame; disciples and imitators multiplied to the number of two or three thousand, and all owned the spiritual oversight of Hilarion. Informed by revelation when sixty-five years old of the death of Anthony, he undertook an extended tour into Egypt, where he visited all the scenes of that saint's labors; afterwards he removed in the company of a favorite disciple, Hesychius, into Sicily, where, however, his popularity rendered impossible the quiet and retirement which were congenial to his habits; a further migration to Epidaurus thus became necessary; and ultimately he found a resting-place in Cyprus, the diocese of his old friend Epiphanius, where in a lonely cell amongst some almost inaccessible rocks he died in 371. According to Sozomen his festival was observed in Palestine with great

solemnity as early as the 5th century; he is now commemorated by the Roman Church on October 21st. His earliest biographers were Epiphanius and Jerome.

HILARIUS, or HILARUS (HILARY), bishop of Rome from 461 to 467, who according to some authorities had attained to the archidiaconate as early as the year 417, is known to have been a deacon and to have acted as legate of Leo the Great at the "robber" synod of Ephesus in 449. There he so vigorously defended the conduct of Flavian in deposing Eutyches that he was thrown into prison, whence he had great difficulty in making his escape to Rome. Chosen to succeed Leo on November 12, 461, he issued a brief *de fide catholica*, in which he anathematized Eutyches, Nestorius, and Dioscurus, and reaffirmed the decisions of the councils of Nice, Ephesus, and Chalcedon. In 465 he held at Rome a council which put a stop to some prevalent abuses, particularly to that of bishops appointing their own successors. His pontificate was also marked by a successful encroachment of the papal authority on the metropolitan rights of the French and Spanish hierarchy, and by a resistance to the toleration edict of Anthemius, which ultimately caused it to be recalled. Hilarius, who died November 17, 467, was succeeded by Simplicius.

HILARIUS, ST., of Arles (*c.* 403–449), an eminent prelate and an able if unsuccessful defender of the liberties of the Gallican Church, was born about 403, and in early youth entered the abbey of Lerins, then presided over by his kinsman Honoratus (St. Honoré). Having succeeded Honoratus in the bishopric of Arles in 429, he set about the discharge of his episcopal functions with unusual energy and zeal. Following the example of St. Augustine, he is said to have organized his cathedral clergy into a "congregation," devoting a great part of their time to social exercises of ascetic religion. As bishop of Arles he held the rank of metropolitan of Vienne and Narbonne, and in this capacity he came into collision in 444 with Leo the Great on the question of the deposition of one of his bishops (Chelidonius); this quarrel resulted in his being deprived of his rights as metropolitan to consecrate bishops, call synods, or exercise ecclesiastical oversight in the province, and in the edict of Valentinian III., so important in the history of the Gallican Church, "ut episcopis Gallicanis omnibusque pro lege esset quidquid apostolicæ sedis auctoritas sanxisset." He died in 449, and his name was afterwards introduced into the Roman martyrology for commemoration on the 5th of May. Hilarius enjoyed during his lifetime a high reputation for learning and eloquence as well as for piety; his extant works (*Vita S. Honorati Arelatensis Episcopi* and *Metrum in Genesin*) compare favorably with any similar literary productions of that period. A poem, *De Providentia*, usually included among the writings of Prosper, is sometimes also attributed to Hilary of Arles.

HILARIUS, ST., bishop of Pictavium (Poitiers), an eminent "doctor" of the Western Church, sometimes referred to as the "malleus Arianorum" and the "Athanasius of the West," was born at Poitiers about the end of the 3d century A. D. His parents, who were pagans of distinction, afforded him every means of acquiring a good education; and to the ordinary accomplishments of an educated gentleman there was added in his case what had even then become somewhat rare in the West, some knowledge of Greek. After he had attained to manhood his attention was directed to the Old and New Testament writings, with the result that he became convinced of the truth of Christianity, and along with his wife and his daughter received the sacrament of baptism. We have no means of knowing the nature or duration of the services which he rendered the church during the period which immediately followed his admission within its pale; but he appears to have continued to reside in Poitiers, and so great was the respect in which he came to be held by the citizens there that about 353, although still a married man, he was by the unanimous voice elected bishop. At that time Arianism, which under imperial protection had overspread the Eastern, was now under similar auspices threatening also to overrun the Western Church; to resist and repel the irruption was the great task which Hilary now set himself to achieve. One of his first steps was to secure the excommunication, by those of the Gallican hierarchy who still remained orthodox, of Saturninus, the Arian bishop of Arles, along with Ursacius and Valens, two of the most prominent of the supporters of that prelate. About the same time he wrote to the emperor Constantius a remonstrance against the persecutions by which the Arians had sought to crush their opponents (*Ad Constantium Augustum Liber Primus*, of which the most probable date is 355). His labors for the triumph of orthodoxy were not in the first instance, however, crowned with success; for at the synod of Biterræ (Beziers), summoned in 356 by Constantius with the professed purpose of settling the long-standing disputes, Hilary was by an imperial rescript banished along with Rhodanus of Toulouse to Phrygia, in which exile he spent nearly four years. From this hostile region, however he continued to govern his diocese without undue difficulty, no successor having been nominated to the see; while at the same time he found leisure for the preparation of two of the most important of his contributions to dogmatic and polemical theology, the *De Synodis*, or *De Fide Orientalium*, an epistle addressed in 358 to the bishops in Gaul, Germany, and Britain, expounding the true views (sometimes veiled in ambiguous words) of the Oriental bishops on the Trinitarian controversy, and the *De Trinitate Libri XII.*, composed in 359 and 360, in which, for the first time, it was successfully attempted to express in the Latin tongue the theological subtleties and refinements which had been elaborated with the aid of the more flexible language of Greece. The former of these works was not entirely approved by some of the members of his own party, who thought he had shown too great forbearance towards the Arians, and had expressed himself too hopefully as to the possibilities of an ultimate reconciliation of the contending views; to their criticisms he replied in the *Apologetica ad Reprehensores Libri de Synodis Responsa.* In 359 Hilary attended the convocation of bishops at Seleucia in Isauria, where, along with the Egyptian Athanasians, he joined the Homoiousian majority against the Arianizing party headed by Acacius of Cæsarea; thence he betook himself to Constantinople, and, in a petition (*Ad Constantium Augustum Liber Secundus*) personally presented to the emperor in 360, repudiated the personal calumnies of his enemies and sought to vindicate his Trinitarian principles. His urgent and repeated request to be permitted a public discussion with his opponents, especially with Ursacius and Valens, proved at last so inconvenient that he was sent back to his diocese, which, accordingly, he appears to have reached about 361, within a very short time of the accession of Julian. Though he was received in his diocese with every demonstration of joy, he yet found Arianism strong enough there to demand his best energy and skill for the next two or three years; but in 364, extending his efforts once more beyond Gaul, he impeached Auxentius, bishop of Milan, and a man high in the imperial favor, as heterodox. Summoned to appear before the emperor (Valentinian) at Milan and there maintain his charges in person, Hilary had the mortification of hearing the supposed heretic give answers entirely satisfactory to all the questions which were proposed; nor did his (doubtless sincere) denunciation of the metropolitan as a hypocrite save himself from an ignominious expulsion from Milan as a disturber of the peace of the church. In 365 he published the *Contra Arianos vel Auxentium Mediolanensem Liber*, in connection with the controversy; and also (but perhaps at a somewhat earlier date) the *Contra Constantium Augustum Liber*, in which he pronounced that lately deceased emperor to have been Antichrist, a rebel against God, "a tyrant whose sole object had been to make a gift to the devil of that world for which Christ had suffered." The later years of Hilary's life were spent in comparative quiet and retirement, devoted in part to the preparation of his expositions of the Psalms (*Tractatus super Psalmos*), for which he was largely indebted to Origen; of his *Commentarius in Evangelium Matthæi*, a work of no exegetical value; and of his no longer extant treatise on the book of Job. He died 13th January, 368. His great energy and zeal, courage and perseverance, rendered him a very influential ecclesiastic during his life; while, in virtue at once of the depth and acuteness of his intellect and of the wide extent of his knowledge, he holds the very highest rank among the Latin writers of his century. Designated already by Augustine as "the illustrious doctor of the churches," he by his works exerted an increasing influence in later centuries; and by Pius IX. he was formally recognized as "universæ ecclesiæ doctor" at the synod of Bordeaux in 1851. Hilary's day in the Roman calendar is January 14; the English "Hilary Term" begins on the 11th and ends on the 31st.

Of Hilary's works, which include, besides those already mentioned, some minor treatises, there have been several editions, of which the most worthy of mention are that of Erasmus (Basel, 1523, 1526, 1528), the Benedictine by Coutant (Paris, 1693; reprinted by Maffei, Verona, 1730), and that of Migne in the *Patrologiæ Cursus Completus*. His biography by Fortunatus probably dates from about the middle of the 6th century; other sources for the facts of the life of Hilary are the numerous incidental notices to be met with in his own writings and in those of Jerome, Sulpicius Severus, and Gregory of Tours. See Reinkens, *Hilarius v. Poictiers* (1864).

HILDA, or HILD (614–680), usually called St. Hilda, a Saxon lady whose name is intimately associated with the history of the early English church and of early English literature. She was a member of the royal family of Northumbria, her father Hereric being a nephew of King Edwin; and it was along with her royal kinsman that, as a girl of fourteen, she received baptism at the hands of Paulinus. During the pagan reaction which followed Edwin's defeat and death, Hilda was tempted to settle with her widowed sister Hereswith at the monastery of Chelles, 12 miles from Paris; but she was recalled to England by Bishop Aidan, the missionary from Iona, and in 649, two years after her consecration as a nun, she was appointed to succeed Heru the abbess of Heortea or Hartlepool. When, in fulfilment of the vow which he had made before the decisive battle with Penda, Oswy came to dedicate his daughter to God, it was to the care of Hilda that he entrusted her. In 658 the abbess founded the famous monastery on the cliffs at Streoneshalh or Whitby, and for the next twenty-two years she ruled with rare ability and virtue over the double community of monks and nuns which gathered round her. Among those who shed the most abiding lustre on the establishment were St. John of Beverley and the Saxon poet Cædmon. Hilda died, full of years, in 680, mourned by her nuns as their common mother. There is a St. Hilda's church both at South Shields and at Hartlepool, and the latter preserves her effigy on its ancient seal. At Whitby the tradition long lingered that on a summer forenoon, when the sun shone in the highest windows of the north part of the abbey, a figure of Lady Hilda could be discerned; and the fossil ammonites of the neighborhood are popularly known as St. Hilda's snakes. See Bede, *Eccl. Hist.*, xxiv.; Dr. G. Young, *Hist. of Whitby*, 1817; Sir Cuthbert Sharp, *Hist. of Hartlepool*, 1816.

HILDBURGHAUSEN (in old records *Hiltpershusia* and *Villa Hilperti*), the chief town of a circle in the duchy of Saxe-Meiningen, Germany, is situated in a wide and fruitful valley on the river Werra and on the Werra Railway, 19 miles south-east of Meiningen by rail. It is the seat of a circle court, of a court of appeal, and of the jury court for the duchy. The streets are wide and regular, and the principal buildings are the former castle of the duchy, erected 1685–95, now used as barracks, with a park in which there is a monument to Queen Louise of Prussia; the old townhouse, the Government buildings, the gymnasium erected in 1877, the normal seminary, and the lunatic asylum. A monument has been erected to those of the citizens who died in the Franco-Prussian War of 1870–71. The manufactures are very various, and include linen fabrics, cloth, papier-mâché, toys, buttons, optical instruments, agricultural machines, knives, mineral waters, condensed soups, and condensed milk. The population in 1905 was 7,456.

Hildburghausen belonged in the 14th century to the counts of Henneberg, from whom it passed into the possession of the dukes of Saxony. In 1683 it became the capital of a principality, which in 1826 was united to Saxe-Meiningen.

HILDEBERT (HYDALBERT, GILDEBERT, ALDEBERT) of Le Mans and afterwards of Tours, a prominent churchleader, and one of the best Latin writers of his century, was born about 1055 at Lavardin near Vendôme, became a pupil of the famous Berengarius of Tours, and made so great progress in all the learning of the time that he was made head master of the school, archdeacon, and finally, in 1097, bishop of Le Mans. In the beginning of his episcopate much trouble was caused him by the jealousy of his dean, Godfrey, who had accused him of immorality; but finally he succeeded in fully vindicating his innocence. He next had to encounter the persecutions of William Rufus, who had captured the city; and these proved so harassing that he ultimately felt it necessary to withdraw to Rome, with the intention of resigning his charge; but Pope Paschalis II. declined to give him his release. On his return to Le Mans, Hildebert found the diocese in a state of great commotion, which had been caused by the preaching of Henry the deacon; but he speedily succeeded in restoring order after he had banished the agitator. About 1125 he was translated, much against his will, to the see of Tours and soon afterwards he held the important synod of Nantes, convened for the purpose of correcting the abuses and terminating the disorder which had so long prevailed in Brittany. A dispute with Louis the Fat about the rights of ecclesiastical patronage brought him into much disfavor with that monarch; but their mutual relations had much improved before the death of Hildebert, which took place on December 18, 1134. From some writers he has received the name of Saint, but his name occurs in no martyrology.

The works of Hildebert, which include letters, sermons, and poems, as well as formal contributions to philosophy and dogmatic theology, have been edited by Beaugendre (Paris, 1708), and in part both by Baluze and Muratori. (See also Galland's *Bibliotheca Patrum*, vol. xiv.) The poems, which are on very various subjects, are disfigured by many faults of metre and defects of style, but nevertheless enjoyed great popularity in their time, and were frequently used as classics in the schools of France and Italy, as also were the letters, of which the literary merit is greater (129 in 3 books). The sermons are often eloquent and instructive, but generally overloaded with imagery and disfigured by an excessive use of the allegorical method of interpretation. The tendency to Mariolatry is strongly developed in them: and the *De Cœna Domini* has an historical interest, as exhibiting the first instance of the use of the word transubstantiation. The *Tractatus de querimonia s. conflictu carnis et animæ* is an imitation of Boetius; and the *Moralis Philosophia* has its sources in earlier Latin authors, and especially in Cicero and Seneca. The *Tractatus theologicus* appears to have determined the form of later systems, and thus to be of importance in the history of dogmatic theology. His method is first to lay down the thesis, which is then supported by scripture proofs and by passages from the fathers, especially from Augustine; he finally proceeds by detailed argument to dispose of difficulties and objections with considerable acuteness, and without that excessive subtlety which characterized later scholastic writers.

HILDEBRAND. See GREGORY VII.

HILDEBRANDSLIED. This invaluable example of Old German alliterative poetry is contained in a MS. originally belonging to the library of Fulda, and now preserved at Cassel. It is written on the first and last pages of a volume of Biblical and theological contents by two contemporary hands apparently belonging to the beginning of the 9th century. The conclusion of the poem is unfortunately wanting, evidently from want of space. From such misreadings as *man* for *inan*, and *puas* for *wuas* or *was* (with *p* for the Runic *w* sign sometimes used here as in Old English MSS.), it is manifest that our text was not written down from memory,—as has often been assumed,—but is a transcript from an older original. This conclusion is confirmed by the state of the language of the fragment, which shows a curious mixture of Low and High German forms that can never have existed in any living dialect of Germany, but can only be explained as the result of an attempt made by a Low German scribe to adapt the forms of a High German original to his vernacular idiom.

The fragment is mostly taken up with a dialogue between Hildebrand and his son Hadubrand. When Hildebrand followed his master Theodoric the Great, exiled from Italy by Odoacer, he left his young wife and an infant child behind him. At his return to his old home, after thirty years' absence at the Hunnic court, he is met by a young warrior and challenged to single combat. Before the fight begins, Hildebrand, asking for the name of his opponent, and discovering his own son in him, tries to avert the fight, but in vain. "Then they let their horses run with their sharp spears, and then they hewed their white shields until they were beaten to pieces with their weapons." With these words the fragment stops abruptly, giving no clue as to the issue of the combat. It is certain, however, from allusions to the tale made in the Old Norse Asmundar Saga, that it must have been fatal to Hadubrand.[1] But in the later traditions both of the Old Norse Thidriks Saga (13th century), and the so-called *Jüngere Hildebrandslied*,—a German popular song preserved in several versions dating from the 15th to the 17th century, but evidently originating at an earlier time,[2]—Hadubrand is represented as defeated simply, and obliged to recognize his father.

[1] See Müllenhoff and Scherer, *Denkmäler*, p. 264.
[2] See Grimm's edition, and Uhland *Alte hoch- und niederdeutsche Volkslieder*, i. 330 foll.

The *Hildebrandslied* was discovered and published for the first time as a prose story, as early as 1729:[1] but it was not till 1812 that its metrical character was recognized by the brothers Grimm.[2] Since that time numerous reprints and critical editions have been published, among which Lachmann's text[3] holds the foremost rank as to critical exactness and sagacity, although some of the metrical rules laid down by Lachmann, and followed in his text, have since been shown not to be applicable to the Old German alliterative verse in which the *Hildebrandslied* is written.[4]

HILDEBRANDT, Eduard (1817–1868), was born in 1817, and served his term as apprentice to his father, a house-painter at Dantzic. He was not twenty when he came to Berlin, where he was taken in hand by Wilhelm Krause, a painter of sea-pieces. Like other artists who have earned a name for subtle and rapid execution, he worked at first in a formal, smooth, and timid fashion. Several early pieces exhibited after his death,—a breakwater, dated 1838, ships in a breeze off Swinemünde (1840), and other canvases of this and the following year,—show Hildebrandt to have been a careful student of nature, with inborn talents kept down by the conventionalisms of the formal school to which Krause belonged It is difficult to say what the outcome of his art would have been if Hildebrandt had not felt other influences than those of his native schools. Accident made him acquainted with masterpieces of French art displayed at the periodical exhibitions of the Berlin Academy, and these awakened his curiosity and envy. He made up his bundle and wandered to Paris, where, about 1842, he entered the atelier of Isabey and became the companion of Lepoittevin. In a short time he sent home pictures which might have been taken for copies from these artists. Gradually he mastered the tricks of touch and the mysterious secrets of effect in which the French at this period were already so perfect. He also acquired the necessary skill in painting figures, and having done this he returned to Germany, unsurpassable in technical execution, and well skilled in the rendering of many kinds of landscape forms. His pictures of French street life, done about 1843, are impressed with the stamp of the Paris school, but they reveal at the same time a spirit eager for novelty, quick at grasping, equally quick at rendering, momentary changes of tone and atmosphere in varying space and medium. After 1843 Hildebrandt, under the influence of Humboldt, extended his travels, and in 1864–65 he actually went round the world. But whilst his experience became enlarged his powers of concentration broke down. He lost the taste for detail in seeking for scenic breadth, and a fatal facility of hand diminished the value of his works for all those who look for composition and harmony of hue as necessary concomitants of tone and touch. In oil he gradually produced less, in water colors more, than at first, and his fame will probably rest on the sketches which he made in the latter form, many of which are known to the general public by means of chromo-lithography. His course may best be compared to that of a meteor, being breathlessly rapid, brilliant, and charged with color. No other had the same art of combining elements singly unpicturesque into a picturesque and striking whole, and this chiefly by contrasts of tint and observation of natural phenomena. Fantasies in red, yellow, and opal, sunset, sunrise, and moonshine, distances of hundreds of miles like those of the Andes and the Himalaya, narrow streets in the bazaars of Cairo or Suez, panoramas as seen from mastheads, wide cities like Bombay or Pekin, narrow strips of desert with measureless expanses of sky,—all alike display the *bravura* of a master who had innumerable admirers in his day on account of this facility, and deserved all the admiration he received, subject to the merited reproach that all these fire-works would have been more satisfactory if combined with deeper meditation on the art of composition and more patient study of detail. Hildebrandt died young at Berlin, on the 25th of October, 1868. His pictures are scattered in vast numbers throughout Germany. But good selections are accessible in the royal palaces and in the collections of Borsig, Raabe, and Ravené at Berlin.

HILDEBRANDT, Theodor (born at Stettin 1804, died at Düsseldorf, 1874), was a disciple of the painter Schadow, and, on Schadow's appointment to the presidency of a new academy in the Rhenish provinces in 1828, followed that master to Düsseldorf. Bred in the academy of Berlin, and finished under Schadow (1820–24), Hildebrandt began by painting pictures illustrative of Goethe and Shakespeare; but in this form he followed the traditions of the stage rather than the laws of nature. His artificial modes of thought were not, however, without admirers, and he produced rapidly Faust and Mephistopheles (1824), Faust and Margaret (1825), and Lear and Cordelia (1828). He visited the Netherlands with Schadow in 1829, and wandered alone in 1830 to Italy; but travel did not alter his style, though it led him to cultivate alternately eclecticism and realism. At Düsseldorf, about the year 1830, he produced Romeo and Juliet, Tancred and Clorinda, and other works of the same kind which deserved to be classed with earlier ones; but during the same period he exhibited (1829) the Robber and (1832) the Captain and his Infant Son, examples of an affected but kindly realism which captivated the public of the time, and marked to a certain extent an epoch in Prussian art. The picture which made Hildebrandt's fame is the Murder of the Children of King Edward, of which the original, afterwards frequently copied, still belongs to the Spiegel collection at Halberstadt. It challenges comparison with a similar composition by Paul Delaroche, though rather to Hildebrandt's disadvantage. Hildebrandt chose the moment when the children are asleep, and the murderers pause ere they smother their victims with a pillow. Delaroche with subtler sense of artistic propriety represented the princes seated on their bed unconscious of the near approach of their assassins, whose vicinity is betrayed by a streak of light at the bottom of the door and the watching of a dog. The execution of Delaroche is spirited and delicate, that of Hildebrandt finished and smooth. But the German master, who was below Sohn and Schadow in power, is also naturally far below his French competitor. Comparatively late in life Hildebrandt tried his powers as an historical painter in pictures representing Wolsey and Henry VIII., but he lapsed again into the romantic in Othello and Desdemona, a fair replica of which, in Schulte's collection at Düsseldorf, gives a good idea of his shiny, ineffective, technical execution. After 1847 Hildebrandt gave himself up to portrait painting, and in that branch succeeded in obtaining a large practice.

HILDEGARD (1098–1179), commonly referred to as St. Hildegard, abbess, "prophetess," and a figure of some consequence in the history of mediæval mysticism, was born of noble parents at Böckheleim in the countship of Sponheim, diocese of Mainz, in 1098 (or 1099), and from her eighth year was educated at the Benedictine cloister of Disibodenberg (Mons Disibodi) in the principality of Zweibrücken, now in Rhenish Bavaria, where Jutta, sister of the count of Sponheim, was at that time abbess. From earliest childhood, we learn from Hildegard herself, she was accustomed to see visions which increased in frequency and vividness as she approached the age of womanhood; these, however, she for many years, though with great pain, kept almost wholly secret, nor was it until she had reached her forty-third year (1141) that she felt constrained at last to divulge them. Committed to writing by her intimate friend the monk Godefridus, they now form the first and most important of her printed works, entitled *Scivias* (probably an abbreviation for "sciens vias" or "nosce vias Domini") *s. Visionum et Revelationum Libri III.*, and completed in 1151. In 1147 St. Bernard of Clairvaux, having come to Bingen while engaged in preaching the new crusade throughout Germany, chanced to hear of Hildegard's revelations, and on inquiry became so convinced of their reality that he not only wrote to her a letter cordially acknowledging her as a prophetess of God, but also successfully advocated her recognition as such by his friend and former pupil Pope Eugenius III. in the synod of Trèves (1148). In the same year Hildegard, who meanwhile had succeeded Jutta as abbess at Disibodenberg, and had attracted overflowing numbers to that cloister, migrated along with eighteen of her nuns to a new convent at Rupertsberg near Bingen, over which she presided during the remainder of her life. By means of voluminous correspondence, as well as by extensive journeys,

[1] See J. G. Eckhard, *Commentarii de rebus Franciæ orientalis*, Würzburg, i. 864 foll.

[2] *Die beiden ältesten deutschen Gedichte aus dem 8ten Jahrh. . . . herausgegeben durch die Brüder Grimm*, Cassel, 1812.

[3] Given in Müllenhoff and Scherer, *Denkmäler deutscher Poesie und Prosa*, 2d ed., Berlin, 1873, No. ii. A lithographic facsimile of the MS. was published by W. Grimm, Göttingen, 1830, and a photographic by E. Sievers, Halle, 1872.

[4] See especially F. Vetter, *Zum Muspilli*, Vienna, 1872, and M. Rieger, *Die alt- und angelsächsische Verskunst*, Halle, 1876 (reprinted from the *Zeitschrift für deutsche Philologie*, vii.).

in the course of which she was unwearied in the exercise of her gift of prophecy, she wielded for many years an increasing influence upon her contemporaries,—an influence doubtless due to the fact that she herself was so fully imbued with the most widely diffused feelings and beliefs, fears and hopes, of her time. Amongst her correspondents were Popes Anastasius IV. and Hadrian IV., the emperors Conrad III. and Frederick I., and also the theologian Guibert of Gembloux who submitted numerous questions in dogmatic for her determination. It deserves to be specially mentioned to her credit that, though zealously opposed to the Catharists, she stood almost alone in maintaining that the image of God ought to be respected even in them, and that therefore they ought not to be killed. She died in 1179, but has never been canonized; her name, however, was received into the Roman martyrology in the 15th century, September 17th being the day fixed for her commemoration. Her biography, which was written by two contemporaries, Godefridus and Theodoricus, was first printed at Cologne in 1566, and has frequently been reproduced in various forms since that date.

The works of Hildegard, in addition to the *Scivias* already mentioned, include *Divinorum operum simplicis hominis liber*, a hitherto unpublished treatise containing later visions and revelations, many of them relating to physical and medical questions; *Vitæ meritorum*, also unpublished, *Lives* of St. Rupert and St. Disibod; *Expositions* of the rule of St. Benedict, and of the Athanasian creed; *Letters*, and *Exhortations*. While her "visions" on such themes of the Christian religion as God and His kingdom, the church and its mystical union to Christ, must be regarded as crude and extravagant even to insanity, it is impossible to deny all ethical or religious value to her earnest denunciations of the corruptions of the clergy and mendicant orders, or to the intense expressions (however ignorant and imperfect) of the life-long aspirations of a mind so singularly unselfish and unworldly as hers. The *Scivias* were printed in 1513 and again in 1628. The *Epistolarum Liber* (first published in 1566) appears with some other *Opuscula* in the *Max. Bibl. Vet. Patr.*, vol. xxiii., and in Martene and Durand's *Amplissima Collectio*, vol. ii. The *Opera Omnia* form vol. cxcvii. of Migne's *Patrologiæ Cursus Completus*. See Meiner's, *De Sanctæ Hildegardis vita, scriptis, meritis* (1793); Dahl, *Die heilige Hildegard* (1832); Görres, *Die Christliche Mystik*.

HILDEN, a town of Prussia, in the government and circle of Düsseldorf, on the Itterbach. It is a station on the Rhenish railway, and has a considerable manufacture of silks, both pure and mixed, calico, and machinery; it also possesses a deaconess institute. During the last half century its growth has been rapid. While in 1816 the population numbered only 2,056, it amounted in 1905 to 13,946. Hilden was constituted a town in 1861.

HILDESHEIM, the chief town of a district in the province of Hanover, Prussia, is beautifully situated on the right bank of the Innerste, 18 miles south-east of Hanover by railway. It has a very antique and quaint appearance, and is surrounded by old ramparts which have been converted into shady alleys and promenades. The streets are for the most part narrow and irregular, and contain many old houses with overhanging upper stories and richly and curiously adorned wooden façades. The town is the seat of a district governorship, a high court of justice, two justice courts, a general superintendency of the Evangelical Church, and a Roman Catholic chapter. The Catholic cathedral, which occupies the site of a building founded by Louis the Pious in 818, dates from the middle of the 11th century. It is chiefly remarkable for the antiquities and notable works of art connected with it, including the bronze doors executed by Bishop Bernward, with reliefs from the history of Adam and Christ; the so-called Irmensäule, at one time believed to have been erected, before it was transferred to its present site, in honor of the Saxon idol Irmin, but now regarded as belonging to an old Roman aqueduct; the Christ column by Bishop Bernward, adorned with reliefs from the history of the Saviour; a brazen font of the 13th century, two candelabra of the 12th century, the sarcophagus of St. Godehard, the tomb of St. Epiphanius, and an immense number of minor articles of ecclesiastical furniture. The rose-bush on the wall of the crypt is alleged to be a thousand years old. Among the other churches those of special interest are St. Godehard's church, completed in 1172 and restored in 1863, a remarkably fine specimen of the Romanesque style, with three massive pyramidal towers; the church of St. Michael, an almost equally fine specimen of Romanesque, founded by Bishop Bernward, and restored in 1186 after injury by fire, containing a beautiful painted ceiling of the 12th century, and the tomb and monument of Bishop Bernward; St. Magdalene's church, which possesses various works in metal by Bishop Bernward; St. Martin's church, now used as a museum and library; the Lutheran church of St. Andrew with very lofty towers; and the fine columnar basilica of the abbey church of Moritzburg, a suburb half a mile south-west of the town. The other principal buildings are the town-house, dating from the 15th century, and containing the archives of the town; the house in the late Gothic style said, but erroneously, to have been built by the Knights Templars; the Michaelis monastery, now used as a lunatic asylum; and the old Carthusian monastery. The educational establishments include a Catholic and a Lutheran gymnasium, a Catholic normal school, a weaving school, and an agricultural school. The other principal public institutions are the Georgstift for daughters of state servants, the maternity hospital, two orphanages, and several other hospitals and infirmaries. The town has iron foundries, manufactures of cloth, damasks, linen fabrics, thread, sail-cloth, wadding, leather, machines, carriages, stoves, glass, tobacco, alcohol, perfumeries, chocolate, and starch. The population in 1905 was 47,061.

Hildesheim, though previously in existence, owes its rise and prosperity to the transference to it in 822 of the bishopric instituted by Charlemagno at Elze in 812. In the 10th century its importance was largely increased under Bishop Bernward, who, if he did not introduce, greatly stimulated by his example and patronage the art of working in metals, for which the town retained a high reputation until the close of the Middle Ages. It also obtained considerable fame by its cathedral school, at which several sons of the emperors received their education. In 1241 it joined the Hanseatic League, and in 1249 received town rights. It was frequently at feud with its bishops, and in the 14th century placed itself more than once under the protection of the house of Brunswick-Lüneburg. The bishops in the course of time had acquired considerable territory, but their feuds with the neighboring princes resulted in 1523 in the annexation of a great part of their possessions to Brunswick. A restoration, however, took place in 1643, and in the beginning of the present century the principality amounted to 682 square miles. The last bishop of Hildesheim possessed also the bishopric of Paderborn, acquired by his predecessor. Both bishoprics were secularized and ceded to Prussia in 1803. In 1807 they were incorporated with the kingdom of Westphalia, but in 1813 they were restored to Prussia, which ceded Hildesheim to Hanover, retaining only Paderborn. In 1866 the principality was united, along with Hanover, to Prussia.

On October 9, 1868, a unique collection of ancient plate was discovered on the Galgenberg near Hildesheim, about 10 feet below the surface. This *Hildesheimer Silberfund*, as it is usually called, has excited great interest among classical archæologists, comprising, as it does, no less than 60 pieces, or a complete service for three persons—plates, dishes, mixing-bowls, etc. The workmanship evidently belongs to the Augustan age, and by some authorities it is conjectured that we have nothing less than the plate that belonged to Drusus himself. The most noteworthy of the pieces are a *crater* richly ornamented with arabesques and figures of children, a platter with a representation of Minerva, and others with a boy Hercules, a Cybele, and a Deus Lunus. The whole collection is preserved in the Berlin Museum. For details see Wieseler, *Der Hildesheimer Silberfund*, Bonn, 1868.

HILDRETH, Richard (1807–1865), an American journalist and author, was born at Deerfield, Massachusetts, June 28, 1807. He was educated at Harvard College, where he graduated in 1826; and after studying law at Newburyport, he was called to the Boston bar in 1830. He had, however, already conceived a predilection for literature, and in 1832 he became joint founder and editor of a daily newspaper, *The Boston Atlas*. Having in 1834 gone to the south for the benefit of his health, he was led by what he witnessed of the evils of slavery to write the anti-slavery novel *Archy Moore*, which, chiefly on account of its subject, met with considerable success in America and England. An enlarged edition of it appeared in 1852 under the title of the *White Slave*. In 1837 he wrote *Banks, Banking, and Paper Currency*, a work which had some influence in fostering the growth of the free banking system in America. In 1838 he resumed his editorial duties on the *Atlas*, but in 1840 he found it necessary on account of his health to remove to British Guiana, where he was editor of two weekly newspapers in succession at Georgetown. He published in the same year *Despotism in America*, and he

also made the columns of his newspapers the medium for the dissemination of anti-slavery opinions. In 1849 he published the first three volumes of a *History of the United States*, a work which, if its narrative is rather bald and tame, is characterized by perfect fairness and candor, and displays great industry and care in the representation of facts. The fourth and fifth volumes were published in 1851, and the sixth volume, completing the work, appeared in 1852. His *Japan as it was and is* is a valuable digest of the information contained in other works on that country. He also wrote *Theory of Morals* (1844), and *Theory of Politics* (1853), as well as *Lives of Atrocious Judges*, compiled from Lord Campbell's two works. For some time Hildreth was on the editorial staff of the *New York Tribune*, and he was also a frequent contributor to periodicals. In 1861 he was appointed United States consul at Trieste, but ill-health compelled him to resign his office and remove to Florence, where he died July 11, 1865.

HILL, Aaron (1685–1749 or 1750), an English poet and miscellaneous writer, was born in London, 10th February, 1685. Though left by his father in necessitous circumstances, he was educated first at Barnstaple and then till his fourteenth year at Westminster School, after which he went out to Constantinople, where Lord Paget, a relative of his mother, was British ambassador. Under the care of a tutor he then travelled through Palestine, Egypt, and a great part of the East, returning to England about 1703. Having subsequently quarrelled with his patron, he again went abroad as travelling companion to a Yorkshire baronet. On returning home he published in 1709 his *History of the Ottoman Empire*, which, according to his own admission, had far more success than it deserved. About the same time appeared his poem of *Camillus*, in honor of the famous Charles Mordaunt, earl of Peterborough; and in the same year he was made manager of Drury Lane Theatre, and afterwards of the Haymarket. Both those offices he soon after lost through his indiscretion, and the remainder of his life was spent partly in literary pursuits, and partly in commercial speculations, which were all unlucky. One of these schemes called him to the Highlands of Scotland, and while there he wrote *The Progress of Wit, being a Caveat for the use of an eminent Writer*. The "eminent writer" was Pope, who had introduced Hill into the *Dunciad*, though in a way that was in fact complimentary. Hill died in 1749 or 1750, and was buried in Westminster Abbey. Two only of his seventeen dramas are now remembered, *Zara*, and *Merope*, both adaptations from the French of Voltaire. His poetry is stilted and commonplace, and even the *Progress of Wit* never rises above a flippant smartness. Though a poor and tasteless poet, and afflicted with an overwhelming sense of his own importance, Hill was an honorable man, and his letters to Savage, on whom he conferred many benefits, show his character in a very amiable light. The *Miscellaneous Works* of Hill were published in 1753 in 4 vols. 8vo, and his *Dramatic Works*, to which a Life was prefixed, appeared in 1759 in 2 vols. 8vo.

HILL, Matthew Davenport (1792–1872), was born August 6, 1792, at Birmingham, where his father, T. W. Hill, was at that time assistant in a charity school. He made such rapid progress in his education that in his thirteenth year he rendered his father efficient assistance in conducting a private school in Birmingham, and in his seventeenth year became the principal teacher. Resolving, however, to adopt the legal profession, he in 1814, while still continuing his scholastic duties, became a student of Lincoln's Inn, and in 1816 began to devote his uninterrupted attention to legal studies. He was called to the bar in 1819, and went upon the Midland circuit, where his ability was soon generally recognized, although for various reasons his acquisition of a profitable practice was not so rapid. In 1832 he was elected one of the Liberal members for Kingston-upon-Hull, but he lost his seat at the next election in 1834. On the incorporation of Birmingham in 1839, he was chosen recorder; and in 1851 he was appointed commissioner in bankruptcy for the Bristol district. Having in the course of his professional duties had his interest excited in questions relating to the treatment of criminal offenders, he in his charges to the grand juries, as well as in special pamphlets, ventilated opinions which have been the means of introducing many important reforms in the methods of dealing with crime. One of his principal coadjutors in these reforms was his brother Frederick Hill, whose *Amount, Causes, and Remedies of Crime*, the result of his experience as inspector of prisons for Scotland, may be said to mark an era in the methods of prison discipline. Hill was one of the chief promoters of the Society for the Diffusion of Useful Knowledge, and the originator of the *Penny Magazine*. He died 7th June, 1872.

His principal works are *Practical Suggestions to the Founders of Reformatory Schools*, 1855; *Suggestions for the Repression of Crime*, 1857, consisting of charges addressed to the grand juries of Birmingham; *Mettray*, 1855; *Papers on the Penal Servitude Acts*, 1864; *Journal of a Third Visit to the Convict Gaols, Refuges, and Reformatories of Dublin*, 1865; *Addresses delivered at the Birmingham and Midland Institute*, 1867. See *Memoir of Matthew Davenport Hill*, by his daughters Rosamond and Florence Davenport Hill, 1878.

HILL, Rowland (1744–1833), an eccentric and popular English preacher, sixth son of Sir Rowland Hill of Hawkstone, was born there 23d August, 1744. After receiving his early education at the grammar school of Shrewsbury and at Eton, he in 1764 entered St. John's College, Cambridge. While at the university he made the acquaintance of the Methodist preacher Whitfield, and stimulated by his example he somewhat scandalized the university authorities and his own friends by preaching, before he had obtained holy orders, in the surrounding villages, and conducting religious services in the houses of the sick and poor. After graduating with distinction he took orders, and in 1773 was appointed to the parish of Kingston, Somersetshire, where he began to indulge his favorite taste for open air preaching, and soon attracted great crowds to the services which he held nearly every day of the week. Having on the death of his father in 1780 inherited considerable property, he built for his own use Surrey Chapel, in the Blackfriars Road, London. The chapel was opened on the 8th June, 1783. Though now practically occupying the ecclesiastical position of a dissenter, Hill conducted his services in accordance with the forms of the Church of England, in whose communion he always remained. From the beginning his success was complete, and his chapel soon came to be filled with an audience such as no other preacher in London could boast. During the summer months he made what he called "gospel-tours" into all parts of the country, sometimes extending them to Scotland and Ireland, and attracted wherever he went audiences as numerous and as interested as those which had crowded to hear Whitfield. After these tours he always returned with increased enthusiasm to his duties at Surrey Chapel, where he continued to officiate almost to the day of his death, 11th April, 1833. The oratory of Rowland Hill, like that of Whitfield, was specially adapted for rude and uncultivated audiences, and it was equally effective although by more varied means. He possessed a voice of great power, and, according to Southey, "his manner" was "that of a performer as great in his own line as Kean or Kemble." Not unfrequently he violated the laws of good taste in the eccentricities of his wit and humor, but the intensity and purity of the purpose by which he was actuated enabled him always to retain uninjured his moral influence over his audience. Among the various publications of Rowland Hill the best known is his *Village Dialogues*, which first appeared in 1810, and reached a 34th edition in 1839.

See *Life* by Rev. Edwin Sidney, 1833; *Memoirs* by Rev. William Jones, 1834; and *Memorials* by Rev. James Sherman, 1857.

HILL, Sir Rowland (1795–1879), author of the penny postal system, a younger brother of Matthew Davenport Hill, and third son of T. W. Hill, who named him after Rowland Hill, the preacher, was born December 3, 1795, at Kidderminster, to which town his father had lately removed from Birmingham. For some years of his childhood his health was very feeble, and as, on account of an affection of the spine, he had to maintain a recumbent position, his principal method of relieving the irksomeness of his situation was by repeating figures aloud consecutively until he had reached very high totals. A similar bent of mind was manifested when he entered school in 1802, his aptitude for arithmetic and mathematics being quite exceptional. But if he owed his subsequent eminence to a peculiar natural talent for figures, he was indebted for the direction of his abilities in no small degree to the guidance of his father, a man of great force of character and of advanced political and social views, which were qualified and balanced by the strong practical tendency of his mind. At the age of twelve Rowland began to assist in teaching arithmetic and mathematics in his father's school at Hilltop, Birmingham, and

latterly he had the chief management of the school. On his suggestion the establishment was removed in 1819 to Hazelwood, a more commodious building in the Hagley Road, in order to have the advantages of a large body of boys, for the purpose of properly carrying out an improved system of education. That system, which was devised principally by Rowland, was expounded in a pamphlet entitled *Plans for the Government and Education of Boys in large numbers*, the first edition of which appeared in 1822, and a second with additions in 1827. The principal feature of the system was "to leave as much as possible all power in the hands of the boys themselves;" and it was so successful that, in a circular issued six years after the experiment had been in operation, it was announced that "the head master had never once exercised his right of veto on their proceedings." This doubtless was in no small degree due to the powerful personality of Rowland Hill, which made itself felt whether he was present or not. The system, it must be admitted, had several features of too utopian a character for the present constitution of society; but on the whole Rowland Hill, as an educationist, is entitled to a place side by side with Arnold of Rugby, and was equally successful with him in making moral influence of the highest kind the predominant power in school discipline. After his marriage in 1827 Hill removed to a new school at Bruce Castle, Tottenham, which he conducted until failing health compelled him to retire in 1833. About this time he became secretary of Gibbon Wakefield's scheme for colonizing South Australia, the objects of which he explained in 1832 in a pamphlet on *Home Colonies*, afterwards partly reprinted during the Irish famine under the title *Home Colonies for Ireland*. It was in 1835 that his zeal as an administrative reformer was first directed to the postal system. The discovery which resulted from these investigations is when stated so easy of comprehension that there is great danger of its originality and thoroughness, and its greatness as an element in human progress, being lost sight of. A fact which also enhances its merit was that he was not a post-office official, and possessed no practical experience of the details of the old system. After a laborious collection of statistics he succeeded in satisfying himself and in demonstrating to the world that the principal expense of letter carriage was in receiving and distributing, and that the cost of conveyance differed so little with the distance that a uniform rate of postage was in reality the fairest to all parties that could be adopted. Trusting also that the deficiency in the postal rate would be made up by the immense increase of correspondence, and by the saving which would be obtained from prepayment, from improved methods of keeping accounts, and from lessening the expense of distribution, he in his famous pamphlet published in 1837 recommended that within the United Kingdom the rate for letters not exceeding half an ounce in weight should be only one penny. The employment of postage stamps is mentioned only as a suggestion, and in the following words:—"Perhaps the difficulties might be obviated by using a bit of paper just large enough to bear the stamp, and covered at the back with a glutinous wash which by applying a little moisture might be attached to the back of the letter." Proposals so striking and novel in regard to a subject in which every one had a special personal interest could not fail to command general attention, and perhaps no pamphlet that ever issued from the press has caused so much and such widespread discussion, or been so speedily effective in promoting reforms in any degree so beneficial to the human race. So great became the pressure of public opinion against the opposition offered to the measure by official prepossessions and prejudices that in 1838 the House of Commons appointed a committee to examine the subject. The committee having reported favorably, a bill to carry out Hill's recommendations was brought in by the Government. The Act received the royal assent in 1839, and after an intermediate rate of fourpence had been in operation from December 5th of that year, the penny rate commenced January 10, 1840. Hill received an appointment in the Treasury in order to superintend the introduction of his reforms, but he was compelled to retire when the Liberal Government resigned office in 1841. In consideration of the loss he thus sustained, and to mark the public appreciation of his services, he was in 1846 presented with the sum of £13,360. On the Liberals returning to office in the same year he was appointed secretary to the postmaster-general, and in 1854 he was made chief secretary. In these positions, his ability as a practical administrator made itself felt in every department of the postal system, and enabled him to supplement his original discovery by practical expedients realizing its benefits in a degree commensurate with continually improving facilities of communication, and in a manner best combining cheapness with efficiency. In 1860 his services were rewarded with the honor of knighthood; and when failing health compelled him to resign his office in 1864, he received from parliament a grant of £20,000, and was also allowed to retain his full salary of £2000 a year as retiring pension. In 1864 the university of Oxford conferred on him the degree of D. C. L., and on the 6th June, 1879, he was presented with the freedom of the city of London. The presentation, on account of his infirm health, took place at his residence at Hampstead, and he survived the ceremony only a few weeks, dying on the 27th August following. He was buried at Westminster Abbey.

HILL, Viscount (1772–1842). Rowland Hill, nephew of the Rev. Rowland Hill, was born at Prees, Shropshire, 11th August, 1772. After receiving his early education at Ightfield and Chester, he was gazetted to the 38th regiment, obtaining permission at the same time to improve himself in the knowledge of his profession in a military academy at Strasburg, where he continued after removing into the 53d regiment with the rank of lieutenant. In the beginning of 1793 he raised an independent company, and was promoted to the rank of captain. The same year he distinguished himself at the siege of Toulon; and after serving for some time on the Continent he in 1797 set out as colonel of the 90th regiment with Sir Ralph Abercromby's expedition to Egypt, where he acquired great distinction, and was wounded at the battle of Alexandria. Having in 1803 been gazetted brigadier-general, he in 1808, accompanied Sir Arthur Wellesley to Spain, and from Vimiera to Vittoria, in advance or retreat, he proved himself the most indefatigable coadjutor of the great captain. In 1809 he was gazetted lieutenant-general, and in the following year was appointed to the independent command of the second army corps of Wellington in Portugal; in 1811 he annihilated the French army under Girard at Arroyomolinos (Caceres), in recognition of which he received the order of the Bath; and for his capture of the forts of Almarez, which cut off the communication between the French armies on the north and south sides of the Tagus, he was in 1814 rewarded with the title of Baron Hill of Almarez. In 1813 he held temporarily the command of the English and Hanoverian troops in Belgium, and two years later crowned the glories of his noble career by his conduct at Waterloo, where he was at the head of the brigade which resisted and repulsed the last effort made in behalf of the French by the imperial guard. When Wellington became premier in 1828 Hill received the appointment of general commanding-in-chief, and on resigning this office in 1842 he was created a viscount. He died on the 10th December of the same year. Lord Hill was, next to Wellington, the most popular and able soldier of his time in the British service, and was so much beloved by the troops, especially those under his immediate command, that he gained from them the honorable title of "the soldier's friend." "With Hill," they used to say, "both victory and life may be ours." On the other hand, the strategic skill and military capacity he displayed in the Peninsula secured for him the not less honorable title of "the right arm of the duke of Wellington." From the first day he entered the army he displayed the germs of those qualities that afterwards secured for him fame, rank, and power—boldness that amounted to daring and was yet always under the control of calm judgment, skill equal to independent commands of the most difficult kind, and a regard for the moral and physical welfare of the army such as had never before been shown by any commander-in-chief.

The *Life of Lord Hill, G. C. B.*, by Rev. Edwin Sidney, A. M., appeared in 1845.

HILLAH, a town of Asiatic Turkey in the pashalik of Baghdad, from which town it lies 60 miles to the south. It is picturesquely situated, in the midst of a very fertile district, on both banks of the Euphrates, which are connected there by a floating bridge 450 feet in length. The estimated population, which includes a large number of Jews, varies from 20,000 to 30,000. The bazaars are large and well supplied; and tanning, dyeing, and silk manufac-

ture are carried on to a considerable extent. The horse mart has recently declined in repute. Hillah occupies the site of the ancient Babylon, and is to a large extent built of bricks obtained from the ruins.

HILLARD, George Stillman (1808–1879), an American author, was born at Machias, State of Maine, September 22, 1808. After graduating at Harvard College in 1828, he became joint rector of the Round Hill Seminary at Northampton. In 1833 he was called to the Boston bar, where he soon obtained a good practice. He was chosen a member of the common council of Boston in 1845, and he was for six months its president. In 1849 he was elected a member of the State legislature. The engrossing character of his professional and other engagements did not, however, prevent him from devoting a large portion of his time to literature. Besides editing successively the *Christian Register* (a Unitarian paper), *The Jurist*, and the *Boston Courier*, he published an edition of Spenser's works (in 5 vols. 1839), and a selection from the works of Walter Savage Landor (1856), and wrote *Six Months in Italy* (2 vols., 1833), *Life and Campaigns of George B. McClellan* (1865), a series of school-books which have met with wide acceptance, and various articles in periodicals and encyclopædias. In addition to this he made frequent successful appearances as a public lecturer. From 1867 to 1878 he was United States district attorney for Massachusetts. He died 27th January, 1879.

HILLEL, a famous Jewish rabbi, sometimes called for distinction's sake הַזָּקֵן, "the elder" or "the old," flourished about the time of Herod the Great. According to the Talmudists he was born of a poor Davidic family, at Babylon, apparently about the year 75 B. C. In his zeal for the study of the law he went, when already of mature age, to Jerusalem, where Shemaiah and Abtalion were at that time the leading teachers. While supporting himself and his family there by working as a day laborer, he was not always able to earn the fee which the porter of the Beth-Midrash or house of instruction is said to have required; but such was his ardor for learning that on one occasion on a cold December morning, having failed to obtain admission, he climbed up to the window of the class-room, where some time afterwards he was found quite buried and half frozen to death under a heavy fall of snow. He was now made free of the schools, and so great were the attainments with which his diligence was ultimately rewarded that, according to the tradition, he understood all languages, including those of the hills and the valleys, the trees and the flowers, the beasts and the demons. In his later years he succeeded the "sons of Bethyras" in the presidency of the sanhedrin, and in this high position he became the author of several important rules of interpretation (the so-called seven "middoth;" see Hermeneutics), and also of some authoritative legal decisions. A contemporary, and perhaps a pupil of his, was Shammai, who became the head of a rival and at times bitterly hostile school. Dying about the year 10 A. D., Hillel was succeeded in his official position by his son Simeon, and afterwards by his grandson Gamaliel I.

There is evidently a good deal of what is incredible in the above Talmudic account; for example, it is now recognized on all hands that the Talmudic statement as to Hillel's presidency over the sanhedrin is absolutely irreconcilable with what we learn from the New Testament writers and from Josephus, and must be regarded as wholly unhistorical. But after every reasonable deduction has been duly made, we still have ample traces of a strong personality, characterized by unusual sweetness and light, bent on supporting the claims of a right-minded and ethical religion against those of mere sacerdotal traditionalism. His "middoth," so far as they go (but they do not go far), are based on sound principles of logic and hermeneutic; the so-called "prosbol," by which he evaded the restrictions laid upon commerce through the law relating to the sabbatic year, showed that he possessed at least some power of adapting old institutions to the changing circumstances and wants of a progressive society; and if most of the questions which are alleged to have divided his school from that of Shammai cannot but strike the modern reader as having been infinitely small, the "golden rule" and some other sayings attributed to him show that he was not incapable of large and true views on the deepest problems of human life.

A remote descendant of the same name, who flourished about 350 A. D., is said to have sought to quiet his co-religionists, restive under foreign domination, with the novel doctrine that all the "Messianic" prophecies of the Old Testament had related to Hezekiah, and had been fulfilled in him.

Our only source of information with regard to Hillel "the old" is the Talmud, unless indeed the Pollion referred to once and again by Josephus be also Hillel under a Greek name. For the grounds on which this probable identification rests, and for a masterly sketch of Hillel and his place in the history of Israel, the great work of Ewald may be consulted (*Gesch. d. V. Israel*, vol. v.). See also Delitzsch, *Jesus u. Hillel* (3d ed., 1879); Derenbourg, *Histoire de la Palestine*, pp. 176–92; and Schürer, *Neutestamentliche Zeitgeschichte*, sec. 25. All the recent works dealing with the life of Christ also touch upon this subject, especially with reference to the question regarding the "originality" of the two teachers. Renan, Keim, and Farrar (vol. ii. appendix) may be specially named.

HILLER, Johann Adam (1728–1804), musical composer, was born at Wendisch-Ossig near Görlitz in Silesia, December 25, 1728. By the death of his father in 1734 he was left dependent to a large extent on the charity of friends. Entering in 1747 the Kreuzschule in Dresden, the school frequented many years afterwards by Richard Wagner, he afterwards went to the university of Leipsic, where he studied jurisprudence, supporting himself by giving music lessons, and also by performing at concerts both on the flute and as a vocalist. Gradually he adopted music as his sole profession, and devoted himself more especially to the permanent establishment of a concert institute at Leipsic. It was indeed he who originated (in 1781) the celebrated Gewandhaus concerts which still flourish at Leipsic. In 1789 he became "cantor" of the Thomas school there, a position previously held by the great John Sebastian Bach. He died June 16, 1804. Two of his pupils placed a monument to his memory in front of the Thomas school. Hiller's compositions are numerous, and comprise almost every kind of church music, from the cantata to the simple chorale. But infinitely more important are his operettas, 14 in number, which for a long time retained their place on the boards, and had considerable influence on the development of light dramatic music in Germany. The *Jolly Cobbler*, *Love in the Country*, and the *Village Barber* were amongst the most popular of his works. Hiller also excelled in songs and ballads of the sentimental kind. With great simplicity of structure his music combines a considerable amount of genuine melodic invention. Although an admirer and imitator of the Italian school, Hiller fully appreciated the greatness of Handel, for the appreciation of whose music in Germany he did much. It was under his direction that the *Messiah* was for the first time given at Berlin, more than forty years after the composition of that great work. Hiller was also a writer on music, and for some years (1766–1770) edited a musical weekly periodical named *Wöchentliche Nachrichten und Anmerkungen die Musik betreffend*.

HILL TIPPERAH, a native state adjoining the British district of Tipperah, Bengal, lying between 22° 59′ and 24° 31′ N. lat., and between 91° 12′ and 92° 24′ E. long., with an area of about 4086 square miles, and population (1900) 173,325. It is bounded on the N. by the Assam district of Sylhet, on the W. by the Bengal districts of Tipperah and Noákhálí, on the S. by Noákhálí and Chittagong districts, and on the E. by the Lushái country and the Chittagong Hill Tracts. As its name implies the country is hilly. Five or six ranges of hills run parallel from north to south, at an average distance of about 12 miles from each other. The hills are covered for the most part with bamboo jungle, while the low ground abounds with trees of various kinds, canebrakes, and swamps. The principal ranges are, beginning from the east, the Jámpui, Sakkankhang, Langtarái, and Atháramurá. The chief rivers are the Gumti, Háorá, Khozái, Dulái, Manu, and Pheni. During the heavy rains the people in the plains use boats as almost the sole means of conveyance. The forests give shelter to numbers of wild elephants and other large game. Small game of various kinds are met with.

The history of the state relates to two distinct periods—the traditional period described in the *Rájmálá*, or "Chronicles of the Kings of Tipperah," and the period since 1407 A. D. The *Rájmálá* is a history in Bengálí verse, compiled by the Bráhmans of the court of Tripurá. In the early history of the state, the rájás were in a state of chronic feud with all the neighboring countries. The worship of the All-destroyer was here, as elsewhere in India, associated with the practice of human sacrifice, and in no part of India were more victims offered up. It was not until the beginning of the 17th century that the Mughals obtained any footing in this country. By dint of constant invasions and continual intrigues, the Mahometans gradually established themselves, and Tipperah soon became a mere Mughal province under a Mussulman governor. The rájá still remained in possession of the hilly tracts, but subject to the nawáb of Murshidabad. When the East India

Company obtained the *dîwânî* of Bengal in 1765, so much of Tipperah as had been placed on the rent-roll came under British rule. Since 1808, each successive ruler has received investiture from the British Government, and has been required to pay the usual *nazar* or tribute on accession. The state has a chronological era of its own, adopted by Rájá Birráj, from whom the present rájá is 92d in descent. The year 1875 corresponded with 1285 of the Tipperah era.

Both as regards its constitution and its relations to the British Government, the state of Hill Tipperah differs alike from the independent native states of India and from those which are tributary and dependent. Besides being the ruler of Hill Tipperah, the rájá holds an estate in the British district of Tipperah, called *chaklá* Roshnábád, which is by far the most valuable of his possessions. The form of government is despotic and patriarchal. The rájá's word is law, without appeal. In 1871 an English officer was appointed as political agent to protect British interests and advise with the rájá. The most important hill tribe is that of the Tipperahs, who were estimated in 1874–75 to number 34,727. There are no towns in Hill Tipperah. Agartalá, the capital of the state and residence of the rájá, is merely a moderate-sized village situated on the north bank of the Haurá.

The principal crop and main food-staple is rice. The other articles of produce are cotton, chillies, and vegetables. The chief exports are cotton, timber, *tíl*, bamboo canes, thatching-grass, and fire-wood. Occasionally small imports are required from the neighboring districts. The total revenue in 1874–75 was £18,693. Besides this, the rájá's estates in Tipperah and Sylhet yield about £50,000 and £1400 respectively. His total annual income, therefore, is about £70,000. The police force (1874–75) consisted of 102 men, and the rájá maintains a force of 277 officers and men. The state has only 2 schools, and only 103 boys are being educated. The climate of Hill Tipperah is generally pleasant; the annual rainfall is 60 inches. The chief endemic diseases are bowel complaints, remittent and intermittent fevers, and rheumatism; the principal epidemic is cholera.

HILTON, William (1786–1839), English painter, was born in Lincoln on 3d June, 1786, son of a portrait-painter, who was probably his first instructor. In 1800 he was placed with the engraver J. R. Smith, and about the same time began studying in the Royal Academy School. He first exhibited in this institution in 1803, sending a group of Banditti; and, though he could not be called a popular artist, he soon established a reputation for choice of subject, and qualities of design and color superior to the great mass of his contemporaries. He made a tour in Italy along with Thomas Phillips, the portrait-painter. In 1814, having exhibited Miranda and Ferdinand with the Logs of Wood, he was elected an associate of the Academy, and in 1820 a full academician, his diploma-picture representing Ganymede. In 1823 he produced Christ crowned with Thorns, a large and important work, which has lately been bought by the Academy out of the Chantrey Fund; this may be regarded as his masterpiece, displaying all the qualities which go to make up pictorial propriety and efficiency, though it does not entitle Hilton to the praise of original genius. In 1825 he succeeded Fuseli as keeper of the Academy; and he died in London on 30th December, 1839, a widower without children. Some of his best pictures remained on his hands at his decease,—such as the Angel releasing Peter from Prison (life-size), painted in 1831, Una with the Lion entering Corceca's Cave (1832), the Murder of the Innocents, his last exhibited work (1838), Comus, and Amphitrite. The National Gallery now contains Edith finding the Body of Harold (1834), Cupid disarmed, Rebecca and Abraham's Servant (1829), and Sir Calepine rescuing Serena (from the *Faerie Queen*) (1831). Hilton's excellence as an artist is relative to the state of art in his country at the time. In a great school or period he could certainly not count as more than a respectable subordinate; but in the British school of the earlier part of this century he had sufficient elevation of aim and width of attainment to stand conspicuous and praiseworthy, and, comparatively speaking, above the level of mediocrity.

HILVERSUM, a village and commune in the Netherlands in the province of North Holland, about equally distant from Amsterdam, Utrecht, and Amersfoort, with all of which it is connected by railway. The village is well sheltered on the west and north-west by a range of hills, and since 1874 it has been the seat of a hospital, the Trompenberg, for convalescents. The public buildings comprise a town-house and four churches and a synagogue, and there is a very handsome railway station. The weaving of floor-cloths, horse blankets, and Hilversum stripe is the principal industry. In 1423 Hilversum was separated from Laren. In 1505 it suffered at the hands of the people of Guelderland, in 1629 from the Croats, and in 1672 from the French. The population of the village in 1840 was 5160, and in 1870 5611; while that of the commune in the same years was 5314 and 6615. Of this last number 3463 were Roman Catholics, 2327 belonged to the Dutch Reformed Church, and 236 were Jews.

HIMALAYA is the name given to the mountains which form the northern boundary of British India, between the 75th and 95th meridians east of Greenwich. The word is Sanskrit, and literally signifies "snow-abode," from *him*, snow, and *álăyă*, abode, and is well translated "snowy-range," though that expression is perhaps more nearly the equivalent of *Himáchăl*, another Sanskrit word, derived from *him*, snow, and *áchăl*, mountain, which is practically synonymous with Himalaya, and probably as often used in conversation by natives of northern India. The letter *y* in the last syllable of Himalaya is purely a consonant, and the last two syllables should be pronounced *lă-yă*, the conversion of the *ay* into a diphthong being quite erroneous. The name, by transformations such as are common to all times and nations in the use of foreign words, was converted by the ancient Greeks into *Emodos* and *Imaos*. Plate XVI. Himalaya: signification of name.

Although the term Himalaya is applied by the natives of India only to the ranges which they see covered with perpetual snow, it has been long used by European geographers to designate the whole mountain region for which the Indian has no other name than *pâhár*, *i. e.*, "the mountains," of which the snowy ranges constitute but a small portion. The first mere cursory examination of these mountains by the older geographers rightly convinced them of the general physical unity of the mountainous region to the north of India, which in length extends from about 72° to 95° E. long., that is, between the rivers Indus and Brahmaputra, and in breadth includes the ranges between the plains of Hindustan and the upper parts of the main branches of these two great rivers. To these ranges the designation of Himalaya has by degrees been specially attached; and there is a certain convenience in still restricting the name to that part of the mountains which is accessible from British India, for this is the practical signification of it now commonly accepted. How applied by geographers.

Though it is to the area thus limited that the present article is mainly designed to refer, it will be necessary, for the correct apprehension of some of its main characteristics, to understand aright the relation which the Himalaya bears to the great mountain region beyond it, and a general description of that region thus becomes requisite.

Scientific investigation has clearly shown that, so far as the main characteristics of the mountains are concerned, the natural boundaries of the Himalayan system must be carried much farther than had at first been recognized. Considerable obscurity still involves the eastern portion of these mountains, and there is great want of precise knowledge as to their connection with the ranges of western China, from which are thrown off the great rivers of China, Siam, and Burmah. On the west, however, it has been completely established that a continuous chain extends beyond the Indus along the north of the Oxus, and ends in that quarter about 68° E. long. In like manner it is found that no separation can be established, except a purely arbitrary one, between the Himalaya as commonly defined and the greatly elevated and rugged table-land of Tibet; nor between this last and the mountain ranges which form its northern border along the low-lying desert regions of Central Asia. Extent of geographical information.

It thus appears that the Himalaya, with its prolongation west of the Indus, constitutes in reality the broad mountainous slope which descends from the southern border of the great Tibetan table-land to the lower levels of Hindustan and the plains of the Caspian; and that a somewhat similar mountain face, descending from the northern edge of the table-land, leads to another great plain on the north, extending far to the eastward, to the northern borders of China. Towards its north-west extremity this great system is connected with other mountains,—on the south, with those of Afghanistan, of which the Hindu-Kush is the crest, occupying a breadth of about 250 miles between Peshâwur and Kúndúz; and on the north, with the mountains that Relation of Himalaya to Tibetan and other mountains.

flank the Jaxartes or Sir on the north, and the Thian-shan or Celestial Mountains. The eastern margin of Tibet descends to western China, and the south-eastern termination of the Himalaya is fused into the ranges which run north and south between the 95th and 100th meridians, and separate the rivers of Burmah, Siam, and western China.

Connection with Tibet.

Nor can any of the numerous mountain ranges which constitute this great elevated region be properly regarded as having special, definite, or separate existence apart from the general mass of which they are the component parts; and Tibet cannot be rightly described, as it has been, as lying in the interval between the two so-called chains of the Himalaya and the Kouenlun or Kara Koram. It is in truth the summit of a great protuberance above the general level of the earth's surface, of which these alleged chains are nothing more than the south and north borders, while the other ranges which traverse it are but corrugations of the mass more or less strongly marked and locally developed.

Extent of Tibeto-Himalayan system.

The average level of the Tibetan table-land may be taken at about 15,000 feet above the sea. The loftiest points known on the earth's surface are to be found along its southern or Himalayan boundary; one of them falls very little short of 30,000 feet in elevation, and peaks of 20,000 feet abound along the entire chain. The plains of India which skirt the Himalayan face of the table-land, for a length of rather more than 1500 miles, along the northern border of British India, nowhere rise so much as 1000 feet above the sea, the average being much less. The low lands on the north, about Kashgar and Yarkend, have an elevation of from 3000 to 4000 feet, and no part of the Central Asiatic desert seems to fall below 2000 feet, the lake of Lob-nor being somewhat above that level. The greatest dimension of the Tibetan mountain area from east to west may be about 2000 miles, while its average breadth somewhat exceeds 500 miles; about 100 miles on either side constitute the sloping faces, the central table-land having a width of about 200 miles on the west and probably 500 miles at its eastern border.

Drainage of its surface.

The southern portion of the Tibetan table-land throws off its waters to the north-west and south-east from a central line almost on 82° E. long., the Indus flowing in the former direction, and the Brahmaputra in the latter. These two rivers maintain their courses for a great distance in opposite ways, longitudinally, along the summit of the table-land; they receive as they proceed the drainage of a large portion of its surface; and their accumulated waters are at length discharged by two openings in the Himalayan slope across the plains of Hindustan into the Indian Ocean. With the one exception of the basin of the Sutlej, the Tibetan area that discharges itself southward at points intermediate between the debouchure of the Indus and that of the Brahmaputra is comparatively insignificant. No important part of the drainage of the table-land, so far as is yet known, passes in the opposite direction through the northern slope to join the rivers which flow from that slope to the Central-Asiatic plain. The waters of the southern slope, together with the drainage of the exceptional Tibetan area above referred to, traverse the Himalaya more or less directly, and constitute the main tributaries of the Indus, the Ganges, and the Brahmaputra.

Watershed lines.

Thus the northern border of the table-land, or the summit of its northern slope, so far as it is known, seems to form the real watershed between the rivers that flow to the Indian Ocean and those that lose themselves in the plains of Turkistan and Mongolia. The summit of the Himalayan slope forms a subordinate watershed, separating the rivers that fall into the Indian Ocean into two classes, those that pass directly through the Himalaya to the plains of India, and those that are collected on the summit of the table-land and discharged, also through the Himalaya, but by two concentrated streams at distant points towards the opposite ends of the chain. It has been proposed to call these dividing lines, respectively, the Turkish and the Indian watershed.

Principal rivers and lake area.

The waters that issue from the Himalaya to the west of the 77th meridian combine to form the Indus. Between the 77th and 88th meridians all the streams fall into the Ganges, and eastward of the 88th meridian into the Brahmaputra. Of the continuity of the Brahmaputra, beyond the point up to which it has been explored from Assam, with the Tibetan river, called on the maps Sanpoo, Yarou dzangbo-tchou, and so forth, there is no room for doubt. The correct Tibetan name for the river is Tachok-tsangpo, *i. e.*, "Horse-river," or simply "Tsangpo," *i. e.*, "Great river," —the word "tsangpo" being applied exactly like the corresponding Indian term "ganga," or the Chinese "kyang," as a generic affix to the name of any large river. In the mountains on the border of Assam the river is called "Dihong," but on entering the plain it receives the waters of the sacred stream locally called "Lohit," which is also believed to have a Tibetan source; and this name the united river retains throughout the greater part of its course in Assam, Brahmaputra being a classical Sanskrit name not commonly used. In its course through Bengal local names are given to the various branches into which it there divides; and this is also the case with the Ganges, which unites with the Brahmaputra about 100 miles from the sea. That part of Tibet which lies north of the 30th parallel of latitude and between the 82d and 92d meridians east is believed to have no escape open for its waters, which are consequently collected in lakes occupying depressions on its surface. The region east of the 92d meridian, excluding the comparatively small tract which drains into the Brahmaputra, feeds the great rivers of western China, Siam, and Burmah.

Oxus and Jaxartes.

At the western extremity of the Tibetan table-land two transverse watershed lines are established in connection with it, by mountain ranges nearly at right angles to what may be regarded as its general direction in this region,—first, on the south by the mountains which under the name of Hindu-Kush form the north-east angle of the high land of Afghanistan, and from the north-west of which the waters flow into the Oxus (the true Turki name of which is "Amu"), and thence to the Aral Sea, while those from its south-eastern face join the Indus through the Cabul river; and second, on the north by the Terek-tagh, which unites the Tibetan system with the mountains of northern Turkistan, and separates the Jaxartes (in Turki "Sir") from the basin of Yarkend. The Oxus and Jaxartes flow off to the Aral Sea in a north-westerly direction, having between them a range which probably represents the extremity of either the Tibetan or the Thian-shan mountains, and which falls away into hills of minor importance beyond the 70th meridian.

Article Asia referred to.

Some further particulars of the relations of the Tibeto-Himalayan region with the contiguous mountain systems, and of its influence both physical and political on the Asiatic continent in the heart of which it is situated, are contained in the article Asia, to which reference may be made. A more detailed account of Tibet will be given under that heading, and the remainder of this notice will be confined to the description of the restricted Himalayan area, as already defined.

Geographical sketch. Plain of North India.

The northern provinces of British India occupy the great plain which flanks the Himalaya on the south, along its whole extent from the issue of the Brahmaputra on the east to the ranges that lie along the Indus. The whole tract, excepting Assam, *i. e.*, the valley of the Brahmaputra, is highly cultivated and populous; and with the same exception the population throughout is of the race known as Aryan, being almost exclusively Hindu in religion on the east, but passing into Mahometan on the west.

Eastern Himalaya: Bhotan; Sikim.

The most eastern portion of the Himalayan mountain slope, as far as the 92d meridian, is occupied by wild tribes of which, or of the country they occupy, little is known. They are in small communities under petty chiefs, and their languages, which vary considerably in detail, are to some extent allied to Tibetan and monosyllabic. Between the 92d and 89th meridians is the small state of Bhotán, the local name of which is "Lhopato." It approximates in language, customs, and religion to Tibet proper, and its government is carried on by two separate chiefs, temporal and spiritual. Its northern border, where it is met by Tibet, lies along the 28th degree of north latitude. The small British district of Sikim succeeds, occupying the lower part of the basin of the Tista river, and having Darjeling as its chief settlement. The native state of Sikim, in Tibetan called "Demojong," extends north of British Sikim to Tibet; it is almost as Tibetan as Bhotán, and still less important. Its western border falls nearly on the 88th meridian.

Nepál. From the 88th nearly to the 80th meridian the whole southern slope is occupied by the kingdom of Nepál, which since the wars with the British in 1814–16 has retained complete independence. The jealousy with which its government has excluded Europeans from most parts of the country leaves us with little precise knowledge of any part of it except its eastern border and the neighborhood of the capital, Káthmándú. The people pass from the Tibetan and Buddhist type, which prevails on the east, into almost pure Hindus, speaking a Hindi dialect, on the west. The rivers Kosi, Gandak, Rápti, and Karnáli are the principal streams that issue from this part of the mountains. The northern border of Nepál follows the main watershed, and its western angle reaches the 30th parallel of north latitude in the vicinity of the well-known Tibetan lakes Rákas-tál and Mánasarowar, where the general direction of the mountains has, from east and west, become nearly south-east and north-west.

Kumaon, Kashmir, to Indus. The Káli or Sárda river forms the boundary between Nepál and the British provinces of Kumaon and Garhwál, the chief town in which is Almora, and which occupy the entire mountain face, from the watershed to the plains, as far as the main stream of the Ganges, for a distance from east to west of about 100 miles. Thence, an equal distance brings us to the Sutlej, the intermediate tract being occupied by many small principalities, independent in their civil government, but entirely under the political control of the British. In this region is situated Simla, the summer capital of the government of British India, on one of the outer ranges overlooking the Sutlej. Other small districts and principalities, partly British, occupy the Himalayan slope as far as the 76th meridian, beyond which we reach the territories of Jamu and Kashmir, which extend to within 50 miles of the Indus, a narrow band bordering on which river is mainly in the possession of Afghan tribes but partly under British rule. From the portion of the mountains west of the 79th meridian issue the rivers Ganges and Jumna; also the five rivers of the Punjáb,—the Sutlej, the Rávi, the Chenáb, the Jhelum, and the Indus, besides the Byás which unites with the Sutlej. The valley of Kashmir is the upper part of the basin of the Jhelum.

People of Western Himalaya. The population of the whole of the mountain districts west of Nepál maintains to a great extent its Hindu type, though the Mahometan religion gradually becomes more prevalent as we approach the Indus, where it is found to have superseded Hinduism. In the more remote and elevated valleys an infusion of Tibetan race, religion, and language is found, diminishing as we pass to the west; but otherwise the dialects spoken are everywhere Prakritic, and closely allied to Hindi. As a rule, the people are short in stature, muscular, as is common among mountaineers, fairer than the inhabitants of the plains, and in the western regions, where the Hindu or Aryan stock prevails, women of remarkable beauty are often seen. At the lower altitudes cotton clothing is usual, at the greater elevations hempen and woollen materials prevail, but an utter disregard of personal cleanliness is universal. Goitre is frequent in both sexes, and cretinism seems to occur much in the European form.

General climate. The eastern ranges are wetter, the climate generally warmer and more equable, and the vegetation more rank and of a more tropical character; the mountains are more copiously covered with forest, and the extent of cultivation is less, and the population probably less also. To the west, with a drier atmosphere and greater variations of temperature, the climate above 5000 or 6000 feet becomes more like that of southern Europe, and the main features of the scenery become more conspicuously similar to those of European mountains. On the east the customs of the people differ little from those of the neighboring Tibetan or semi-Tibetan provinces. On the west there is no great distinction between the people of the hills and of the plains in their customs, agriculture, or other occupations.

Customs.

Tibet. The summit of the table-land from the borders of China to the 75th meridian, where the Indus suddenly turns off to the south, is comprised in Tibet, or as it is called in the language of its inhabitants "Bod" or "Bodyul," the latter word being equivalent to "Bod-land." Of the eastern half of Tibet very little is known, and that little chiefly relates to the most southern portion which borders on the Himalaya, and the most eastern which abuts on China. The table-land here has its greatest development, and is perhaps as much as 500 miles from north to south. At its north-western end its breadth is reduced to something under 200 miles. The physical features of Tibet, from its great elevation, are so peculiar, and it is so cut off by nature from communication with its neighbors, that it is not surprising to find in it a distinct race with a language of their own, and habits widely different from the surrounding nations. The extreme cold and drought make Tibet essentially poor; and the character of its inhabitants approaches that of the denizens of the Arctic regions, who live under somewhat similar physical conditions. The people are broadly built, with a strongly marked Mongolian physiognomy, dark hair, little or no beard, oblique eyes, and prominent cheek bones. In the warmer valleys they are mainly agricultural, and live in houses; in the higher regions they are shepherds, living in tents, thinly scattered over a large area. They are clothed in woollens or sheep skins. The practice of polyandry prevails, a woman marrying a whole family of brothers. The government at Lhassa is nominally administered by the Tibetans themselves, but in reality is altogether under the control of a Chinese resident. The authority of the Lhassan Government extends to about 78° E. long.; west of this as far as the Indus, the country was conquered some forty years ago by the sovereign of Kashmir and remains under him. In the most western province of Tibet, called "Balti," the Buddhist religion ceases to prevail; the population is exclusively Mahometan, and that religion only is known beyond the Indus.

Pamir. To the west of Tibet the mountains are prolonged to the 70th meridian at an elevation not greatly less than that which prevails eastward, and the table-land there ends in the region known as Pamir, which has all the characteristics of the higher parts of Tibet. Beyond this we pass into Turkistan and reach the limits by which the scope of the present article is restricted.

Physical features. Uniformity of structure. The difficulty of accomplishing with any approach to success such a task as that of giving a sufficient account of the chief physical and other characteristics of mountains like the Himalaya is much diminished by the remarkable uniformity in many points of structure and other important peculiarities, which prevails along the whole length of the chain. The perception of such general characteristics among mountains so vast is, indeed, too often overshadowed and obscured by the magnitude of their parts, the multitude of their details, and the variety of their forms; yet when the idea of the subordination of all these elements to common laws has once been duly conceived, it obtains constantly growing confirmation from what at first only produced impressions of hopeless confusion.

The great northern plain. The great plain of northern India stretches with an almost unbroken surface along the foot of the Himalaya from the upper Indus to the head of the delta of the Ganges, and thence has a narrow prolongation along the Brahmaputra up the valley of Assam. Including its extensions to the sea, along the Indus on the west, and along the Ganges on the east, its area is about 500,000 square miles. It nowhere rises to more than 1000 feet above the sea-level, and to the unassisted eye it appears a perfectly dead flat. That part of the plain which lies along the foot of the mountains, and more particularly the central and eastern portion, is well watered, being intersected by the numerous streams that flow from the mountains, and under the full influence of the periodical rains, and it comprises the best cultivated, the richest, the most populous, and most civilized districts of India.

The Tarai. The snowy peaks of the Himalaya are, under favorable conditions, visible from the plains at a distance of about 200 miles. It is not, however, till the traveller is within 30 or 40 miles of the foot of the mountains that the outlines of the great peaks become well defined and their grandeur appreciable. At about the same distance, too, the lower ranges begin for the first time to attract attention. At about 20 or 25 miles from the outer hills the cultivation of the plain commonly becomes less complete, and the villages more sparse; an open grassy tract is entered, often traversed by shallow, sluggish streams, along which are formed morasses, or fringes of gigantic

reeds and grasses, frequently occupying very large areas. This tract is known as the "Tarai," or "Tariyáni." Where most strongly developed it has a width of 10 or 15 miles, but its existence is manifestly greatly dependent on the local conditions of drainage and of rainfall, and to the west of the point where the Ganges leaves the mountains the Tarai is not formed. It has been erroneously described as a depression along the foot of the mountains, but there is no foundation for such a view, and the causes that lead to the formation are not far to seek.

The Bhábar.

To explain these it is necessary to take a further step towards the mountains. Just as the Tarai somewhat suddenly appears along a certain definite line, so it as suddenly ceases, and is replaced by a band of forest of about equal breadth, known as the "Bhábar." This tract is almost waterless, and the soil is seen to be chiefly sand or shingle, more or less filled with boulders. The streams that issue from the outer hills on entering the Bhábar are for the most part rapidly absorbed, and finally disappear in their sandy or shingle beds, the water they pour into the soil being again discharged along the outer and lower border of the tract, and collecting once more in the streams which characterize the Tarai.

How formed.

The Bhábar and Tarai slope continuously from the foot of the mountains to the cultivated plain. The inclination is so uniform as to be hardly perceptible, but becomes gradually less as the distance from the mountains becomes greater. Observation leads us to suppose that the upper part of this talus, lying along the foot of the outer hills, is composed of coarser matter, and the lower part, which comes into view at a greater distance, of a finer and less permeable silt; and that, the latter having a smaller inclination and extending further than the former, the water absorbed by the upper beds will naturally be brought to the surface at their termination, where the finer materials forming clayey strata make their appearance. That the swampy Tarai is not developed in the western part of the range is doubtless due to the smaller rainfall in that region; while its more marked occurrence to the east of the Ganges at irregular intervals arises from the local peculiarities of the surface drainage, which at some places is carried off directly into the larger rivers without check, and in others is forced to follow a line nearly parallel to that of the mountains for considerable distances, through a tract from which there is no free escape for the water; and which, thus becoming water-logged and covered with a rank development of vegetation, acquires its peculiarities, among which has to be reckoned a climate in which fevers of a deadly character are frequently induced, rendering its permanent occupation and cultivation difficult or impossible.

Siwáliks or sub-Himalaya.

The transition from the plains to the mountains is sudden and well-defined along a line that is almost continuous. The ranges to which geologists have given the name of "Siwálik," and "sub-Himalayan," rise abruptly, and without any intermediate undulating ground from the apparently level surface of the plain. These hills, which from recent geological investigation we learn to be formed of deposits of various periods of the Tertiary epoch, attain elevations from a few hundred to 3000 or 4000 feet. The dip of the strata composing them is usually at a low angle towards the mass of the mountains, so that they present a steep face to the plains, while a comparatively easy declivity slopes inwards, and frequently, by meeting a corresponding but longer and more gradual talus descending from the foot of the internal line of mountains, forms a shallow, narrow valley which runs generally parallel to the outer range.

The Dúns or Mári.

These valleys, which are very characteristic of the outer border of the mountains, have by some writers been erroneously confounded with the Tarai. They are termed "Dún" in the western regions; in Nepál they are known by the name of "Mári." Their floors consist of deposits of gravel and boulders, having a maximum elevation of about 2000 or 2500 feet above the sea. Their continuity is broken at intervals by low, transverse, watershed lines, from which the drainage is thrown off along their longitudinal axis, and falls into some of the larger streams which cross them from the inner ranges, though less frequently it finds an independent exit into the plains by a sudden bend to the south through a rupture in the line of outer hills. At intervals these valleys are entirely wanting, and the outer hills which form them elsewhere are undistinguishable from the general mass of mountain within, except through the aid of their geological character. From the considerable elevation of the dúns above the plains, down to the level of which the streams which drain them descend in a very short distance, the unconsolidated strata which form the floors of these valleys are often deeply cut into by the watercourses, and present a surface worn into terraces descending in steps of various heights. These conditions lead to a peculiarity which characterizes large parts of the dúns, the almost complete impossibility of getting water from wells, due no doubt to the thorough desiccation of the subsoil.

Extent of sub-Himalaya.

The sub-Himalayan ranges have a well-defined distinct geographical existence along the greater part of the chain, and their geological continuity is established where no valley is formed between them and the inner ranges, and where they cannot be otherwise distinguished from the general mass of mountains. To the west of the Sutlej river these ranges and the valleys connected with them have an unusual development, the width over which they extend increasing from 10 or 15 miles to as much as 50 miles, with a series of two or three dún-like valleys one within another. West of the river Jhelum, again, the aspect of the outer Himalaya is entirely modified by a small tableland, which is formed to the north of the line of elevation known as the Salt range, and extends to the Indus. Its general surface lies at about 1000 feet above the general level of the plain, having a maximum elevation of about 1800 feet, and being remarkable for the extraordinary manner in which it is broken up by ravines, the number, gigantic dimensions, and intricacy of which are alike perplexing and astonishing—the extremely dry climate leading to an almost total want of vegetation, and the absence of any such concealment exhibiting a picture of confusion and desolation not often seen.

Outer ranges of main chain.

The ranges which lie immediately within the external band of the Siwáliks, or sub-Himalaya, rise abruptly above it to much greater elevations, and constitute the first masses which in such a region we can with propriety dignify with the name of mountains. Their ordinary elevation is about 7000 feet, and the highest summits on them reach 8000 or 9000 feet above the sea. It is on them that sanitary stations have been established for the convenience of the European residents in the neighboring provinces of India, as affording the nearest sites to the plains at which a temperate climate can be reached. These ranges cover a breadth of about 60 or 70 miles, within which the magnitude of the mountains does not very greatly vary, their crests rarely going above 10,000 feet or falling below 5000 feet. Beyond this again another great change is observed, and the mountains rise rapidly and attain those surpassing heights which place the snow-clad summits of the Himalaya in the foremost rank of all the mountains of the earth.

Character west of Sutlej.

A remarkable deviation from the normal character of this zone of the mountains is observed to the west of the Sutlej, where, combined with the exceptional extension of the sub-Himalayan ranges already noticed, is found what may perhaps be best described as an outlier of the great central axis of snowy mountains. With a marked change in respect to elevation, as well as in respect to its mineral constituents, the range locally known as the "Dhaola-dhár," or White Mountain, rises directly from the dún of Kángra, the elevation of which is about 2500 feet, into the regions of perpetual snow, its highest points reaching an elevation of 16,000 to 17,000 feet. The same features are prolonged still further to the west beyond the Rávi, and this line of elevation forms the great snow-clad range that shuts in the valley of Kashmir on the south, there known as the Pír-panjál, the general elevation of which is from 14,000 to 15,000 feet, and the passes over it not lower than 10,000 feet.

Snowy ranges: general position.

With this exception the ranges covered with perpetual snow are first met with on the southern slope of the great Indo-Tibetan table-land, along a line between 80 and 90 miles from the foot of the outer mountains, and 20 or 30 miles south of the Indian watershed, and from this line northward snowy peaks abound everywhere over the summit of the table-land. The highest yet measured are near the Indian watershed, but as it is only in this region of the western Himalaya, and in northern Ladák, that any complete survey has been made, it is neces-

Sketch Map shewing the connexion between the Himalaya Mountains, and the Tibetan table-land, and their relation to the adjacent plains and mountains.

The darkest shade indicates the area the mean elevation of which exceeds 10,000 feet, the lighter shades shew mountain areas of smaller elevation. The space left uncoloured represents the great plains.

sary to be cautious in making statements as to absolute maximum elevation, for the known in these mountains still bears far too small a proportion to the unknown to afford sufficient ground for safe speculation on such a subject.

Line of highest peaks.

On the Himalayan slope the loftiest peaks are usually met on the first ranges that enter the limits of perpetual snow, advanced some 20 or 30 miles south of the Indian watershed, and not on a continuous ridge, but grouped in masses separated from one another by deep depressions, through which is discharged the drainage of the tract lying between them and the watershed.

Heights of peaks.

The highest known peak in the Himalaya, and indeed in the world, is that in Nepál known as Mount Everest, which rises to 29,002 feet. Kinchinjinga, in Sikim, on the east, reaches 28,156 feet, and another peak more recently measured, in the extreme west, reaches 28,278 feet. Dháwalagiri, in Nepál, is stated to be 26,826 feet, and Nanda-devi, in Kumaon, to be 25,700 feet above the sea. But many other points have been measured exceeding 25,000 feet in elevation, two of which are to the north of Kumaon; and the enumeration of all known peaks over 20,000 feet would be wearisome. These statements have reference to the particular zone along the Indian watershed above described, beyond which, as was before said, few measurements have been made (excepting in Ladák), but there is every reason to believe, from such scanty facts as are available for forming an opinion, that mountains rising considerably above 20,000 feet are of frequent occurrence throughout Tibet.

Numbers of great peaks.

To give a more precise idea of the character of the snowy zone, it will be worth while to state somewhat in detail the distribution of the great peaks which lie between the 78th and 81st meridians, in the provinces of Kumaon and Garhwál, which have been far better surveyed than any other part of the range. On a line of something less than 150 miles in length are found six great snowy groups, with five great rivers passing between them:—(1) on the east is the cluster of Api in Nepál, with a peak of 22,700 feet; (2) Yirnajang, between the Dárma river and the Káli, rising to 21,300 feet; (3) the Pánch-chuli group, between the Dárma river and the Gori, with a maximum of 22,700 feet; (4) the great compound mass which lies between the Gori and the Dhaoli rivers consisting of Nanda-devi, Nanda-kot, Dunagiri, and Trisúl, the first reaching 25,700 feet, the second 22,600 feet, the third 23,200 feet, and the last, having a length of more than 10 miles, no part of which is under 20,000 feet, its central point reaching 23,400 feet above the sea; (5) the peaks between the Dhaoli and Vishnuganga rivers, three of which lie between 22,300 and 22,600 feet; (6) the great group of Badarináth, Kedárnáth, and Gangotri, between the Alaknanda and Bhágirathi, the chief feeders of the Ganges, the first mass rising to 22,400 feet and the second to 22,900 feet, while the third has five points varying in height between these. All these masses are connected with the main watershed by ridges more or less covered with perpetual snow, on which have been measured two other peaks rising above 25,000 feet, several others reaching 23,000 feet, and many more between 19,000 and 20,000 feet. There is no reason for thinking that this gives an exaggerated idea of the vast scale on which these mountains are developed. There can be little doubt that as precise knowledge is advanced the number of peaks between 25,000 and 30,000 feet will be found to be very much extended; nor will it be surprising if points are eventually discovered exceeding 30,000 feet in altitude.

Elevation of Indian watershed.

The average elevation of the crest of the Indian watershed, between the points where the Indus and Brahmaputra cross it, a distance of some 1500 miles, most probably exceeds 18,000 feet. At a comparatively few points only its continuity is broken, and it allows the passage of rivers that rise on its northern flank; but at all other parts its summit must be crossed to enter Tibet from the south. The passes over it, in ordinary use for men and animals, are frequently more than 18,000 feet above the sea, and except where it is broken through as just mentioned, one point only is believed to exist at which it can be surmounted under 16,400 feet. This pass, which leads directly from Kashmir into the Tibetan district of Drás, is only 11,300 feet, and is quite anomalous; such a depression elsewhere would have been sufficiently deep to open a passage for the drainage of the table-land, but the great depth of the valley further north, in which the Indus flows, here gives the waters a more favorable escape in that direction.

Valleys.

The valleys which traverse the mountains between the plains and the great watershed are for the most part little more than gigantic ravines, at the bottom of which flows the river each contains, in a very contracted bed which at rare intervals opens out into a narrow alluvial flat capable of cultivation. The level of the river beds is necessarily very various. Valleys only 2000 or 3000 feet above the sea are often opened up into the very heart of the mountains, and carry with them the heat and vegetation of the tropics among ranges the summits of which are capped with eternal snow. In tracing up the larger streams it is usually found that on arriving within 10 miles of the line of the great peaks the rivers are flowing at an elevation of little more than 4000 or 5000 feet, but on crossing that line the acclivity suddenly and rapidly increases, and the river-beds in a very few miles are found to be at an altitude of 9000 or 10,000 feet, indicating that the sudden increase to the height of the mountains along this line is not confined to the peaks alone, but consists of a general elevation of the whole surface. Having once crossed the line of great peaks, the inclination of the valleys again becomes much less, and they thus continue for some miles, those that are fed from the larger glaciers frequently emerging from the ice at a level no more than 12,000 feet above the sea in the western mountains, 1000 or 2000 feet higher on the east.

Their slope.

The slope of the larger Himalayan rivers may be estimated to range from 20 feet per mile near the plains to between 100 and 200 feet per mile where they approach the snowy mountains. In their passage through these the inclination increases to as much as 700 or 800 feet in the mile, but to the north it is again reduced to 150 or 200 feet. Like all Indian rivers, they vary greatly in volume at different seasons of the year, and among the higher mountains are liable to special fluctuations from the more or less rapid melting of the snow from which they are fed. In the summer their waters increase and decrease with the varying temperature of the day or power of the sun, and in the winter they contract to a small fraction of their summer volume as the permanent frosts set in. In the lower parts of their courses the rivers commonly present an alternation of sparkling rapids with long reaches of deep, clear, tranquil water, in which the action of the current is often hardly visible; as we ascend, the rapids become by degrees more frequent and more impetuous, till in passing among the snowy mountains we find only the most furious torrents, pouring their turbid glacier waters over boulders of gigantic dimensions among which they are at times almost lost to view, and filling the valleys with their incessant roar.

Kashmir and Nepál.

The valleys of Kashmir and Kathmándu, by their exceptionally large extent and comparatively level character, offer such remarkable deviations from the normal characters of Himalayan valleys as to require some comment. But the differences are after all rather in degree than in kind, and it would not be difficult to find somewhat similar areas, though on a much smaller scale of development. In Kashmir, too, is found one of the very few lakes which occur in the Himalaya. The almost complete absence of such collections of water is among the circumstances which serve to give a special character to the scenery of the Himalaya, and to distinguish it from that of European mountains.

Table-land of Tibet.

On crossing the Indian watershed into Tibet, the general character of the country completely changes. The summit of the table-land, though deeply corrugated with valleys and mountains in detail, is in its general relief laid out horizontally at a mean height little inferior to that of the watershed itself. The valleys of central Tibet are commonly long, flat, and open, of no great breadth, perhaps 1 to 3 miles, with a bottom of alluvial soil laid out nearly horizontally, from which the mountains rise abruptly on either side. The plateau of Gugé, immediately to the north of Kumaon, the average elevation of which is not less than 15,500 feet above the sea, and at the extremity of which lie the two lakes of Rákas-tál and Mánasarowar, the waters of which are also nearly at that level, is a remarkable expansion of the ordinary Tibetan valley, and calls for special notice. It

varies in breadth from 15 to 60 miles, and its extreme length is 120 miles, lying along the upper course of the Sutlej, which runs through it at the bottom of a stupendous ravine furrowed out of the alluvial matter of which the plateau is formed, to a depth of 2000 or 3000 feet. Into this run, across the western part of the plain, numerous other similar ravines in every gradation of size, often for miles together as even and straight as a railway cutting; and so extraordinary is their magnitude in some cases that, in his account of a journey across the plateau, Moorcroft, a traveller of great accuracy in general, describes these slopes as those of mountains.

Tibetan rivers and lakes.

The main valleys are everywhere remarkable for their gentle slope, and in the central parts of the table-land the inclination at length frequently becomes so small as to give rise to the accumulation of the drainage in lakes, invariably salt when there is no efflux, and as invariably fresh when there is. The upper Indus has a slope as little as 3 feet per mile. Further to the west, as it approaches its great bend to the south, the inclination becomes greater, averaging about 24 feet per mile, and the width of its valley floor is reduced. It descends to a level of little above 4000 feet before it finally leaves Tibet.

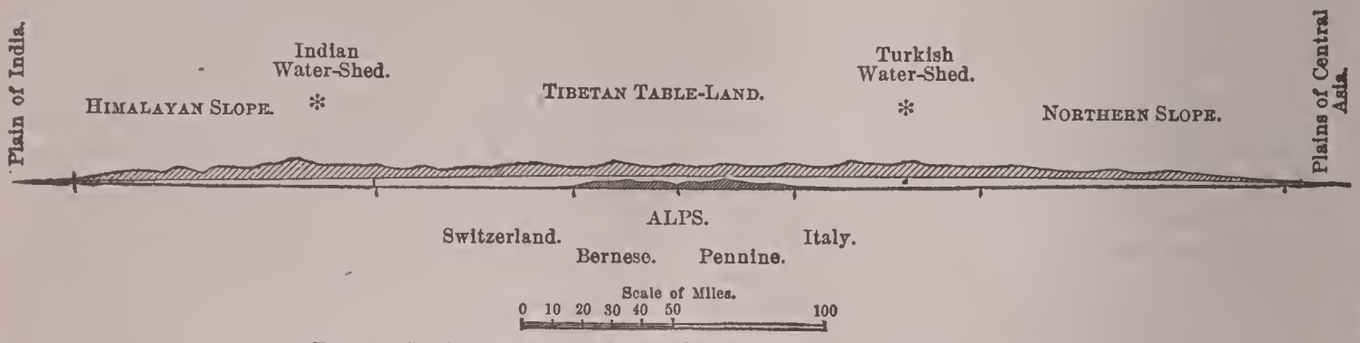


Fig. 1.—Sections of the Alps and of the Himalaya on the same scale.

Comparison of Himalaya with Alps.

It may aid in conveying a clear conception of the magnitude of these Himalayan masses, to compare them with the Swiss Alps, which will be familiar to many English readers. The above diagram represents on the same scale sections of the Alps and of the Himalaya, the curved line from which the latter are shown to rise representing the curvature of the earth. The Alps, measured across from the Lake of Thun to the plains of Lombardy, have a width of about 75 miles, the Tibeto-Himalayan mountains on a line drawn through Simla being about 400 miles across. To complete the comparison a few further explanations may be offered. The range that has already been noticed as the Dhaola-dhár, which rises from the Kángra dún, if measured in breadth from Kángra to the upper Rávi, and in length between that river and the Byás in Kullú, is about equal to the whole of the Bernese Alps comprised between Altdorf and Martigny in length, and laterally between lines drawn along the Rhone and Reuss on one side, and through the Lakes of Lucerne and Thun to the Lake of Geneva at Vevay on the other. The area covered in both cases is rather less than 100 miles in length by 20 or 25 in breadth, the highest peaks being in the Alps the Finsteraarhorn, 14,100 feet, and in the Dhaola-dhár a point 17,100 feet above the sea. The prolongation of the Himalayan ridge just spoken of, which bounds Kashmir on the south, known as the Pir-panjál, would in like manner compare with the Pennine Alps and their continuation as far as St. Gothard. Here the peak of Mont Blanc, 15,750 feet, slightly exceeds the highest point of the Pir-panjál, which is but little over 15,500 feet, though, with this single exception, the Kashmir range certainly much exceeds in general mass that of the portion of the Alps compared with it. To obliterate these two ranges from the Himalaya would make no very sensible inroad on it, though they surpass in bulk the whole of the Swiss Alps; and it is no exaggeration to say that, along the entire range of the Himalaya, valleys are to be found among the higher mountains into which the whole Alps might be cast without producing any result that would be discernible at a distance of ten or fifteen miles. And it is important to bear in mind these relations of magnitude, for the terms at our disposal in the description of mountains are so limited that it is necessary to employ the words chain, range, ridge, spur, etc., rather with reference to relative than to absolute importance, so that the scale of our nomenclature changes with the extent and altitude of the mountains of which we speak.

Surface drainage of Himalaya: how determined.

An examination of the maps of the Himalaya indicates that throughout their whole extent a constant tendency is discernible for the rivers to flow either parallel to the general direction of the part of the chain through which they run, or perpendicular to it,—many or perhaps most of them combining both tendencies, and running first in the one direction and then in the other. The conclusion is hence suggested that the system of surface drainage is determined by a series of longitudinal and transverse lines of rupture along and across the mountains. The study of the rivers and mountains themselves confirms this view. In many cases an apparent diagonal direction is found to be really due to a succession of short abrupt bends, though no doubt the rivers at times actually take an oblique course across the mountains. Frequently, too, where a river changes from a longitudinal to a transverse direction, another longitudinal stream meeting the first flows down from an exactly opposite direction. The same disposition is otherwise often exhibited by the occurrence of both transverse and longitudinal lines of drainage, or valleys, starting in opposite directions from the same point on the main ranges, while a depression occurs in the ridge at the point whence such valleys take their departure.

Arrangement of mountain features.

As the rivers and ridges that separate them must be laid out on the same general plan, it is natural to find in these last the same tendency to follow lines perpendicular, or parallel, to the general direction of the chain. There is no part of the mountains in which these peculiarities may not be traced, the longitudinal character prevailing on the summit of the table-land, and the transverse being dominant on the Himalayan slope. By the combination of these tendencies the rivers flow to the plains along a line generally oblique to the component parts of their actual course; and the watershed ridges that separate them follow corresponding directions. But such watershed lines rarely have any true structural continuity, however strongly they may be marked on our maps, and great caution must be exercised in inferring physical relations among such features of the mountains without obtaining some knowledge of their geological structure.

Geology. Imperfection of data.

Considering the vast extent of these mountains, and the material and political difficulties in the way of the traveller who visits them, it is not surprising that the knowledge of their geological structure is still very imperfect. From causes which are not very obvious, important parts of the deposits of which they consist have till now not yielded any fossil remains by which their age can be determined; the visits of qualified geologists to the more remote parts of the chain have been very rare; and it is only within the last few months that any connected memoir on the subject has been published. Much that has been written on it is of too speculative a nature to find place in such an account as the present, and all that can be attempted is a brief outline of the main conclusions that seem established.

The great plain.

Of the great Indian plain nothing very definite can be said. It is an alluvial deposit of sandy clay, on the surface of which nothing in the shape of a pebble can be found excepting in the immediate vicinity of the hills that rise from it. In one place alone, in the north-west, on the Jumna river, have fossil remains been found embedded in it, at some depth below the surface. They belonged to terrestrial mammals, with fish and croco-

diles, which seem to be of the post-Tertiary epoch. A few borings have been made to depths of some hundreds of feet, but they throw no great light on the subject of the origin of the plain. There is no direct evidence either for or against its having been laid out by the sea; on the one side it seems difficult to understand how so even a surface could have been produced otherwise than under the sea, while on the other there is a complete want of marine remains both in the alluvium itself and in the most recent deposits which form the hills that rise from it. It seems to be admitted that some parts of the alluvial plain of the Indus have been submerged, and in any case, if it was produced by river action, it must have been by rivers having a very small inclination, and in a delta, or at a low elevation.

The outer Siwáliks. The outermost ranges of the sub-Himalaya are also geologically the most recent. They are composed of gray micaceous sandstones, generally very soft and often quite unconsolidated, with beds of red and blue clays and marls interspersed, and boulder and gravel beds, at times hardly to be distinguished from those formed in the existing rivers, and often cemented by carbonate of lime into conglomerates. Though these formations are most strongly developed to the west, they have been observed in Nepál and also in Bhotán. It is from the ranges in the vicinity of the Jumna river that the characteristic Siwálik fossils have chiefly been obtained. They consist of numerous species of mammals and reptiles, with a few fish, birds, and mollusca,—all, however, remains of land or fresh-water animals, with no certain trace of marine creatures. Lignite occurs in thin isolated beds in small quantities. It had been commonly supposed that the Siwálik fauna was of Miocene age. The later views rather point to its being Pliocene. Sixteen genera among the fossil remains have not been found in any beds older than Pliocene, and of the many genera which continue to the present time, some of the forms preserved in these fossils are remarkably similar to existing species, all of which indicates a closer relation to the more recent than to the older Tertiaries.

The inner sub-Himalaya. In close juxtaposition with this external band, but connected geologically in a manner that has not been very clearly established, is an older series of beds, the lowest of which is nummulitic and of the oldest Tertiary epoch. The fossils found in these beds are as markedly marine as those of the other series are terrestrial. The junction of the newer with this more ancient series is concealed by disturbances, and the former has not been found overlying the latter, but only abutting upon it. This older section of the Tertiary beds of the sub-Himalaya has only been properly made out to the west of the Jumna, though it is likely that it is also represented in the central and eastern parts of the chain by certain sandstones which occur there at the foot of the higher mountains. It may be surmised also that the nummulitic beds of these ranges are connected on the one side with those which are found to the west of the Indus extending to Sindh, and on the other with the nummulitic rocks of the hills south of Assam.

The outer parts of main chain. A complete change of geological character occurs on passing from these outer and lower ranges to those higher mountains which extend to the line of snowy peaks. On the west of the chain the first of these ranges consist of argillaceous shales and schists, grits and limestones, intersected by several lines of igneous action, and all devoid of fossil remains. True slates also occur. The stratification is everywhere well marked, the dip being usually towards the interior of the chain at an angle of from 10° to 20°. Portions of the mountains are found in which the dip is quite reversed, or towards the plains, a result no doubt of absolute rupture and partial dislocation. The lines of igneous action follow generally the line of strike, the type of the rock being greenstone, and conglomerates or breccias being often associated with it.

Probable age and relations. How far these beds extend to the eastward is somewhat in doubt. Suggestions have been made that they are the representatives of the Silurian or other fossiliferous beds found to the north of the great snowy mountains, but the evidence for this is hardly conclusive. The occurrence at the foot of the mountains in Sikim and Bhotán of a deposit containing fossil coal-plants, which are apparently identical with those of the Bengal coal-field, renders it probable that the rocks there are of the age of that coal, that is to say, of the lower Trias, a conclusion which somewhat serves to corroborate the speculation as to the age of the western beds just referred to.

Lines of granite and other igneous rocks. In certain parts of this outer region of the mountains granite also occurs, accompanied by gneiss and mica-schist, the latter often abounding in garnets. In mineralogical character this granite and its accompanying schists differ greatly from those of the great peaks, which are also formed of granite and schists; this has suggested a possible difference of age, and it remains uncertain whether any or what connection exists between them.

The snowy mountains. As we approach the line of great peaks the rocks pass into highly crystalline gneiss or mica schist, and another more continuous line of granite intrusion occurs, divided into several branches, but distributed generally on the line of strike, that is, along the principal direction of the chain itself. It is chiefly in veins, though it expands at times into masses of considerable size, and more rarely into outbursts large enough to constitute whole mountains. The general dip of the strata continues throughout this area to be directed inwards, its angle being increased to as much as 45°, though seldom to more than that. Beds of highly crystalline limestone, some pure, and some not easily distinguished from the gneiss or mica schist among which they occur are common along a band following the direction of the strike. The vein granite is usually large-grained; hornblende at times replaces the mica; the felspar is invariably white, and crystals of schorl and kyanite are frequently seen in it.

Great peaks. The great peaks are, with few exceptions, composed of schistose rock, though granite veins may be seen in the mountain faces to very great elevations; one of these exceptions is the great peak of Kámet in Kumaon, which rises to about 25,000 feet in what appears to be a mass of gray granite.

Fossiliferous strata on Tibetan border. Passing to the north of the line of great peaks the metamorphosed schists are suddenly replaced by slates and limestones, which are in many places highly fossiliferous, exhibiting what appears to constitute in the aggregate a fairly continuous series from the Lower Silurian to the Cretaceous formations, though the complete sequence has not been observed in any one locality. The western region of the Himalaya alone has been sufficiently explored to admit of any positive statements, but the indications gathered from such imperfect accounts and other data as exist relative to the eastern parts of the mountains leave little doubt that the change observed in the west on approaching and entering Tibet holds good on the east also, and that the general physical features of the whole tract are much alike, though doubtless with many differences in detail.

Plateau: Tertiary. The fossiliferous strata of western Tibet are continued, though perhaps with some breaks, to the Tertiary period. In certain localities nummulitic rocks, probably Eocene, have been observed, and from the great alluvial deposit which forms the plain of Gugé, already noticed, the remains of mammals, apparently of Siwálik age, have also been obtained. Among these were bones of the elephant and the rhinoceros, the existence of which, in the present condition of these regions, would be wholly impossible; so that there is no room to doubt that these deposits have been raised from a comparatively low level to their existing great elevation of upwards of 15,000 feet, since they were laid out. As in the case of the plain of India, we here, too, have no complete proof of the origin of these great nearly horizontal deposits, but it seems clear, from the materials of which they are formed, that they must have been laid out by water, either by the sea or some great inland lake. They are largely composed of boulder deposits, and large boulders are strewed over the surface imbedded in the ground in a manner that seems only explicable as the result of the action of a considerable body of water.

Eruptive rocks in Tibet. Several lines of granitic and eruptive rock occur in western Tibet, of which all that need here be said is that they appear all to be older than the Tertiary alluvium, but some of them are possibly contemporaneous with the nummulitic and older formations.

Epoch of elevation The general conclusion that may be drawn from the facts of structure thus briefly indicated is that the elevation of the Himalaya to its pres-

ent great height is of comparatively recent occurrence. An area of land must have existed where the main line of snowy peaks now stands, which has not been submerged since the Palæozoic period, and which then had its northern boundary somewhere along what has been termed the Indian watershed. Evidence of a similar ancient sea on the south also exists, but in a less definite shape; and whether it was united with the northern sea or not is still a matter of conjecture, though the distinctive character of the fossils rather indicates that there was no direct union. The possible connection of this ancient Himalayan land area with the pre-Tertiary land of the peninsula of India is also only a matter for speculation.

Ancient pre-Tertiary land.

There is further reason to infer that the existence of the great line of peaks is rather due to some previous line of elevation on the ancient land, which has continued to retain its relative superiority while the whole area has been raised, rather than to any special line of energy of upheaval of recent date; and that the fundamental features of its former configuration of surface in mountain and valley have been preserved throughout. There is evidence for the conclusion that the chief rivers of the pre-Tertiary land issued from the mountains where the present main streams are found, and this embryo Himalaya may have been of such moderate height as to have permitted the passage across it of the Siwálik mammals, the remains of which appear both on the border of the Indian plain and in Tibet. It is after the middle Tertiary epoch that the principal elevation of these mountains must have taken place, and about the same time also took place the movements which raised the table-lands of Afghanistan and Persia, and gave southern Asia its existing outlines.

Forces to which elevation is due: their mode of action.

The best answer that can be given to an inquiry as to how changes of level could have arisen, such as those which are observed in the Himalaya, is that they should be regarded as due rather to secondary actions consequent on the general contraction of the cooling terrestrial sphere than to direct elevating forces, for which no known origin can be assigned. The contraction of the cooling but now solid crust of the earth must have set up great horizontal strains, partly of tension and partly of compression, which would necessarily have been followed by rupture or crushing along lines of least resistance, and the movements on such lines are marked by the great mountain ranges that traverse the surface. A dislocation of the solid crust of the earth once having taken place, it would probably continue to be a line of least resistance ever after, and a succession of movements during past geological periods may thus be reasonably expected along such lines. Somewhat in proportion as the disturbing forces are intense, and the thickness of the crust on which they act is great, will be the tendency for the lines of rupture to be continuous for a considerable distance; and as the disturbed area is extended in its dimensions, the probability will increase of a repetition of a series of similar dislocations on lines approximately parallel to, or at right angles to, one another, and to the line on which the greatest compression and consequent tension take place. In a disturbed area, one transverse dimension of which is sensibly greater than the rest, the longitudinal ruptures will predominate in the interior and the transverse towards the borders. Almost all mountains give indications of having been shaped by forces thus related, and to the action of such forces may the main characteristics of the structure of the Himalaya, and the arrangement of its ridges and valleys, be attributed. Whatever may be the power of rivers in general as instruments of erosion, and whatever effect the Himalayan rivers have had in removing the fragments of the rocks over and among which they took their courses, it is hardly possible to doubt that their main directions were determined by the anterior lines of dislocation which opened up hollows down which they could flow, and which must invariably have been accompanied by a destructive and crushing action on the rocks along them, which has enabled the waters the more readily to sweep away the obstacles in their path. The parallelism of many of the great Tibetan and Himalayan rivers for hundreds of miles together amid such mountains, seems wholly inexplicable in any other manner.

Meteorology.

Although the loftiest mountains when compared to the earth's diameter are insignificant in their dimensions, and the irregularities of the surface would hardly be perceptible on any sphere, however large, that could be made to represent the earth, yet in relation to the depth of the atmosphere even moderate elevations become of great importance, and such heights as those reached by the Himalaya introduce modifications of climate in ascending over its slopes that are not surpassed by those observed in moving from the equator to the poles. One half of the total mass of the atmosphere and three-fourths of the water suspended in it in the form of vapor lie below the average elevation of the Himalaya, and of the residue one half of the air and virtually almost all the vapor come within the influence of the highest peaks.

Effect of mountains on atmosphere.

The general changes of pressure of the atmosphere indicated by the barometer extend in a modified but well-marked manner to the greatest elevations to which observation has been carried, and the annual and diurnal oscillations are not less regular in Tibet than in the plains of India, though somewhat reduced in amount. With the increase of elevation the diminution of the quantity of vapor held in suspension is very marked, and at the greatest heights reached there is found not more than one-sixth or one-seventh part of that observed at the foot of the mountains, and the proportion is sometimes as low as a tenth, or less. As is well known, the maximum quantity of water that can be suspended in the air in a state of vapor depends on the temperature of the air, and observation has established that the actual quantity at all elevations is approximately proportionate to this maximum, and is thus determined by the temperature, which in turn is regulated by the elevation. The theoretical view once held that watery vapor was distributed in the atmosphere in accordance with the laws of pressure of elastic fluids is manifestly inconsistent with observed facts, which indicate that the diffusion of vapor is powerfully obstructed by the air particles, and that it by no means behaves as an independent elastic fluid, but rather as though it were merely mixed up with or entangled among the air particles.

Barometric pressure and vapor.

The great elevations to which the Himalaya ascends, and the broad zone which it covers in respect to latitude, and its varying distance from the sea necessarily lead to correspondingly great variations of climate in its different parts, including the temperature and the degree of humidity in the atmosphere, and the amount of rainfall. The general position of the whole tract between the 25th and 35th degrees of north latitude renders it subject to high summer temperatures The heat of the great plain of northern India is not surpassed at any other part of the earth, the air temperature rising in the hottest months to more than 110° Fahr.; the fall of temperature in the winter is considerable, the thermometer receding at times to the freezing point, or even a little below it; the mean temperature varies from 78° Fahr. in the east or southern portion to 75° in the west or north. On the mountains every altitude has its corresponding temperature, an elevation of 1000 feet producing a fall of about $3\frac{1}{3}$°, or 1° Fahr. to 300 feet. The mean winter temperature at 7000 feet is about 44° Fahr., with a mean minimum of 32° Fahr., and the summer mean about 65° Fahr. At 9000 feet the mean temperature of the coldest month is 32° Fahr., at 12,000 feet the thermometer ceases to fall below freezing point from the end of May to the middle of October, and at 15,000 feet it is seldom above that point at the coldest part of the day in the height of summer. There seems to be less variation of temperature at equal altitudes on the mountains in passing from east to west than might have been expected from the greater winter cold of the western part of the plains. This is probably due to the greater relative humidity and heavier rainfall of the eastern regions, and the denser vegetation which covers them. These influences tend to keep down the day temperature on the eastern mountains, while the clearer skies and more open character of the west operate in the opposite direction. On the more woody and rainy mountains in the outer parts of the chain the mean summer temperature will be 60° at 10,000 or 11,000 feet, but it will still be as much as that up to 12,000 feet, or even to a greater elevation, in the bare and sunny valleys near the Indian watershed.

Temperature of Himalaya.

In Tibet the thermometrical conditions vary considerably from those of the Himalayan slope.

Of Tibet.

At 12,000 feet the maximum temperature is perhaps 70° Fahr. and the absolute minimum 5° Fahr. The ordinary winter temperature is from 0° Fahr. to 30° Fahr., with a mean of the coldest month of 10°. The mean of the hottest month is about 60°, and of the year 35°. At 15,000 feet the frost is permanent from the end of October to the end of April, and the lakes are usually frozen over for nearly five months in the year. Between 15,000 and 16,000 feet the thermometer will fall below the freezing point every night of the year. At heights of 17,000 or 18,000 feet it rises considerably above that point in the summer months. From 18,000 to 19,000 feet it thaws only in the afternoons of July and August, and at 20,000 feet there is probably perpetual frost in the shade, though in the sun the air no doubt rises above the freezing point to much greater elevations.

Freezing of rivers.

All the rivers in Ladák are frozen over every winter down to 8000 feet, a phenomenon that has been nowhere seen in the Himalaya, the rivers that are accessible during the winter being at too small an elevation to be ever frozen, and the main streams probably everywhere too rapid.

Diurnal and other ranges of temperature.

The diurnal range of temperature is directly dependent on the condition of the surface and the state of the sky. On all well-wooded ranges it is very small, particularly in the cloudy and rainy months, when it will not exceed 5° or 6°. In the dry months of April or May, before the summer rains begin, and in the autumn when clear skies again prevail, the variation is greatest. In Tibet it is greatest in summer and least in winter, which is the most cloudy season. The annual variation follows a similar law, 20° being about the minimum mean monthly range on the wooded outer mountains, while in Tibet it amounts to as much as 50°.

Comparison of eastern and western parts of chain.

The difference of temperature between ranges densely clad with forest and the Indian plains may be twice as much in April and May as in December or January; and the differences between the temperatures of a well-wooded hill-top and an open valley below have been observed to vary as much as from 9° in the coldest to 24° in the hottest hour. Precisely the converse may be found to hold good in comparing greater altitudes in Tibet with lesser in the Himalaya, where the humidity is greater.

General relation of temperature to altitude.

It is generally true here as elsewhere—(1) that the decrement of temperature with altitude is most rapid in summer; (2) that the annual range diminishes with elevation; and (3) that the diurnal range also diminishes with elevation. But the greater quantity of cloud and the more dense covering of forest between 9000 and 10,500 feet render comparisons between this zone and the more open and less cloudy regions above and below anomalous, for reasons that will be apparent after the above remarks.

Rainfall: periodicity, how caused.

The chief rainfall on the Himalaya, like that of India generally, occurs in the summer months between May and October, the remainder of the year being comparatively dry. The physical causes which give rise to the south-west monsoon, under which name is known the season of summer rain as well as the south-westerly winds which accompany it, have been sufficiently explained in the article on Asia, to which the reader is referred for further details.

General distribution.

The fall of rain over the great plain of northern India gradually diminishes in quantity, and begins later, as we pass from east to west. At the same time the rain is heavier as we approach the Himalaya, and the greatest falls are measured on its outer ranges; but the quantity is again much diminished as we pass onward across the chain, and on arriving at the border of Tibet, behind the great line of snowy peaks, the rain falls in such small quantities as to be hardly susceptible of measurement.

Mountain winds: their causes.

An important agent in distributing the rain which falls over the Himalaya, if indeed it be not the essential one, is found in the diurnal currents of wind which are established from the plains towards the mountains, and *vice versa*, blowing up the valleys towards the main watershed from about 8 A. M. to 8 P. M., and in the opposite direction during the corresponding hours of the night. These diurnal winds, which are a very striking phenomenon, and blow in the afternoon with great force along the Himalayan and Turkish watersheds and the neighboring parts of the plain of Tibet, are common to all mountains, and are no doubt due to the disturbances of the planes of equal atmospheric pressure in a direction transverse to the mountains, caused by the unequal diurnal expansion and contraction of the columns of air respectively over the plains and mountains, the former being obviously longer than the latter, so that the planes of equal pressure are lifted by expansion higher over the plains during the day, and depressed by contraction during the night, thereby setting up currents to and from the highest region of the mountains, as these alternating actions take place.

Their effects in relation to rain.

The condensation of vapor from the ascending currents thus set up across the Himalaya from the Indian plain, and their gradual exhaustion by repeated precipitations as they cross successive ranges, is manifested to the traveller on the face of the mountains themselves, by the changes observed in the vegetation on passing to leeward of any important range, and more especially the line of great snow peaks. In the rainy months in the higher parts of the chain the southern face of each ridge is clothed by the day up wind with a crest of cloud, which hangs upon it, the northern face being often left entirely free, thus showing how large a portion of the vapor is arrested, and showing also that it is only up the deeper gorges that a small supply of moisture finds its way to the Tibetan table-land.

Quantity of rain measured.

The yearly rainfall, which amounts to between 60 and 70 inches in the delta of the Ganges, is reduced to about 40 inches where that river issues from the mountains on the 78th meridian, and is no more than 30 inches near the foot of the mountains at the issue of the Indus. At Darjeling, at about 7000 feet on the east, on the outer border of the mountains, it amounts to about 120 inches; at Naini-tal, at about the same elevation and similarly situated in 79½° E. long., it is about 90 inches; and further west it is still more reduced in quantity. In passing from the exterior to the interior of the chain the quantity greatly diminishes. In Kumaon, while in three months 49 inches was registered at Naini-tal on the outer range, only 19 inches fell at Almora, at 5600 feet, 30 miles further in. At Joshimath, 50 miles onward and close under great snowy peaks, at 6500 feet, 22 inches were measured in the same period; while at Niti, 11,500 feet behind the snowy peaks, the fall did not exceed 5½ inches. In a week of rainy weather, when 1½ inches fell at Joshimath, half an inch was measured at Niti; while beyond the Tibetan watershed during the same period the rain fell in a very faint drizzle which could not be measured at all. Similar facts might be quoted from the eastern mountains.

Snowfall.

In the eastern Himalaya the ordinary winter limit of snow is 6000 feet, and it is rare for even 3 inches to remain as many days on the ground on a southern exposure at 7000 feet. In Kumaon, on the west, it is pretty certain that snow will fall every year at about 6500 feet, and at 5000 feet it will not fail one year out of ten; the lowest level to which sporadic snowfalls are known to descend is about 2500 feet, of which two or three instances have occurred in the present century. At Peshawar, at an elevation of a little above 1000 feet, snow occasionally falls, but very rarely. At Lé, in western Tibet, the results of two years' observations indicate that the depth of snow that falls is less than 2 feet, the heaviest continued fall measuring 8 inches and lasting three days, at an elevation of 12,500 feet. Depths of 3 feet have been measured on passes between 17,000 feet and 19,000 feet above the sea. On the Indian watershed the falls are much heavier, and even in September the passes are sometimes quite blocked by the falls which commonly occur after the equinox, and they are not usually open again till the middle of June.

The snow line.

It is now satisfactorily established that the snow line, or the level to which snow recedes in the course of the year, ranges from 15,000 to 16,000 feet on the southern exposures of the Himalaya that carry perpetual snow, along all that part of the chain that lies between Sikim and the Indus. It is probably not till December that the snow begins to descend for the winter, though after September light falls occur which cover the higher mountains down to 12,000 feet, but these soon disappear. On the Indian watershed the snow line is not lower than 18,500 feet, and on the summit of the table-land it reaches a height of about 20,000 feet. On all the

higher passes into Tibet the vegetation reaches to about 17,500 feet, and in August they may all be crossed in ordinary years, even up to 18,400 feet, without finding any snow upon them; and it is as impossible to find snow in the summer on the great plain of Gugé in western Tibet, at 15,500 feet above the sea, as on the plains of India.

Cause of higher level in Tibet than on Himalaya.

There was at one time much discussion as to the true cause of the level of the snow line being higher in Tibet than on the outer ranges of the Himalaya. But the reason is obvious, namely, the greater quantity of snow that falls on the exterior ranges. The snow line marks the limit beyond which some snow always remains unmelted, that is, the point where on the average of years the summer heat will destroy the winter's snow. The main element in determining such a point will evidently be the quantity of winter snow that falls, the summer heat being not very different over the whole area. That the fall of snow on the outer ranges is greater than it is nearer the watershed at the same elevation is beyond doubt, and the smaller quantity of snow is more easily and earlier melted.

Glaciers.

It was long affirmed that there were no true glaciers in the Himalaya, and ingenious arguments were adduced to account for their absence. But, in fact, they abound along all the higher ranges precisely in those circumstances under which they are found elsewhere, and all the phenomena observed elsewhere in connection with them are reproduced in these mountains.

Elevations at which found.

The level to which the Himalayan glaciers descend is very various, being greatly dependent on local conditions, principally the extent and elevation of the snow basins which feed them, and the slope and position of the mountain on which they are formed. A glacier formed on the southern face of the Himalaya may readily be in a position in which it might, with a length of 10 miles, descend from 18,000 feet to 11,500 feet. But in Tibet, or in the highest valleys, it might as readily happen that in 10 miles no lower level than 16,000 feet could be reached. With a larger snow basin on the south the greater waste in reaching the lower level might easily be compensated, while no conceivable supply would enable the Tibetan glacier to reach 11,500 feet, to do which it must extend perhaps 100 miles. These considerations will sufficiently explain the fact that the glaciers on the outer slopes of the Himalaya descend much lower than is commonly the case in Tibet, or in the most elevated valleys near the watershed. The glaciers of Sikim and the eastern mountains are believed not to reach a lower level than 13,500 or 14,000 feet. In Kumaon many of them descend to between 11,500 and 12,500 feet. In the higher valleys and Tibet 15,000 and 16,000 feet is the ordinary level at which they end, but there are exceptions which descend far lower. In Europe the glaciers descend between 3000 and 5000 feet below the snow line, and in the Himalaya and Tibet about the same holds good. The summer temperatures of the points where the glaciers end on the Himalaya also correspond fairly with those of the corresponding positions in European glaciers, viz., for July a little below 60° Fahr., August 58°, and September 55°.

Their movement.

Measurements of the movement of Himalayan glaciers have been made which also give results according closely with those obtained under analogous conditions in the Alps, viz., rates from 9½ to 14¼ inches in twenty-four hours. The motion of one glacier from the middle of May to the middle of October averaged 8 inches in the twenty-four hours. The average yearly motion of the glacier of the Aar is said to be 7½ inches in twenty-four hours. The dimensions of the glaciers on the outer Himalaya, where, as before remarked, the valleys descend rapidly to lower levels, are fairly comparable with those of Alpine glaciers, though frequently much exceeding them in length—8 or 10 miles not being unusual. In the elevated valleys of northern Tibet, where the destructive action of the summer heat is far less, the development of the glaciers is enormous. At one locality in north-western Ladák there is a continuous mass of snow and ice extending across a snowy ridge, measuring no less than 64 miles between the extremities of the two glaciers at its opposite ends. Another single glacier has been surveyed 36 miles long.

Former extension beyond present limits.

In connection with almost all the Himalayan glaciers of which precise accounts are forthcoming are found ancient moraines indicating some previous condition in which their extent was much larger than now. In the east these moraines are very remarkable, extending 8 or 10 miles. In the west they seem not to go beyond 2 or 3 miles, and they have been observed on the summit of the table-land as well as on the Himalayan slope. The explanation suggested to account for the former great extension of glaciers in Norway would seem applicable here. Any modification of the coast line which should submerge the area now occupied by the North-Indian plain, or any considerable part of it, would be accompanied by a much wetter and more equable climate on the Himalaya; more snow would fall on the highest ranges, and less summer heat would be brought to bear on the destruction of the glaciers, which would receive larger supplies and descend lower. Such an explanation is not inconsistent with what is known of the geological formation of the mountains, and appears to be otherwise supported by the evidence of a greater former extension of the lakes of Tibet, and of the former existence of rivers flowing from the Himalaya between the Jumna and the Sutlej, the dry beds of which are now to be traced, in which water is never seen. Till now no geological evidence has been adduced to indicate in this region anything corresponding to the glacial epochs of northern Europe, to which these former extensions of the glaciers could be attributed.

Botany. General characteristics of flora.

Speaking broadly, the general type of the flora of the lower, hotter, and wetter regions, which extend along the great plain at the foot of the Himalaya, and include the valleys of the larger rivers which penetrate far into the mountains, does not differ from that of the contiguous Malayan peninsula and islands, though the tropical and insular character gradually becomes less marked as we pass from east to west, where, with a greater elevation and distance from the sea and higher latitude, the rainfall and humidity diminish and the winter cold increases. The vegetation of the western part of the plain and of the hottest zone of the western mountains thus becomes closely allied to, or almost identical with, that of the drier parts of the Indian peninsula, more especially of its hilly portions; and, while a general tropical character is preserved, forms are observed which indicate the addition of an Afghan as well as of an African element, of which last the gay lily *Gloriosa superba* is an example, pointing to some previous connection with Africa.

Relation to neighboring areas.

The European flora, which is diffused from the Mediterranean along the high lands of Asia, extends to the Himalaya; many European species reach the central parts of the chain, though few reach its eastern end, while genera common to Europe and the Himalaya are abundant throughout and at all elevations. From the opposite quarter an influx of Japanese and Chinese forms, such as the rhododendrons, the tea plant, *Aucuba*, *Helwingia*, *Skimmia*, *Adamia*, *Goughia*, and others, has taken place, these being more numerous in the east and gradually disappearing in the west. On the higher and therefore cooler and less rainy ranges of the Himalaya the conditions of temperature requisite for the preservation of the various species are readily found by ascending or descending the mountain slopes, and therefore a greater uniformity of character in the vegetation is maintained along the whole chain. At the greater elevations the species which are identical with those of Europe become more frequent, and in the alpine regions many plants are found identical with species of the Arctic zone. On the Tibetan plateau, with the increased dryness, a Siberian type is established, with many true Siberian species and more genera; and some of the Siberian forms are further disseminated, even to the plains of Upper India. The total absence of a few of the more common forms of northern Europe and Asia should also be noticed, among which may be named *Tilia*, *Fagus*, *Arbutus*, *Erica*, *Azalea*, and *Cistaceæ*.

Eastern mountains.

In the more humid regions of the east the mountains are almost everywhere covered with a dense forest which reaches up to 12,000 or 13,000 feet. Many tropical types here ascend to 7000 feet or more. To the west the upper limit of forest is somewhat lower, from 11,500 to 12,000 feet, and the tropical forms usually cease at 5000 feet.

The outer ranges.

In Sikim the mountains are covered with dense forest of tall umbrageous trees, commonly accompanied by a luxuriant growth of under

shrubs, and adorned with climbing and epiphytal plants in wonderful profusion. In the tropical zone large figs abound, *Terminalia*, *Shorea* (sál), laurels, many *Leguminosæ*, *Bombax*, *Artocarpus*, bamboos, and several palms, among which species of *Calamus* are remarkable, climbing over the largest trees; and this is the western limit of *Cycas* and *Myristica* (nutmeg). Plantains ascend to 7000 feet. *Pandanus* and tree-ferns abound. Other ferns, *Scitaminæ*, orchids, and climbing *Aroideæ* are very numerous, the last-named profusely adorning the forests with their splendid dark-green foliage. Various oaks descend within a few hundred feet of the sea-level, increasing in numbers at greater altitudes, and becoming very frequent at 4000 feet, at which elevation also appear *Aucuba*, *Magnolia*, cherries, *Pyrus*, maple, alder, and birch, with many *Araliaceæ*, *Hookböllea*, *Skimmia*, *Daphne*, *Myrsine*, *Symplocos*, and *Rubus*. Rhododendrons begin at about 6000 feet and become abundant at 8000 feet, from 10,000 to 14,000 feet forming in many places the mass of the shrubby vegetation, which extends some 2000 feet above the forest. Epiphytal orchids are extremely numerous between 6000 and 8000 feet. Of the Coniferæ, *Podocarpus* and *Pinus longifolia* alone descend to the tropical zone; *Abies Brunoniana* and *Smithiana* and the larch (a genus not seen in the western mountains) are found at 8000, and the yew and *Picea Webbiana* at 10,000 feet. *Pinus excelsa*, which occurs in Bhotán, is absent in the wetter climate of Sikim.

Inner ranges.

On the drier and higher mountains of the interior of the chain, the forests become more open, and are spread less uniformly over the hill-sides, a luxuriant herbaceous vegetation appears, and the number of shrubby *Leguminosæ*, such as *Desmodium* and *Indigofera*, increases, as well as *Ranunculaceæ*, *Rosaceæ*, *Umbelliferæ*, *Labiatæ*, *Gramineæ*, *Cyperaceæ*, and other European genera.

Alpine and Tibetan region.

The alpine flora of Sikim closely resembles that of the western Himalaya, and so far as generic forms are concerned, that of the alpine regions of Europe and western Asia. The vegetation of the Tibetan region appears on rising above 14,000 feet, and its last representatives reach even to 18,000 feet.

Flora of central mountains.

Passing to the westward, and viewing the flora of Kumaon, which province holds a central position on the chain, on the 80th meridian, we find that the gradual decrease of moisture and increase of high summer heat are accompanied by a marked change of the vegetation. The tropical forest is characterized by the trees of the hotter and drier parts of southern India, combined with a few of European type. Among them are *Moringa*, *Bombax*, *Butea*, *Anogeissus*, *Erythrina*, *Acacia*, *Bauhinia*, *Nauclea*, and *Ulmus integrifolia*. *Pinus longifolia* descends almost to the level of the plains. Among the more common shrubs are *Zizyphus*, *Adhatoda*, *Calotropis*, *Carissa*. Ferns are more rare, and the tree-ferns have disappeared. The species of palm are also reduced to two or three, and bamboos, though abundant, are confined to a few species.

The outer ranges: forests.

The outer ranges of mountains are mainly covered with forests of *Pinus longifolia*, rhododendron, oak, and *Pieris*. At Naini-tal cypress is abundant. The shrubby vegetation comprises *Rosa*, *Rubus*, *Indigofera*, *Desmodium*, *Berberis*, *Bœhmeria*, *Viburnum*, *Clematis*, with an *Arundinaria*. Of herbaceous plants species of *Ranunculus*, *Potentilla*, *Geranium*, *Thalictrum*, *Primula*, *Gentiana*, and many other European forms are common. In the less exposed localities, or northern slopes and sheltered valleys, the European forms become more numerous, and we find species of alder, birch, ash, elm, maple, holly, hornbeam, *Pyrus*, etc. At greater elevations in the interior, besides the above are met *Corylus*, the common walnut, found wild throughout the range, horse chestnut, yew, also *Picea Webbiana*, *Pinus excelsa*, *Abies Smithiana*, *Cedrus Deodara* (which tree does not grow spontaneously east of Kumaon), and several junipers. The denser forests are commonly found on the northern faces of the higher ranges, or in the deeper valleys, between 8000 and 10,500 feet. The woods on the outer ranges from 3000 up to 7000 feet are more open, and consist mainly of evergreen trees.

Herbaceous vegetation.

The herbaceous vegetation does not differ greatly, generically, from that of the east, and many species of *Primulaceæ*, *Ranunculaceæ*, *Cruciferæ*, *Labiatæ*, and *Scrophulariaceæ* occur; balsams abound, also beautiful forms of *Campanulaceæ*, *Gentiana*, *Meconopsis*, *Saxifraga*, and many others.

Cultivation.

Cultivation hardly extends above 7000 feet, except in the valleys behind the great snowy peaks, where a few fields of buckwheat and Tibetan barley are sown up to 11,000 or 12,000 feet. At the lower elevations rice, maize, and millets are common, wheat and barley at a somewhat higher level, and buckwheat and amaranth usually on the poorer lands, or those recently reclaimed from forest. Besides these, most of the ordinary vegetables of the plains are reared, and potatoes have been introduced in the neighborhood of all the English stations.

Flora of most western area.

As we pass to the west the species of rhododendron, oak, and *Magnolia* are much reduced in number as compared to the eastern region, and both the Malayan and Japanese forms are much less common. The herbaceous tropical and semi-tropical vegetation likewise by degrees disappears, the *Scitaminæ*, epiphytal and terrestrial *Orchideæ*, *Araceæ*, *Cyrtandraceæ*, and *Begoniæ* only occur in small numbers in Kumaon, and scarcely extend west of the Sutlej. In like manner several of the western forms suited to drier climates find their eastern limit in Kumaon. In Kashmir the plane and Lombardy poplar flourish, though hardly seen further east, the cherry is cultivated in orchards, and the vegetation presents an eminently European cast. The alpine flora is slower in changing its character as we pass from east to west, but in Kashmir the vegetation of the higher mountains hardly differs from that of the mountains of Afghanistan, Persia, and Siberia, even in species.

Of western Thibet.

The flora of western Tibet is essentially European in its character. The juniper and poplar are the only trees that are seen, excepting fruit-trees, which include apricot, pear, and grape. The shrubby plants include small forms of willow, elm, *Lonicera*, rose, *Myricaria*, *Ephedra*, and *Hippophae*. The ordinary firewood of the more elevated tracts is supplied by bushes of *Caragana*, the furze of travellers, and dwarf *Lonicera* and willow. Species of *Astragalus*, *Urtica*, *Allium*, small *Cruciferæ* and saxifrages, *Saussurea*, and *Rheum* are common. *Artemisiæ* and many salt-plants, with *Glaux maritima* and *Triglochin*, are found especially on the borders of the salt lakes. Mosses and ferns are very rare. Many European grasses and *Carices* occur in the pastures. The herbaceous vegetation ascends freely to 16,000 feet, and isolated plants may be found as high as 19,000 feet; but excepting in the close neighborhood of small streams the growth is very scanty, and not one-twentieth of the surface is commonly clothed with vegetation. Barley is cultivated up to 15,000 feet, wheat, millet, and rape, with buckwheat, being common up to 12,000 feet. Apples and apricots grow up to 11,000 and 12,000 feet, and grapes to 9000 feet.

Number of species and character of families.

The total number of flowering plants inhabiting the range amounts probably to 5000 or 6000 species, among which may be reckoned several hundred common English plants chiefly from the temperate and alpine regions; and the characteristic of the flora as a whole is that it contains a general and tolerably complete illustration of almost all the chief natural families of all parts of the world, and has comparatively few distinctive features of its own.

Timber trees.

The timber trees of the Himalaya are very numerous, but few of them are known to be of much value, and the difficulties of transport are so great as to render their removal to a distance in many cases impracticable. The "Sál" is one of the most valuable of the trees; with the "Toon" and "Sissoo," it grows in the outer ranges most accessible from the plains. The "Deodar" is also much used, but the other pines produce timber that is not durable. Bamboos grow everywhere along the outer ranges, and ratans to the eastward, and are largely exported for use in the plains of India. Other vegetable products of economical value, excluding the ordinary cereals and esculent plants, are not numerous; and the primitive condition of the people and the difficulties and expense of carriage are so great as to render the trade in such articles very insignificant.

Tea.

Though one species of coffee is indigenous in the hotter Himalayan forests, the climate does not appear suitable for the growth of the plant which supplies the coffee of commerce. The cultivation of tea, however, is now carried on successfully on a large scale, both in

the east and west of the mountains, and has already become an important item of the export trade of India. In the western Himalaya the cultivated variety of the tea plant of China has been introduced, and succeeds well; on the east the indigenous tea of Assam, which is not specifically different, and is perhaps the original parent of the Chinese variety, is now almost everywhere preferred. The produce of the Chinese variety in the hot and wet climate of the eastern Himalaya, Assam, and eastern Bengal is neither so abundant nor so highly flavored as that of the indigenous plant, and therefore not so commercially valuable.

Cinchona. The cultivation of the cinchona, several species of which have been introduced from South America and naturalized in the Sikim Himalaya, is still in its infancy, but promises to yield at a comparatively small cost an ample supply of the precious febrifuge that is extracted from its bark. At present the manufacture is almost wholly in the hands of the Government, and the drug prepared is all disposed of in India. The progress of cinchona cultivation on the Nilgherries is not less promising than on the Himalaya.

Zoology. General characters. The general distribution of animal life on these mountains is manifestly determined by much the same conditions that have controlled the vegetation. The connection with Europe on the north-west, with China on the north-east, with Africa on the south-west, and with the Malayan region on the south-east is manifest; and the greater or less prevalence of the European and Eastern forms varies according to more western or eastern position on the chain. So far as is known these remarks will apply to the extinct as well as to the existing fauna. The Palæozoic forms found in the Himalaya are very close to those of Europe, and in some cases identical. The Triassic fossils are still more closely allied, more than a third of the species being identical. Among the Jurassic Mollusca, also, are many species that are common in Europe. The Siwalik fossils contain 84 species of mammals of 45 genera, the whole bearing a marked resemblance to the Miocene fauna of Europe, but containing a larger number of genera still existing, especially of ruminants, and as before stated now held to be of Pliocene age.

Fauna of Tibetan region. The fauna of the Tibetan Himalaya is essentially European, or rather that of the northern half of the old continent, which region has by zoologists been termed Palæarctic. Among the characteristic animals may be named the yák, from which is reared a cross breed with the ordinary horned cattle of India locally called "zobu," many wild sheep, and two antelopes, as well as the musk-deer; several hares and some burrowing animals, including pikas (*Lagomys*) and two or three species of marmot; certain arctic forms of carnivora—fox, wolf, lynx, ounce, marten, and ermine; also wild asses. Among birds are found bustard and species of sand-grouse and partridge; water-fowl in great variety, which breed on the lakes in summer and migrate to the plains of India in winter; the raven, hawks, eagles and owls, a magpie, and two kinds of chough; and many smaller birds of the passerine order, amongst which are several finches. Reptiles, as might be anticipated, are far from numerous, but a few lizards are found, belonging for the most part to types, such as *Phrynocephalus*, characteristic of the Central-Asiatic area. The fishes from the head waters of the Indus also belong, for the most part, to Central Asiatic types, with a small admixture of purely Himalayan forms. Amongst the former are several peculiar small-scaled carps, belonging to the genus *Schizothorax* and its allies.

Of Himalaya generally. The ranges of the Himalaya, from the border of Tibet to the plains, form a zoological region which is one of the richest of the world, particularly in respect to birds, to which the forest-clad mountains offer almost every range of temperature.

Mammals. Only two or three forms of monkey enter the mountains, the langúr, a species of *Semnopithecus*, ranging up to 8000 or 9000 feet. No lemurs occur, although a species is found in Assam, and another in southern India. Bats are numerous, but the species are for the most part not peculiar to the area; several European forms are found at the higher elevations. Moles, which are unknown in the Indian peninsula, abound in the forest regions of the eastern Himalayas at a moderate altitude, and shrews of several species are found almost everywhere; amongst them are two very remarkable forms of water-shrew, one of which however, *Nectogale*, recently discovered, is probably Tibetan rather than Himalayan. Bears are common, and so are a marten, several weasels and otters, and cats of various kinds and sizes, from the little spotted *Felis bengalensis*, smaller than a domestic cat, to animals like the clouded leopard rivalling a leopard in size. Leopards are common, and the tiger wanders to a considerable elevation, but can hardly be considered a permanent inhabitant, except in the lower valleys. Civets, the mungoose (*Ichneumon*), and tree-cats (*Paradoxurus*) are only found at the smaller elevations. Wild dogs (*Cuon*) are common, but neither foxes nor wolves occur in the forest area. Besides these carnivora some very peculiar forms are found, the most remarkable of which is *Ælurus*, sometimes called the cat-bear, a type peculiar to the Himalaya. Two other genera, *Helictis*, an aberrant badger, and *Prionodon*, an aberrant civet, are representatives of Malayan types. Amongst the rodents squirrels abound, and the so-called flying squirrels with a membranous expansion or parachute between their fore and hind legs are represented by several species. Rats and mice swarm, both kinds and individuals being numerous, but few present much peculiarity, a bamboo rat (*Rhizomys*) from the base of the eastern Himalaya being perhaps most worthy of notice. Two or three species of vole (*Arvicola*) have been detected, and porcupines are common. The elephant is found in the outer forests as far as the Jumna, and the rhinoceros as far as the Sarda; the spread of both of these animals as far as the Indus and into the plains of India, far beyond their present limits, is authenticated by historical records; they have probably retreated before the advance of cultivation and fire-arms. Wild pigs are common in the lower ranges, and one peculiar genus of pigmy-hog (*Porculia*) of very small size inhabits the forests at the base of the mountains in Nepál and Sikim. Deer of several kinds are met with, but do not ascend very high on the hill sides, and belong exclusively to Indian forms. The musk deer keeps to the greater elevations. The chevrotains of India and the Malay countries are unrepresented. The gaur or wild ox is found at the base of the hills. Three very characteristic ruminants, having some affinities with goats, inhabit the Himalaya; these are the "serraw," "goral," and "táhr," the last-named ranging to rather high elevations. Lastly, the pangolin or manis is represented by two species in the eastern Himalaya. A dolphin living on the Ganges ascends that river and its affluents to their issue from the mountains.

Birds. Almost all the orders of birds are well represented, and the marvellous variety of forms found in the eastern Himalaya is only rivalled in Central and South America. Eagles, vultures, and other birds of prey are seen soaring high over the highest of the forest-clad ranges. Owls are numerous, and a small species, *Glaucidium*, is conspicuous, breaking the stillness of the night by its monotonous though musical cry of two notes. Several kinds of swifts and nightjars are found, and gorgeously-colored trogons, bee-eaters, rollers, and beautiful kingfishers and barbets are common. Several large hornbills inhabit the highest trees in the forest. The parrots are restricted to parrakeets, of which there are several species, and a single small lory. The number of woodpeckers is very great, and the variety of plumage remarkable, and the voice of the cuckow, of which there are numerous species, resounds in the spring as in Europe. It is impossible to do more than indicate some of the chief passerine birds; their number is immense. Amongst them the sun-birds resemble in appearance and almost rival in beauty the humming-birds of the New Continent. Creepers, nuthatches, shrikes, and their allied forms, flycatchers and swallows, thrushes, dippers and babblers (about fifty species), bulbuls and orioles, pecular types of redstart, various sylviads, wrens, tits, crows, jays, and magpies, weaver-birds, avadavats, sparrows, crossbills, and many finches, including the exquisitely colored rose-finches, may also be mentioned. The pigeons are represented by several wood-pigeons, doves, and green pigeons. The gallinaceous birds include the peacock, which everywhere adorns the forest bordering on the plains, jungle fowl, and several pheasants; partridges, of which the chukor may be named as most abundant; and snow-pheasants and partridges, found only at the greatest elevations. Waders and waterfowl are far less abundant, and those occurring are nearly all migratory forms which visit the peninsula of India,—the only important exception being two kinds of solitary snipe, and the red-billed curlew.

Reptiles. Of the reptiles found in these mountains many are peculiar. Some of the snakes of India are to be seen in the hotter regions, including the python and some of the venomous species, the cobra being found as high up as 8000 or 9000 feet, though not common. Lizards are numerous, and as well as frogs are found at all elevations from the plains to the upper Himalayan valleys, and even extend to Tibet.

Fishes. The fishes found in the rivers of the Himalaya show the same general connection with the three neighboring regions, the Palæarctic, the African, and the Malayan. Of the principal families, the *Acanthopterygii*, which are abundant in the hotter parts of India, hardly enter the mountains, two genera only being found, of which one is the peculiar amphibious genus *Ophiocephalus*. None of these fishes are found in Tibet. The *Siluridæ* or scaleless fishes, and the *Cyprinidæ*, or carp and loach, form the bulk of the mountain fish, and the genera and species appear to be organized for a mountain-torrent life, being almost all furnished with suckers to enable them to maintain their positions in the rapid streams which they inhabit. A few *Siluridæ* have been found in Tibet, but the carps constitute the larger part of the species. Many of the Himalayan forms are Indian fish which appear to go up to the higher streams to deposit their ova, and the Tibetan species as a rule are confined to the rivers on the table-land or to the streams at the greatest elevations, the characteristics of which are Tibetan rather than Himalayan. The *Salmonidæ* are entirely absent from the waters of the Himalaya proper, of Tibet, and of Turkistan east of the Terektág. On crossing the watershed that leads from the streams flowing into the Indus to those falling into the Oxus, a trout is reported to have been found, though it is said not to live in the Jaxartes or its affluents.

Other orders of animal kingdom. No such general or connected account of the Mollusca, insects, or other lower forms of life, of these mountains exists as will admit of anything but very vague statements regarding them. It is, however, understood that the same relations with the neighboring European, Asiatic, and African regions are found to exist as have been noticed as characterizing the other forms of life.

Mollusca. Of the land Mollusca, one-half appear to belong to the genera *Helix* and *Bulimus*, and about one-third to the family of *Cyclostomidæ;* the species appear to be for the most part very local, and of about 120 species in all, only about one-tenth are recorded as being found in Tibet or the highest Himalayan valleys.

Insects. The Himalayan butterflies are very numerous and brilliant, for the most part belonging to groups that extend both into the Malayan and European regions, while African forms also appear. There are large and gorgeous species of *Papilio*, *Nymphalidæ*, *Morphidæ*, and *Danaidæ*, and the more favored localities are described as being only second to South America in the display of this form of beauty and variety in insect life. Moths, also, of strange forms and of great size are common. The cicada's song resounds among the woods in the autumn; flights of locusts frequently appear after the summer, and they are met far within the mountains, carried by the prevailing winds even among the glaciers and eternal snows. Ants, bees, and wasps of many species, and flies and gnats in great variety of form, and possessed of equal variety of powers of annoyance, abound, particularly during the summer rainy season, and at all elevations.

Apart from the connection which subsists between the Himalaya and the earliest developments of the Hindu religion, there is little in these mountains that is of interest as throwing light on the earlier history of our race. The mythical geography of the Hindus represents the peak of Kailás, the snowy mountain north of the Tibetan lake of Manasarowar, as the centre of the world, around which its visionary kingdoms are spread out. The sanctity of the Himalaya, in Hindu mythology, is known to all, and thousands of pilgrims from all parts of India still continue to seek salvation in the holy waters of the Ganges, and at its sacred sources in the snowy Himalaya. "He who thinks on Himáchal," says the Mánaskhanda, one of the Puránas or holy books of the Hindus, "though he should not behold him, is greater than he who performs all worship at Káshi (Benares). In a hundred ages of the gods I could not tell of the glories of Himáchal. As the dew is dried up by the morning sun, so are the sins of mankind by the sight of Himáchal." And to those who have performed such a pilgrimage the wondrous snow-clad peaks of the Himalaya, though seen through the atmosphere of the 19th century, seem still to be surrounded with the same halo of glory as of old.

Relation of Himalaya to Hindu mythology; mythical geography.

Holy rivers and places: the Ganges. The Ganges, which issues from the mountains at Hardwár, is fed by two principal tributaries which unite about 40 miles higher up, the Alaknanda, far the larger, and the Bhághirati, the more sacred. The source of the last-named river is in the glacier above the temple at Gangotri, which lies to the north of a great cluster of snowy peaks, on the south of which is found the temple of Kedarnáth, and on the east that of Badarináth. Large glaciers exist near both of these temples, that near Kedarnáth feeding the Mandákni, and that near Badarináth feeding the Vishnuganga, which river gives the main supply of water to the Alaknanda. Both the valley above Gangotri and that above Badarináth lead to Tibet, passing through a region of snowy peaks of first-class magnitude. To the west of Gangotri and the Bhághirati lies the hardly less sacred source of the Jumna and the temples of Jamnotri.

Badarináth and Kedarnáth. The temple at Badarinátli, on the Vishnuganga, as the latter name suggests, is dedicated to Vishnu, and is served by priests of the Vaishnava sect, presided over by a "Ráwal" or abbot, who is invariably a Brahman from south India. The temple at Kedarnáth is dedicated to Shiva, symbolized by the Lingam, and is more especially venerated by the Saiva sect; and the chief priest here, too, is a Brahman from Malabar in the same part of India. The origin of this connection of the holy places in the Himalaya with southern India is very obscure; possibly, however, it dates back to the 8th or 9th century, to the time of Sankara Acháraya, a native of Malabar, the chief expositor of the Saiva doctrines, who is said to have died at Kedarnáth. That the Himalaya and the sources of the Ganges, however, were regarded as holy, and had become places of pilgrimage for Hindus long before this event, or before the development of the two sects that have been here specially named, there can be no reasonable doubt; but how or when the Aryan races of India first developed for themselves a system of mythology so intimately bound up with these mountains must ever remain a subject of mere speculation.

Buddhist and Greek remains in western mountains. Remains of Buddhist monasteries and temples on a great scale, the majority of which are believed from inscriptions found on them to date back to about the commencement of the Christian era, are met with along the foot of the western end of the Himalaya, in the Yusafzai country bordering on the Indus, and similar ruins are seen as far west as Jellalabad in Afghanistan. Some of the buildings are doubtless of much greater age, and may go back to the earliest days of Buddhism, about six centuries before our era; and the discovery in this locality of what is probably a contemporaneous copy of Asoka's well-known inscription, cut into the face of a great rock, testifies to the development of a great centre of Buddhism in his days, that is, about 250 B. C. Among these ruins are found fragments of sculpture bearing the impress of the Greek art introduced by the successors of Alexander; and other relics of the Greco-Scythic kings, in the form of numerous coins, have been obtained from the same quarter. The exact point at which Alexander entered India is still a subject of discussion among antiquaries, but it probably was on the line following the skirt of the north-west Himalaya along which the road now runs, and which is known to have been the chief line of traffic for centuries. How the influence of Greek architecture was carried forward both in time and place is illustrated by the curious temple of the sun, or "Marttand," in the valley of Kashmir, the date of which is about 400 A. D.

Comparison of Himalayan with other mountain scenery. It would be a task, certainly fruitless, and probably impossible, to endeavor to estimate aright the conflicting claims to admiration of the scenery of the Himalaya and other great mountain ranges. If some elements of the picturesque be better found elsewhere, and if the softer features of hill, valley, and lake be absent, yet nowhere can the Himalaya be surpassed in the magnificence and variety of its forests, or in the wealth and beauty of its alpine flora, which offer to the traveller ever-changing and ever-renewed pictures, combining the charm of former memories

with fresh conceptions of the wonderful never-failing profusion of nature; and to the student of natural phenomena of every description surely no grander field will ever be open than that presented by these mountains.

Grandeur of the views it affords.

In many circumstances mere magnitude may not be effectual in adding to the apparent grandeur or sublimity of mountain scenery, for everywhere the features nearest to the eye, though absolutely smaller, may cut off from view those of far greater importance which are further removed. And this is often conspicuously true in the valleys of the Himalaya. But the extraordinary scale on which every part of the mountains is developed, the actual vast dimensions of the main features, the apparently endless succession of range after range, of ascent and descent, of valley and mountain top, of river, torrent, and brook, of precipitous rock and grassy slope, of forest and cultivated land, cannot fail to produce impressions of wonder, which are not likely to be equalled and certainly will not be exceeded on any other chain. Upon these mountains alone, of all on the earth, can the traveller, as he climbs their slopes, obtain at a glance a range of vision extending 5 miles in vertical height, from 2000 or 3000 feet to 29,000 feet above the sea, and see spread out before him a compendium of the entire vegetation of the globe from the tropics to the poles. Here may the eye as it sweeps along the horizon embrace a line of snow-clad mountains, such as exist in no other part of the world, stretching over one-third of the entire circle, at a distance of 40 or 50 miles, their peaks towering over a sea of intervening ranges piled one behind another, whose extent on either hand is lost in the remote distance, and of which the nearest rises from a gulf far down beneath the spectator's feet, where may be seen the silver line that marks a river's course, or crimson fields of amaranth and the dwellings of man. Sole representative of animal life, some great eagle floats high overhead in the pure dark-blue sky, or, unused to man, fearlessly sweeps down within a few yards to gaze at the stranger who intrudes among these solitudes of nature. As the sun sinks the cold gray shadow of the summit where we stand is thrown forward, slowly stealing over the distant hills, and, veiling their glowing purples as it goes, carries the night up to the feet of the great snowy peaks, which still rise radiant in rosy light above the now darkening world. From east to west in succession the splendor fades away from one point after another, and the vast shadow of the earth is rapidly drawn across the whole vault of heaven. One more departing day is added to the countless series which has silently witnessed the death-like change that passes over the eternal snows as they are left raising their cold pale fronts against the now leaden sky; till slowly with the deepening night the world of mountains rises again, as it were to a new life, under the changed light of the thousand stars which stud the firmament and shine with a brilliancy unknown except in the clear rarefied air of these sublime heights. (R. S.)

HIMERA, a city on the north coast of Sicily. It was founded in 648 B. C. by the Chalcidian inhabitants of Zancle, but with them were many Syracusan exiles who gave to the language of the city a Doric character. Early in the 5th century the tyrant Terillus, being expelled by Theron of Agrigentum, invoked the aid of the Carthaginians. They gladly availed themselves of the pretext, but their general Hamilcar was defeated at Himera by the Greeks under Gelon of Syracuse (480 B. C.). Thrasydæus, son of Theron, brought a large body of Doric immigrants to the city in 476; but was not long after expelled by Hiero. It seems to have enjoyed great prosperity during the rest of the 5th century. In 415 it refused to admit the Athenian fleet, and was a zealous ally of Syracuse. In 408 the Carthaginians sent another great army under Hannibal, grandson of Hamilcar, who razed the city to the ground. A new city called Thermæ Himerenses was founded in 407 close to the former site. This name was derived from the famous hot springs, in which Hercules was said to have bathed. The new city was in Carthaginian hands till it was annexed by the Romans in the Second Punic War. It was treated with peculiar favor by them, and was left a free city under its own laws. In the time of Cicero it was a flourishing town, though not very large. Under Augustus it became a "colonia." We hear little of it from that time, though the site was never deserted, and the town still exists under the name of Termini. Ergoteles, an Olympian victor celebrated by Pindar (*Ol.* xii.), was a citizen of Himera. Stesichorus the poet was a native of the city; and his statue was preserved at Thermæ in the time of Cicero. Agathocles also was a native of Thermæ.

HIMMEL, Frederick Henry (1765–1814), a German composer of mark, was born November 20, 1765, at Treuenbrietzen in Brandenburg, Prussia, and originally studied theology at Halle. During a temporary stay at Potsdam he had an opportunity of showing his self-acquired skill as a pianist before King Frederick William II., who thereupon made him a yearly allowance in order to enable him to complete his musical studies. This he did under Naumann, a German composer of the Italian school, and the style of that school Himmel himself adopted in his serious operas. The first of these, a pastoral opera *Il Primo Navigatore*, was produced at Venice in 1794 with great success. After his return to Berlin in 1795 Himmel became court chapel master to the king of Prussia, and in that capacity wrote a great deal of official music, such as cantatas, a coronation Te Deum, and the like, now justly forgotten. The same fate is shared by his Italian operas, successively composed for Stockholm, St. Petersburg, and Berlin, and all received with great applause in their day. Infinitely more important than these is an operetta to German words called *Fanchon*, the popularity of which has seldom been surpassed. Although antiquated it still remains an admirable specimen of the primitive form of the musical drama known in Germany as the "Singspiel." Himmel's gift of writing genuine simple melody, to which the operetta owed its success, is also observable in his songs, amongst which one called "To Alexis" is the best. It may be found in the first volume of the *Musical Library*. Himmel died at Berlin, June 8, 1814.

HINCKLEY, a market-town of England, county of Leicester, is situated 13 miles S. W. of Leicester, on a branch line between that town and Nuneaton, which connects the London and North-Western and the Midland railways. The principal buildings are the church of St. Mary, a Gothic structure lately restored, with tower and spire 120 feet high; the town-hall; the priestshouse and Roman Catholic academy named St. Peter's Priory; and the union poorhouse, erected in 1838, with accommodation for 400 inmates. There are a grammar school, a national school, and board schools. Hinckley is the centre of the stocking-weaving district, and its specialty is circular hose. It also possesses breweries, brick and tile works, and lime works. There are several mineral springs in the neighborhood, and at one of these baths have been erected. The population in 1901 was 11,304.

Hinckley was created a barony soon after the Conquest, when it was held by Hugh de Grentismenil, who erected a castle, the ditch of which is still traceable, and also founded a priory of Benedictine monks. Originally the town had the privileges of a borough, but these were annulled by Edward IV. Mention is made of "Hinckley Fair" in the second part of *Henry IV.*, act v. sc. 1.

HINCMAR (c. 806–882), archbishop of Rheims from 845 to 882, a prominent figure in most of the theological and ecclesiastical struggles of his day, and perhaps the most vigorous and influential prelate France has ever produced, belonged to a noble West Frankish family, and was born about the year 806. Other forms of the name are Ingumar, Ingmar, and Igmar. His early education was received at the abbey of St. Denis under Hilduin (the author of *Areopagitica*), whom he followed to Corvey, Westphalia, when banished by Louis the Pious in 830 for having joined the party of Lothair. Returning about two years afterwards along with his superior to St. Denis, of which he had become a canon, he resided partly there and partly at court, where he rapidly rose high in the royal favor. He was with Louis at the "Field of Falsehood" (Campus mendacii) in Alsace, and was one of the few who remained faithful when the majority of the prelates and nobles went over to the other side. After the death of Louis (840), he equally gained the confidence of Charles the Bald, through whose influence, after he had successively held the abbacies of St. Mary's, of Compiègne, and of St. Germer, he was in 845 elected to succeed the deposed Ebbo or Ebo in the archiepiscopal see of Rheims. Having exacted from Charles a full restitution of all the church property which had belonged to the diocese, and a further promise that it should never again be alienated, he at once entered on the duties of his office, and took a leading part in the council

of Meaux (C. Meldense), the reforming decrees of which so strongly roused the opposition of the king. Some attempt having been made to revive the claims of Ebo, Hincmar's title to the archbishopric was confirmed by a synod of French bishops at Paris, and ultimately settled by Leo IV.'s transmission of the pallium in 847. Apart from the ordinary affairs of his diocese, which included the completion and adornment of the cathedral begun by his predecessor, he now became deeply involved in the discussions which arose out of the predestinarianism of Gottschalk (see GOTTSCHALK), whom Hrabanus Maurus at the synod of Mainz (848) had caused to be relegated to Hincmar as his metropolitan. At a synod held at Quierzy on the Oise (Carisiacum), in the diocese of Soissons, in 849, Hincmar had united with Wenilo of Sens and other prelates in condemning the refractory monk to degradation, scourging, and imprisonment; but in a short refutation of the "predestinarian heresy," which he himself shortly afterwards wrote and circulated, he so failed to do justice to the orthodox faith as to elicit the censure of Ratramnus of Corvey, who was afterwards supported by Prudentius of Troyes, Lupus of Ferrières, and a large Augustinian party (850). Hincmar now summoned the dialectic skill of John Scotus Erigena to his aid, and the controversy became general. Another synod held at Quierzy in 853 passed the four "Capitula Carisiaca," which in substance taught that there is but one divine predestination; that free will, lost by the fall, is restored by the preventing and assisting grace of Christ; that God wills generally that all men should be saved; and that the blood of Christ was shed for all. These were answered by the six canons of the (Lotharingian) synod of Valence, which elicited from Hincmar, two years afterwards, the *De Prædestinatione Dei et Libero Arbitrio Libri tres*, of which all that is now extant is the prefatory letter to the king. By the synod of Langres (S. Lingonensis, 859), however, the articles of Valence were confirmed,—a decision which was afterwards supported by the general synod held at Savona or Savonnières, otherwise known as the Concilium Tullense (859). Hincmar now published the *Posterior de Prædestinatione Dei et Libero Arbitrio Dissertatio*, but without influencing the voice of the church; nor was he more successful in his controversy with Gottschalk on the Trinity, his *Collectio ex Sanctis Scripturis et Orthodoxorum Dictis* against the phrase "Trina Deitas" having been totally disregarded; he had, however, the satisfaction of preventing the release of Gottschalk, who died in prison in 868. While these speculative controversies were doubtfully raging, Hincmar found scope for his greater practical talent in the events which followed the death of the emperor Lothair in 855, and which chiefly resulted in the strengthening of clerical ascendency. Having saved Charles from the hands of his own nobles and of the Germans, the great metropolitan was in a position at last to say, "If kings rule after God's will, they are subject to none; if they be great sinners, then is their judgment in the hands of the bishops." In 860 began the divorce suit in which the interests of Thietberga, the oppressed queen of Lothair II., were involved; and here, undoubtedly, the whole weight of Hincmar's influence was thrown into the scale of morality and right. His contribution to the discussion is still extant in the treatise *De Divortio Lotarii et Teutbergæ Reginæ* (860). While this controversy still remained unsettled, Hincmar became involved in a struggle with the pope (Nicholas I.), which is of very considerable historical importance from the part which was played in it by the newly introduced "Isidorian" decretals, and from the effect which it had in limiting the rights of metropolitans. Rothad, bishop of Soissons, having been deposed for acts of insubordination and violations of duty at a synod of Soissons presided over by Hincmar in 863, had appealed to Rome; the appeal had been sustained; and ultimately in 865 orders were given that the judgment of Hincmar should be reversed, and that his suffragan should be restored to his office. The decision, which, though not without murmuring and contentions, was acquiesced in by Hincmar, was an important step in the development of the hierarchical monarchy of Rome. Hincmar was somewhat more successful when he found himself in opposition to the successor of Nicholas, Adrian II. This pope, who highly disapproved of the action of the archbishop in crowning Charles as the successor of King Lothair of Lorraine in 869, had fulminated threats of excommunication against all who had been concerned in that action; Hincmar replied that the Roman see had no right to interfere in such a matter, and that the impending ban would have no validity; and the actual result was that, notwithstanding alike the protest of the emperor and the prohibition of the pope, Charles the Bald and Louis the German quietly divided the dominions of their nephew. Again, when Hincmar of Laon, his nephew and suffragan, had defied his authority and appealed to the pope, a long controversy resulted in the appellant's being imprisoned, degraded, and sentenced to the loss of his eyes (871). Of the remaining years of Hincmar's life few incidents are recorded; in 882 he was compelled by Norman invasion to transfer his see to Epernay, where in the same year he died.

The works of Hincmar, which include, besides these already mentioned, a variety of capitula and other occasional pieces, were first edited by Sirmond in 2 vols. fol. (1645). They are reprinted in Migne's *Cursus Patr. Comp.* The *Annales Bertiniani* from 861 to 882 are also by Hincmar. See Gess, *Merkwürdigkeiten aus dem Leben und Schriften Hincmars* (1806); Prichard, *The Life and Times of Hincmar* (1849); and Noorden, *Hincmar, Erzbischof von Rheims* (1863).

HINDLEY, a manufacturing town of Lancashire, is situated on the Lancashire and Yorkshire railway, 3 miles south-east of Wigan. Cotton-spinning and the manufacture of cotton goods are the principal industries, and there are extensive coal-mines in the neighborhood. Hindley possesses a grammar school, and among its places of worship may be mentioned the old parish church, and St. Peter's church, erected in 1864 in the First Pointed style. In the time of the Puritan revolution Hindley church was entered by the Cavaliers, who played at cards in the pews, pulled down the pulpit, and tore the Bible in pieces. The population in 1901 was 23,504.

HINDOL, one of the tributary states of Orissa, India, situated between 20° 29′ 30″ and 20° 49′ 30″ N. lat., and between 85° 8′ 35″ and 85° 31′ 15″ E. long. It is surrounded on all sides by native states, being bounded on the N. and E. by Dhenkánal, on the S. by Baramba and Narsinhpur, and on the W. by Angul. Area, 312 square miles; population (1872), 28,025 (Hindus, 23,345; Mahometans, 122; and "others," 4558). The Cuttack and Sambalpur highroad runs through the state. Only five villages contain upwards of 100 houses. Hindol consisted originally of three or four petty states, completely buried in jungle, and ruled by separate chiefs, till two Marhattá brothers, belonging to the family of the Kimidi Rájá in Madras, drove them out, and formed their territories into one principality. The present chief maintains a military force of 83 men, and a police force 133 strong. His estimated annual revenue is returned at £2082; tribute, £55.

HINDÚ KÚSH is a title applied to the line of alpine watershed stretching W.S.W. from the southern margin of Pamir, the Caucasus of Alexander's historians, which divides Afghanistan in a general sense from Afghan Turkestan, and the basin of the Cabul river from the basin of the Oxus. Looking towards the heart of a map of Asia, the eye is caught by that remarkable point where the great highland seems clenched as it were to a knot, whence expand in different directions (1) to east and south-east the great Tibetan plateau, (2) to north that of Pamir, and (3) to west that of Khorasan and Persia. Between the diverging masses run up the great basins of the Indus, the Yarkand river, and the Oxus. Some dim memory of these great features perhaps, transformed and transplanted further east, appears in the cosmography of the Puranas, in which the mythical Ganges falling on Mount Meru divides into four great rivers flowing to the cardinal points.

This is the first impression. But, imperfectly as we yet know the mountain structure, the more we learn the more evanescent becomes this idea of triplicity as typifying the true skeleton. This node is in fact the place of contact or intersection of two great elevations:—(1) of the Himalaya of which the axial lines approach in a direction from S. E. to N. W.; and (2) of the Thian-Shan and allied ranges, of which the axial lines run from E. N. E. to W. S. W. The parallelism of Hindú Kúsh seems to attach it to the latter system.

The definition of geographical features must often be in part arbitrary, but that of Hindú Kúsh fairly coincides with natural limits. On the east we take it as commencing at the Baroghil Pass, leading from the high valley of Little Pamir south into the valley of Káshgár or Chitrál. Just

east of this is a cluster of peaks of great altitude, but their alignment attaches them to the great Gilgit range of the Himalaya (Múztagh of some maps, *Dapsang* of Richthofen). On the west we regard Hindú Kúsh as including and terminating at the Hajjigak Passes, those most commonly used between Cabul and Turkestan. West of this the range continues as a watershed of considerable altitude, but with a partial change of direction and loss of true alpine character. In maps this prolongation is styled Koh-i-Baba. Properly Koh-i-Baba is the name of a conspicuous three-peaked mountain rising over the Hajjigak Pass, to a height of at least 16,500 feet, which we regard as the terminal prominence of Hindú Kúsh, though it is in truth also isolated from the higher summits to the eastward, which especially claim that name, by a considerable interval of tamer mountains, rounded and naked.

The total length of Hindú Kúsh as thus defined is 365 miles. Towards the eastern extremity the watershed perhaps emerges little from the table-land, for the Baroghil Pass is of singularly easy acclivity on both sides, and no prominent summits adjoin it on the west. But for the rest of its extent the mountain tract of Hindú Kúsh realizes the popular idea of an alpine chain, *i. e.*, of an unpierced mountain barrier whose passes are never far below the line of perpetual snow, and whose highest peaks are never very far from the watershed.

The general altitude of the "cols" or passes runs from 12,000 to 13,000 feet. We give those that have been calculated (besides which some 20 or 22 are known more vaguely), beginning from the east:—

		Long.	Feet.
1. Baroghil Pass		73°26′	12,000
2. Nuksán	"	71°37′	17,000
3. Dora	"	71°24′	16,000–16,500
4. Khawak	"	69°39′	13,200
5. Sar-ulang	"	68°47′	12,000
6. Kúshán	"	68°40′	15,000
7. Irák	"	67°52′	12,900
8. Kálú	" (on Hajjigak Road)	67°45′	12,480

The three highest (2, 3, 6) do not rest upon any observations of barometer or boiling point, but on other and looser data. Of the height of the peaks we have nothing definite. Captain Burslem, who ascended Koh-i-Baba with Lieutenant Sturt in 1840, speaks of seeing the lofty peaks to the eastward "many thousand feet" above, and Burnes uses similar language. The greak peak near the Kúshán Pass, sometimes specially called Hindú Kúsh, which is seen at once from Cabul on the south and from Kunduz on the north, is probably not less than 20,000 feet high. Much further east the estimated heights of passes 2 and 3 indicate probable summits of as great altitude. A great mountain due north of Chitrál, called Tirich Mir, and said to be visible from a great part of Kafiristán and from Zebák in Badakhshan, is estimated by Major Biddulph, who alone has seen it, at the enormous height of 27,000 feet, but General Walker reduces this to 23,000 with a (?).

Apart from this exceptional peak we shall form a just conception of the calibre of Hindú Kúsh among the ranges of the world if we class it with the French and Swiss Alps in extent and mass, but with greater average altitude. We have only one report of a glacier, viz., on the Nuksán Pass, No. 2 in the list of heights above.

The idea of a distinct southern range running parallel to Hindú Kúsh, north of the Cabul river, which Wood calls "the Himalaya," is founded on misconception. But peaks have been measured on the spurs which run south on both sides of the Kunar river. They rise to near 19,000 feet on the left bank, east of Chitrál, descending to 11,800 near the Afghan boundary. In Kafiristán there are peaks on these spurs of 16,600 and 16,800 feet, and even within 25 miles of the Cabul river are some as high as 14,000 feet.

On the south side of Hindú Kúsh the earliest sources of the Helmand are in the gorges up which the Koh-i-Baba passes mount. All the rest of the range drains on that side to the Cabul river, and so to the Indus. On the north all the drainage reaches the Oxus.

Both hydrographic features and the limits of our knowledge conveniently divide the Hindú Kúsh into three sections.

(1.) Beginning from the east, in the first section, drainage southward is into the Chitrál valley, and forms the great, perhaps greatest, contributary to the Cabul river, known as the Kunar or Beilam (probably *Choaspes* and *Malamanthus* of the ancients). The highest part of this basin is known as Chitrál *Bálá* (upper), and is politically united to Yasin in the Gilgit basin (see GILGIT). It consists of two or three confluent valleys, some of them thick with villages, whose continuous cultivation, supported by copious springs, extends far up the hillsides. Mastúj, the chief place, stands 7500 feet high, in 36° 10′ N. lat. Twenty miles farther down is the boundary of Lower Chitrál or Káshgár. This forms a state of which the chief or king (he is styled "Bádsháh") resides at Chitrál town (height 5200 feet, 35° 53′ N. lat.). The people are Moslem, apparently a converted section of the neighboring Kafirs, and speaking a kindred dialect of Sanskritic affinity. Fruit is good, including fine grapes, and the wine was once famous. Chitrál is the Bolor of Chinese geography, the misplacement of which so long perplexed and vitiated the geography of the Pamir highlands. The name *Balaur* mediævally covered a larger tract, probably the whole of the then pagan country from Khawak Pass to the Indus. Below Chitrál the valley narrows, and is shut in by Kafir villages in nominal subjection to the small state of Asmar (35° 4′ N. lat.). Afghan territory begins at Maraora, 20 miles farther down. On the north of this section most part of the drainage flows directly into the Little Pamir stream of the Oxus, or into the Panja, the union of the streams from Little and Great Pamir. We have accounts of no passes immediately west of Baroghil, though certainly they exist. From Avi, near the boundary of Upper and Lower Káshgár, a pass crosses (about 72° E. long.) to Ishtrágh on the Panja. At the western limit of the section are the lofty passes of Nuksán, Kharteza, Agram, and Dora, which lead through the Badakhshan canton of Zebák to the Vardoj branch of the Kokcha or river of Badakhshan. On the "Nuksán" (quasi *Via Mala*) in descending towards Chitrál the traveller is girt with a leathern kilt, and slides down the snow. Ponies, with feet tied, are rolled down. "By these processes," says the native authority, "both men and beasts *generally* reach the bottom in safety."

(2.) The next section is that of which we know least. It embraces on the south Kafiristán, never yet penetrated by European traveller. There is a pass south to Kafiristán from Zebák and Sanglich, and one from Kurán, probably several more. The chief streams southward are that of Pech, joining the Kunar river at Chigar Serai (*Chaghanserai* of Sultan Baber), and the Alingar and Alishang, which unite in Laghmán, formerly Lamghán (*Lambagæ* of Ptolemy), and join the Cabul river at Chárbágh above Jalalábád. West of Kafiristán are the Afghanized valleys of Tagao and Nijrao, hardly better known, and occupied largely by Pashais, a people seemingly akin to the Kafirs. On the north side the valleys form mirships or cantons among the congeries of small states owning allegiance to Badakhshan, and several of them having their peculiar dialect of old Persian affinity. One of these valleys is Kurán, down which flows the Jerm branch of the Kokcha. It is a wild glen near the borders of Kafiristán, coupled in a local rhyme with the jaws of hell, but which in the 8th century was of sufficient substance as a state to send a mission of homage to the Chinese court,—such disproportionate pretensions being probably due to its containing the mines of lazuli, famous for ages, commemorated by Marco Polo, and visited by Lieutenant Wood in 1838. Adjoining this are Mungán and Anjumán, high valley cantons of which we barely know the names. Their streams chiefly bear north-west, and join the river of Taljkan, which carries them to the river of Kunduz, and so into the Oxus about 68° 18′ E. long.

(3.) The last section extends from the borders of Kafiristán to the Koh-i-Baba. On the south the drainage is received by two catchment channels flowing parallel to the watershed in opposite directions,—the Panjhir (or Panjshir) from the east, and the Ghorband river from the west, meeting near Charikar and flowing S. S. E. to meet the river from Cabul. The Panjhir valley is populous and fruitful, with irrigated orchards and mulberry gardens, the chief support of the people, though these, of Pashai kindred, have for ages borne a repute for ruthless turbulence. It contains silver-mines, worked at an early date, and early Mahometan coins bear the mint marks of secluded towns like Panjhír and Andaráb,—the latter place north of the mountains, head of a canton subject of Kunduz. From the Panjhir to the Andaráb valley lead at least seven passes. The chief of these is Khawak, crossed by Wood from the north in 1838, and nearly 1200 years before (644) by Hwen-Tsang from the south. The Túl Pass, a loop to this, was crossed by the great Timur on his advance to India (1398). From the Ghorband valley there are also seven or more passes; two ascend from Parwán, one of which, Sar-aulang, was attempted unsuccessfully by Wood and Lord in November, 1837,—since crossed and surveyed by Havildar Hyder Shah (1870). Kúsháu Pass, under the great peak, was ascended by Leech and Lord in October, 1837. Four of the Ghorband passes descend on the lower Andaráb valley, two more on the Surkháb river, coming from the valleys about Bamian. The last, the pass of Shibr, ascends from the top of Ghorband valley, and descends on that of Bamian near the castle of Zohák. This was crossed by Hwen-

Tsang in approaching India (630), and by Timur on his return (1399), and was commonly used by Baber, who calls it Shibrtu. There remain the Koh-i-Baba passes of Irák, Hajjigak, and Pusht-i-Hajjigak. These are all approached from Cabul by the upper valley of the Cabul river and headwaters of the Helmand. The first Brigadier Dennie's force crossed to Bamian in 1840, before fighting Dost Mahommed on that famous site; Burnes (1832), Wood and Lord (1837), Griffith (1840), and others at that time crossed the Hajjigak, the best known of all the passes. North of the mountains the Andaráb river and the Surkháb form catchments like Panjhir and Ghorband rivers on the south. Uniting near Ghori they form the river of Kunduz or Akserai (called by Baber *Doghâba*) flowing north to the Oxus. Hazáras (see vol. i. p. 211) are the chief occupants of this section in its western portion. Further east on the north side the higher valleys are occupied by tribes of old Tajik lineage, mixed more and more with Uzbeks and other Turki people as the Kokcha is approached (see also vol. i. p. 216 *sq.*).

Geology.—Information is most scanty, and applies only to the western extremities of Hindú Kúsh. On the Kushán Pass Lord speaks of the lower parts as consisting of micaceous schist, black slate with occasional bursts of granite, then mica slate and gneiss, and the summits of the pass and range of a granite core shooting up in precipitous peaks. On the Koh-i-Baba, also, Griffith speaks of the lower mass as predominantly of slaty formations; the summits of coarse quartzose gray granite, and of very compact brown quartzose rock. In the Irák Pass, and at Zohák, are masses of conglomerate. Limestone occurs in the upper part of the valley of Parwán, exhibiting large cavities, in one of which the stream is engulfed for two miles; also higher up the Ghorband valley, where a magnificent natural cavern occurs. Limestone occurs also on the Hajjigak Pass; and we hear of another great cavern near Doab, north of Bamian. Eruptive deposits occur in Ghorband valley towards Chárdeh, and these recur at Bamian. Richthofen has supposed, from Chinese analogies, that the multitude of artificial caves and cave dwellings about Bamian indicate a loess deposit; such details as we have seem hardly to corroborate this.

The region is rich in minerals. Iron is abundant and widely diffused. Villages called *Ahangirán* (of the "iron-workers") are numerous. There is a rich black ore on the Hajjigak Pass, but fuel is entirely absent. Iron is also made at several places in Badakhshán, and of excellent quality in Bajaur east of the Kunar river. The districts adjoining the Jerm and Vardoj rivers are called Yamghán, which is popularly interpreted as *Hamah-Kán* ("All-Mines") from its various mineral wealth. Copper mines (not worked) exist here and also in Chitrál. Antimony is found in Ghorband, and accurate Griffith speaks of ore of antimony forming boulders and even "a large mountain" on the top of Hajjigak. Lead is found in Ghorband and in Yamghán. Sulphate of zinc occurs in Ghorband; silver, as above mentioned, at the head of Panjhir; rock-salt on the borders of Badakhshán and Kunduz (mentioned by Marco Polo); sulphur in Yamghán and Sanglich (north of the Dora Pass); sal-ammoniac in Kurán. Orpiment is exported from Chitrál, a fact mentioned also by Hwen-Tsang. The lazuli of Kurán has been spoken of.

Zoology.—Of this we have not space to speak, nor accurate material. Afghanistan lies on the borders of the Oriental and Palæarctic regions (vol. vii. p. 234), and partakes in degree of both; but the Hindú Kúsh is to a certain extent a boundary between them. Thus it limits the genus *Salmo*, which is found in no Indian or Persian stream, but immediately on crossing the passes. The late estimable Russian traveller Fedchenko thought he had first discovered trout in Turkestan, but they were frequently caught by English officers at Bamian in 1840, and Marco Polo mentions them in Badakhshán.

Vegetation.—The only basis for a view of this would be Griffith's collections near Koh-i-Baba and in the Kunar valley, but they have not been analyzed in such a sense. These general remarks by Hooker and Thomson are, however, apposite:—"The collections of Griffith, besides containing an immense number of Persian and European plants which find their eastern limits within the British territory, are rich in Himalayan forms which advance no farther west; and, what is of still greater importance, they contain many species common both to Europe and the Himalaya, but which, from mere differences induced by local causes in these two distant countries, might not be imagined to have a common origin, did not the Afghanistan specimens blend their characters or show the transition between them."—*Flora Indica*, i. 85, 86.

Historical Notices.—We have said that Hindú Kúsh is the Caucasus of Alexander's historians. It is also included in the Paropamisus, though the latter term embraces more, Caucasus being apparently used only when the alpine barrier is in question. Whether the name was given in mere vanity to the barrier which Alexander passed (as Arrian and others repeatedly allege), or was founded also on some verbal confusion, we cannot say. It was no doubt regarded (and perhaps not altogether untruly) as a part of a great alpine zone believed to traverse Asia from west to east, whether called Taurus, Caucasus, or Imaus. Arrian himself applies Caucasus distinctly to the Himalaya also. The application of the name Tanais to the Sir seems to indicate a real confusion with Colchian Caucasus. Alexander, after building an Alexandria at its foot (probably at Hupián near Charikár), crossed into Bactria, first reaching Drapsaca, or Adrapsa. This has been interpreted as Andaráb, in which case he probably crossed the Khawak Pass, but the identity is uncertain. The ancient Zend name is, according to Rawlinson, *Paresina*, the essential part of Paropamisus; this accounts for the great Asiatic *Parnassus* of Aristotle, and the *Pho-lo-sin-a* of Hwen Tsang.

The name Hindú Kúsh does not appear, so far as we can ascertain, in any of the earlier Arab geographers. But it is used by Ibn Batuta, who crossed (*c.* 1332) from Andaráb, and he gives the explanation of the name which, however doubtful, is still popular, as (Pers.) Hindú-Killer, "because of the number of Indian slaves who perished in passing" its snows. Baber always calls the range Hindú Kúsh, and the way in which he speaks of it shows clearly that it was a range that was meant, not a solitary pass or peak (according to modern local use, as alleged by Elphinstone and Burnes). Probably, however, the title was confined to the section from Khawak to Koh-i-Baba (see Baber, pp. 136, 139). The name has by some later Oriental writers been modified into Hindú *Koh* (mountain), but this is factitious, and throws no more light on the origin of the title. The name seems to have become known to European geographers by the Oriental translations of the two Petis de la Croix, and was taken up by Delisle and D'Anville. Rennell and Elphinstone familiarized it, and Wilford wilfordized about it. Burnes first crossed the range (1832). A British force was stationed at Bamian beyond it in 1840, with an outpost at Saighán.

The Hindú Kúsh, formidable as it seems, and often as it has been the limit between petty states, has hardly ever been the boundary of a considerable power. Greeks, White Huns, Samanidæ of Bokhara, Ghaznevides, Mongols, Timur and Timuridæ, down to Saddozais and Barakzais, have ruled both sides of this great alpine chain. (H. Y.)

HINDUR, also called NALAGARH, one of the Punjab hill states, under the government of the Punjab, India, lying between 30° 54′ 30″ and 31° 14′ 15″ N. lat., and between 76° 39′ and 76° 56′ 45″ E. long. Area, 256 square miles. The country was overrun by the Ghoorkas for some years prior to 1815, when they were driven out by the British, and the rájá was confirmed in possession of the territories. The estimated population in 1875 was 70,000; the estimated revenue £9000, and tribute £500. The principal products are opium and the usual grains.

HINDUSTAN. See INDIA.

HINDŪSTĀNĪ,[1] or URDŪ, is a dialect of the Hindī, one of the seven languages of Aryan stock spoken at the present day in North India, the others being the Panjābī, Sindhī, Gujarāti, Marāthī, Bangālī, and Oriyā. The area over which it is spoken in North India may be said to be co-extensive with that of the Hindī, which is estimated at about 250,000 square miles, extending from the river Gandak in the east to the Sutlej in the west, and from the Himālaya in the north to the Vindhiyā mountains

[1] Hindūstānī (*lit.* "Of or belonging to Hindūstān") is the English name for the language. The natives generally call it *Urdū* or *Urdū Zabān*, "the camp language" (the word *Urdū* meaning, in Turkish, "a camp"), and the poets, *Rekhta*, "mixed;" while the phase of the dialect which is peculiar to southern India is termed *Dakhinī*, or "southern." The term *Hindī*, on the other hand, is derived from the Persian *Hind*, "India," and, strictly speaking, is applicable only to the modern language of the Hindūs. The old language, prior to the inroads of the Musalmāns, is termed *Hindūī*, and is derived from Hindū. It may be added that the present article has reference only to the so-called High Hindūstānī, which differs considerably from the vulgar speech. This, in some parts of the area mentioned in the text, bears but little resemblance to the cultivated language, except in the possession of a few Persian or Arabic words. The High Hindūstānī is that which is uniformly employed in literature over the whole of the specified area. It is, moreover, the language in which the proceedings of the various Government courts and offices are carried on, and is spoken in its purity in all the large towns by the educated classes generally, by Hindūs as well as Musalmāns.

in the south. It is also extensively used, though in a somewhat different phase, in a great part of the Deccan, and is moreover the *lingua franca* of most parts of India.

As the Hindī language consists of many dialects, it is necessary to state that it is the Braj Bhāshā, or the dialect that is spoken in the districts of Agra and Mathura, and in the neighborhood of Dehlī, the ancient capital of the Mahometan empire, which is generally regarded as the parent of Hindūstānī. The grammatical structure and also a vast number of the commonest vocables of the Braj were incorporated in the new dialect, and to these were added a vast number of Persian, Arabic, and even Turkish words. "Such words, however, in no wise altered or influenced the language itself, which, as regards its inflectional or phonetic elements, remains still a pure Aryan dialect, just as pure in the pages of Walī or Saudā, as it is in those of Tulsī Dās or Bihārī Lāl."[1] Peculiarities of composition, such as reversing the positions of the governing and the governed word (*e. g.*, *bāp merā* for *merā bāp*), or of the adjective and the substantive it qualifies, or such as the use of Persian phrases with the preposition *ba* instead of the Hindī postposition of the ablative case (*e. g.*, *ba-khushī* instead of *khushī se*, or *ba-ḥukm sarkār-ke*, instead of *sarkār ke ḥukm se*), are no doubt to be met with in many writings, and these, perhaps, combined with the too free indulgence on the part of some authors in the use of high-flown and pedantic Persian and Arabic words in place of common and yet chaste Hindī words, and the general use of the Persian instead of the Nāgarī character, have induced some to regard Hindūstānī or Urdū as a language distinct from Hindī. But such a view betrays a radical misunderstanding of the whole question.

As regards the introduction of foreign words into the various dialects of Hindī, it seems highly probable that it had its origin at an early period, perhaps as early as the 8th or 9th century of our era. But there is good ground for the opinion that, although the Hindī area was overrun as early as the 12th century, the Hindūstānī was not formed till the 16th century. "For many generations after the victories of Kutbu'd-dīn Aibak, the first Musalmān sovereign of Dehlī, the conquerors retained their own Persian, and the conquered their Hindī. The Musalmāns had long been accustomed to speak pure Hindī, and it was not they who introduced Persian words into the language, but the Hindūs themselves, who at the epoch above mentioned were compelled by Todar Mal's new revenue system to learn Persian."[2] And we learn from Mīr Amman of Dehlī (whose brief account of the origin of Urdū in the preface to his well-known *Bāgh-o-Bahār* bears on the face of it every convincing mark of probability, and, scanty as it is, is remarkable as, perhaps, the only attempt at a critical disquisition in the whole range of Hindūstānī literature) that at the date of the composition of his work (1802) the Musalmān dynasties had endured for a thousand years, and that as intercourse increased the languages of the Hindūs and Musalmāns became to a certain extent mixed. By the arrival and stay of the Amīr Tīmūr the camp or bāzār of the army was introduced into the city, whence the city bāzār was called Urdū, a Tartar word signifying "camp." . . . "When Akbar ascended the throne, various races from all quarters, on hearing the kind patronage and bounty of that incomparable house, came and assembled in the royal presence, but the speech and dialect of each was different. From their being collected together, and owing to the trade, traffic, and intercourse which they carried on with one another, a single language, that of the Urdū (or Hindūstānī), was established."

The epoch of Akbar, which first saw a regular revenue system established, with toleration and the free use of their religion granted to the Hindūs, was, there can be little doubt, the period of the formation of the language. But its final consolidation did not take place till the reign of Shah Jahān. After the date of this monarch the changes are comparatively immaterial until we come to the time when European sources began to mingle with those of the East. Of the contributions from these sources there is little to say. Like the greater part of those from the Arabic and Persian, they are chiefly nouns, and may be regarded rather as excrescences which have sprung up casually and have attached themselves to the original trunk than ingredients duly incorporated in the body. In the case of the Persian and Arabic element, indeed, we do find not a few instances in which nouns have been furnished with a Hindī termination, *e. g.*, *kharīdnā*, *badalnā*, *guzarnā*, *dāghnā*, *bakhshnā*, *kamīnapan*, etc. But the European element cannot be said to have at all woven itself into the grammar of the language. It consists, as has been observed, solely of nouns, principally substantive nouns, which on their admission into the language are spelt phonetically, or according to the corrupt pronunciation they receive in the mouths of the natives, and are declined like the indigenous nouns by means of the usual postpositions or case-affixes.[3] A few examples will suffice. The Portuguese, the first in order of seniority, contributes a few words, as *kamarā* or *kamrā* (camera), "a room;" *mārtol*, "a hammer;" *nilām*, "auction" (often corrupted into *lilām*); *perū*, "a turkey," etc., etc. Of French and Dutch influence scarcely a trace exists. English has contributed a number of words, some of which have even found a place in the literature of the language; *e. g.*, *Kammishanar* (commissioner); *jaj* (judge); *isṭanṭ* (assistant); *dākṭar* (doctor); *dāktari*, "the science of medicine," or "the profession of physicians;" *inspektar* (inspector); *sosayaṭī* (society); *apīl* (appeal); *apīl karnā*, "to appeal;" *dikrī* or *digrī* (decree); *digrī* (degree); *inch* (inch); *fut* (foot); and many more, are words now commonly used. How far the free use of Anglicisms will be adopted as the language progresses is a question upon which it would be hazardous to pronounce an opinion.

The grammatical structure of the Hindūstānī differs in no essential particular from that of the Hindī from which it is sprung. It is therefore of the rise and formation of this language, and of the stage to which it had attained when the new phase of the Hindūstānī was developed from it, that we shall now speak.

Of the history and development of the Hindī or Hindūī language previous to the 11th century of our era little or nothing is known. It is accepted as a fact by most scholars that Sanskrit ceased to be a vernacular in the 6th century B. C., when the Buddhist religion was founded, which for ten centuries drove Brāhmanism into obscurity. From that time the Aryan people of India spoke popular dialects called Prākrits,[4] and it is from these that the modern Aryan tongues are mainly derived. These Prākrit dialects are generally grouped under five heads, viz., the Maharāshtrī, Saurasenī, Māgadhi, Paisāchī, and Apabhransa. Of these the Saurasenī, or dialect of Saurasena, the modern tract of Mathurā and the surrounding country, is taken to be the parent of the Hindī, or at any rate of that phase of it with which we have to do. These Prākrits were, like the Sanskrit, synthetical and inflectional in their structure, and certainly continued to be so up to the 1st century of our era, the lowest stage to which in point of development scholars have been able to reach. At what precise period the synthetical structure of the Prākrit began to break up and to give place to the analytical formations of the modern speech it is impossible to tell. The gap of nine centuries has yet to be filled up. And unless future discoveries of Buddhistic literature should shed light on the subject, it is to be feared that the history of this period will ever remain unknown.

The dawn of modern Hindī may be dated from the 11th century. The earliest known writer in the language was Chand Bardāī (*c.* 1200), whose epic is in a dialect rude and half-formed, but as decidedly analytical as the Hindī of the present day.[5] Much of the old synthetical structure no doubt is still to be found in the work; the particles and the auxiliary verbs are in a very crude and unformed state (as, for example, the use of an obscure *ka* for the modern geni-

[1] Beames, *Comparative Grammar of the Modern Aryan Languages*, vol. i. p. 32.

[2] Beames, *Ibid.*, vol. i. p. 30, note.

[3] It is supposed, however, that the strange dialect in which the Lascārs, or "native seamen," and the Dāndīs, or "boatmen," hold converse, and in which orders are given to a native crew regarding the working of a ship, is compounded of Portuguese words assimilated to Hindūstānī in their terminations and inflections. Of this there is no positive proof, and until the matter has been properly and satisfactorily investigated it would be injudicious to pronounce a decided opinion.

[4] Prākrit is derived from the Sanskrit *prakriti*, "nature," and signifies "natural," "not accomplished," "vulgar." It is the collective name of those dialects which are immediately derived from, or which stand in an immediate relation to, Sanskrit, or "the polished or accomplished language" of the Hindūs.

[5] It is this striking change from the synthetical structure of the Prākrit to the analytical of the Hindī, coupled with an accidental resemblance in certain of the case-affixes to those of the Dravidian tongues, that has led some Oriental scholars to claim for Hindī a non-Aryan descent. But this view is ably combated by Mr. Beames in his *Comparative Grammar of the Aryan Languages of India*, and by Professor Rudolf Hoernle, in his *Essays on the Gaurian Languages*.

tive affix *kā*, which *ka* does not vary with the governed noun, and is frequently left out altogether; the total absence of the ordinary substantive verb *hai*, etc.); but these crudities and remnants of old Prākrit forms do not affect the general structure. Indeed, they are to be found in writings of a much later period, in works belonging to the 14th and 15th centuries, *e.g.*, in the *Ādi Granth*, the language of which exhibits, according to Trumpp, "grammatical forms not firmly fixed, but rather in a state of transition." And although the forms assume greater fixity, and marked progress is observable in the works of later writers in the Braj Bhākhā dialect, *e.g.*, in those of Kabīr, Sūr Dās, Nabhā Jī, Kesava Dās, and Bihārī Lāl (whose poems are, as a rule, composed in very pure and elegant Hindī), we still find certain crudities and traces of Prākrit forms and organic structure, and these continue even in the language of the present day.

To give a minute account of the grammatical formation, to indicate the various phonetic or glottic laws by the operation of which the vocables and grammatical forms of the Hindī are derived from those of the Prākrit or Sanskrit, is beyond the scope of the present article. We can but notice a few general laws, and exhibit results, so far as they have been ascertained. For closer acquaintance with the subject we must refer the reader to the *Prākrit-Prakāsa* of Vararuchi, edited by Professor E. B. Cowell; the *Prākrit Grammar* of Hemachandra, edited by Professor Pischel; the *Comparative Grammar of the Modern Aryan Languages of India*, by John Beames, B. C. S.; and *Essays on the Gaurian Languages*, by Professor Rudolf Hoernle.

Prākrit tolerates no compound consonant in the beginning and no dissimilar consonant in the middle of a word. Two dissimilar consonants in a Sanskrit word are changed in Prākrit to two similar consonants, and occasionally one of these is elided and the preceding vowel lengthened. In the modern dialects this elision of one consonant and compensatory lengthening of the preceding vowel is the rule. Prākrit either changes a medial surd mute consonant to the corresponding sonant one, or elides it altogether; and it generally changes an aspirate mute consonant to the simple aspirate *h*. In fact the modern Aryan tongues stand to the Prākrit and the Sanskrit in a relation very similar to that existing between the Italian, etc., and the Romance and Latin languages. Hindī "is not the daughter of Sanskrit, as we find it in the Vedas, or in the later literature of the Brāhmans, it is a branch of the living speech of India, springing from the same stem from which Sanskrit sprang when it first assumed its literary independence." [1]

Vocables.—The vocables may be classed under three heads:—1. Words which are pure Sanskrit, as *rājā*, "a king"; *pitā*, "father;" *kavi*, "a poet;" *nāgarī*, "of or belonging to a city;" *karma*, *kārya*, "work;" *krodha* (vulg. *krodh*), "anger." Not a few of this class of words have existed in the language for some centuries; some are to bo found even in the oldest specimens of the literature; but by far the larger number have passed into tho language during the present century, and the introduction is still progressing. The form in which they appear is that of the Sanskrit nominative singular.

2. Words which are derived from tho Prākrit, and have been considorably changed in the process, though not so much as to obscuro their origin, *e.g.*, *kām*, "work," Prk. *kamma*, S. *karma*; *kān*, "car," Prk. *kaṇṇa*, S. *karṇa*; *āṭh*, "eight," Prk. *aṭṭha*, S. *ashṭha*; *hāth*, "hand," Prk. *hattha*, S. *hasta*; *āp*, "self," Prk. *appā*, S. *ātmā*; *bāt*, "word," Prk. *vattā*, S. *vārttā*; *āj*, "today," Prk. *ajja*, S. *adya*; *āge*, "before," Prk. *agge*, S. *agre*; *āg*, "fire," Prk. *aggi*, S. *agni*; *dūdh*, "milk," Prk. *duddha*, S. *dugdha*; *phāgun*, "Feb.-March," Prk. *phaggun*, S. *phālgun*; *buḍḍhā*, "old," Prk. *vuḍḍho*, S. *vriddhah*; *kahā*, "said" (Braj *kahyau*), Prk. *kahido*, *kahio* S. *kathitah*; *rahā*, "remained," (Braj *rahyau*), Prk. *rahido*, *rahio*, S. *rahitah*; *thā*, "was," Prk. *thio*, S. *sthitah*. This is by far the largest class of words in the Hindī. And, as in the case of the first class, they are adopted in the form of the nominative singular of the Prākrit. They are divisible into two classes, the first comprising such as have in their declension preserved traces of the old organic inflection of the Prākrit declension, and the second those which have preserved no such traces. As regards these it may be observed that the terminations *ā*, *e*, *ī*, *o*, *ū*, of the Prākrit are regularly reduced in the Hindī to their inherent simple vowels, viz., *ā* to *a*, *e* and *ī* to *i*, and *o* and *ū* to *u*; and these short vowels are, as a rule, made quiescent, so that a word ending in reality in a short vowel virtually terminates in a consonant; and, not being pronounced, the final short vowel is frequently suppressed in writing also.

3. Words which cannot apparently bo traced to any Sanskrit original, and are therefore considered by some scholars as words of non-Aryan origin; *e. g.*, *pagrī*, "turban;" *gor*, Prk. *goṛam*, "leg." Such words form but a small proportion; and it is probable that further research and a better acquaintance with the laws of development of the modern Aryan tongues will ultimately enable scholars to very much diminish their number.

Gender.—The three genders of the Prākrit and Sanskrit are, in Hindī and Hindūstānī, reduced to two, the neuters and masculines of the old tongues generally becoming masculines in the modern language. Instances, however, are not a few in which they are changed to feminines. A striking feature in the modern tongues is the preponderance of masculines ending in *ā*, with the corresponding feminines in *ī*. Now in the Sanskrit *ā* is a typical feminine ending, and *ī* is as often a masculine as a feminine termination. Many feminine words ending in *ā* are no doubt to be found in the Hindī, as *chhimā*, "patience," = S. *kshamā*; and similarly many masculine words which in the Prākrit and Sanskrit terminate in *ī* are also to be met with, as *pānī*, "water," = S. *pānīyam*; *hāthī*, "elephant," = S. *hastī* (*hastin*). But *ā* is typically a masculine and *ī* a feminine termination in the Hindī and Hindūstānī, and this is probably due to the number of sources from which the termination springs; thus we have—(1) *ā* = Prk. *o*, = S. *as* or *ah*, *e.g.*, *kaisā*, "like what," "what manner," "how," Prk. *kĕriso*, S. *kīdṛiśah*; (2) *ā* = Prk. *aö*, = S. *akas* or *akah*, *e. g.*, *ghoṛā*, "horse," Prk. *ghoṛaö*, S. *ghoṭakah*; (3) *ā* = Prk. *a(k)am*, *aam*, = S. *am*, *e. g.*, *kelā*, "plantain," Prk. *kera(k)am*, *keraäm*, S. *kadaram*. Again, the masculine ending *aka* of the old languages has a corresponding feminine in *ikā*; and as the Prākrit commonly employs the ploonastic increment *k* to raise bases to the form *aka*, so it employs the same affix to form the feminine *ikā* of these masculines; *ikā* becomes *iyā*, and more commonly *ī* in the modern tongues. The form *iyā* is that which is generally used in feminine diminutives; *e.g.*, *ḍibiyā*, "a tiny box;" but it is also used like *ī* for a simple feminine; *e.g.*, *kuttā*, "dog," *kuttiyā*, "bitch;" *būṛhā*, "old man," *buṛhiyā*, "old woman." If to the above class of feminines ending in *ī* be added the large class which in Prākrit and Sanskrit form the feminine in *ī* (*i. e.*, the Prākrit masculines in *o*, = S. *as*), the preponderance of nouns ending in *ī* seems sufficiently accounted for. It may be added that *ā* and *ī* are so universally regarded as masculine and feminine terminations respectively that the natives employ them freely in forming feminines from masculines and *vice versa*, *e. g.*, *badlā*, *badlī*, from the Arabic *badal*. There are a few other feminine terminations which are worthy of notice, not so much on account of their origin (which presents no difficulty), as on account of the free use which is made of them; these are—(1) *inī*, *in*, *an*, *nī*, = S. *inī*, (fem. of *in*, *ī*); (2) *ānī*, *āni*, *āin*, = S. *ānī*. These are not only found in words derived from the Prākrit, but are added to Persian and even Arabic words; *e. g.*, *hāthinī*, *hāthin*, *hathnī*, "female elephant" (= S. *hastinī*); *sunārin*, *sunāran*, "a goldsmith's wife" (fem. of *sonār*, "goldsmith," = S. *suvarnakāra*); *shernī*, "tigress," from the Persian *sher*, "tiger;" *naṣīban*, a proper name, from the Arabic *naṣīb*; *paṇḍitānī*, "the wife of a pandit;" *chaudhrāin*, "the wife of a *chaudharī* or head-man;" *mĕhtrānī*, "the wife of a sweeper, a sweeper-woman," from the Persian *mĕhtar*, "a sweeper."

Declension.—It is here that the most striking contrast between the old and the new languages is found. The synthetical method of the Prākrit and the Sanskrit is, as a whole, rejected, only certain half-effaced traces of declension being retained. The number of cases, as in the Sanskrit, is seven, the nominative, accusative, instrumental, dative, ablative, genitive, locative, and vocative; but the inflections of the Prākrit have given place to case-affixes or postpositions. For example, where the Sanskrit has *śivāyai* and *śivasyai*, the Hindī has *siv-ko*, and *siv-kā*.

The case-affixes or postpositions are as follows:—

Instrumental	*ne*, "by."
Dative-Accusative	*ko*, "to," "for."
Ablative	*se*, "from."
Genitive	*kā(ke, kī)*, "of."
Locative	*men*, *par*, "in," "on."

The genitive affix, it may be observed, varies its termination so as to agree with the governing noun. In other words, it is adjectival, and agrees with the governing noun just as an adjective would; *e. g.*, *sone-kī ghaṛī*, "a gold watch."

The case-affixes or postpositions are all, there can be no doubt, remnants of Prākrit nouns which were probably in use at the period when the modern Aryan languages began to be formed. The majority of these are fairly determined, and it seems probable that the remainder will also be fixed before long. The results of the investigation of scholars, as regards the postpositions noticed above (which are those commonly employed in the declension of Hindī and Hindūstānī nouns), we will here attempt to exhibit.

The case-affix *ne* of the instrumental (or case of the agent) is regarded by Trumpp and others as derived from *ena*, the instrumental case-ending of the Sanskrit. This opinion is, however, combated by Beames (*Comp. Gram.*, vol. ii. p. 266, *et seq.*), who is of opinion that it is an affix of the dative, which was

[1] Max Müller, *Lectures on the Science of Language*, lect. ii.

probably transferred to the instrumental as late as the time of Shāh Jahān, in whose reign, as has been shown above, Urdū or Hindūstānī was consolidated. Beames shows that the postposition is not used in the old Hindī, and is not to be found in most of the dialects, except as a dative; but he does not, we believe, trace it to any particular original. It is clear, however, that whether this affix is derived from the instrumental case-ending of the Sanskrit or not, it bears a striking resemblance to the latter in its use and the construction it requires; *e. g.*, the Sanskrit *tena uktam* is marvellously like the Hindī *us-na kahā*, "by him it was said," or freely "he said."

The dative postposition *ko* is derived by Dr. Trumpp from the Prākrit *kiö, kiö*, = S. *kṛitam*. Dr. Hoernle,[1] however, would seem to connect it with the Bangālī *kāchhe* "near," and the S. *sa-kāśa*; and Beames (*Comp. Gram.*, vol. ii. p. 257), accepting this as a right clue, traces the affix to the Prākrit *kakkham*, = S. *kakṣham*, "arm-pit," "side," the locative of which, *kakṣhe*, he believes to be the source of the Bangālī *kāchhe*.

The postposition *se* of the ablative is traced by Beames (*Comp. Gram.*, vol. ii. p. 274) to the Sanskrit *samam*, "with," through an old form *soṅ* still used in the rustic dialects.

The genitive case-affix *kā* (fem. *kī*, oblique *ke*) is derived by Trumpp and others from the Sanskrit affix *ka*. But Hoernle[2] shows conclusively (and his derivation is accepted by Beames) that the affix is derived from the Prākrit *kariö* (= S. *kṛitas*), which becomes *kero*, *kera(k)o*, and then *keraö*; *kero* is then shortened to *karā*, whence the modern form *kā*.

Of the locative case-affixes, *meṅ*, "in," is derived by scholars from the Sanskrit *madhye*, the locative of *madhya*, "the middle;" while *par* (*pari*, or *pai*) is obviously traceable to the Sanskrit *upari*, "upon."

The declensions are two in number. In the one the nominative or base is inflected before the case-affixes are added; in the other no change takes place in the nominative form. The first consists solely of masculine nouns ending in *ā* = Prk. *o* = S. *as* (*e. g.*, *ghoṛā*, "horse," = Prk. *ghoṛaö*, = S. *ghoṭakas*); the second comprises all other nouns, whether they end in vowels or consonants. The base of the first declension is inflected by changing final *ā* to *e*; *e. g.*, nom. *ghoṛā*, inflect. base *ghoṛe*, gen. *ghoṛe-kā*, dat. *ghoṛe-ko*. But in the second declension we find, nom. *rājā*, "king," gen. *rājā-kā*, "of a king," etc. Dr. Hoernle connects the *e* of the inflected base with the *yā* of the oblique form in Marāṭhī, and so traces it to a Prākrit genitive in *yassa* = *iassa* = *ikassa*. The correctness of this derivation would seem to be established by the analogy of the oblique or inflected base of the plural of nouns, and especially by the inflected base of the pronouns, both these bases being indisputably traceable to the Prākrit genitive. Mr. Beames, however, is of opinion that "it is not correct to derive the oblique form from any special case of the Sanskrit;" he thinks that "it rather results from a general fusion of all the cases" (*Comp. Gram.*, vol. ii. p. 210). This is the more remarkable as he accepts without demur the fact that the plural oblique base is a corruption of the Prākrit genitive plural.

The terminations of the nominative plural of nouns (where a plural form is used) are clearly traceable to the Prākrit. Nouns which fall under the first of the declensions noticed above terminate in *e* in the nom. plur. (*e. g.*, *ghoṛā*, "horse," nom. plur. *ghoṛe*, "horses," which is identical in form with the inflected base of the sing.). The termination *e* = Prk. *e*, = S. *āḥ*. Feminines ending in a consonant (and also fem. Arabic words ending in *ā*, as *balā*), form the nom. plur. by adding *eṅ* to the sing. nom. This ending, *cṅ*, = Prk. neuter *āi*, *āiṅ*, = S. neut. *āni*. The plur. termination *āṅ* of the nom. of feminines ending in *i* (as *betī*, "daughter") is also to be referred to the Prākrit *āiṅ* = S. *āni*. The oblique form of the plural of all nouns ends in *oṅ* (*e. g.*, *ghoṛoṅ*; gen. *ghoṛoṅ-kā*; *rājā-oṅ*, dat. *rājā-oṅ-ko*). The termination *oṅ* is derived from the Prākrit *āṇam* (= S. *āṅām*), the termination of the genitive plural.

Pronouns.—The pronouns stand in marked contrast to the nouns in respect of the fidelity with which they have preserved the Prākrit forms. Those of the first and second persons run parallel to one another, and have four fundamental forms, namely, the nominatives and the obliques in both numbers. The genitive is a possessive pronoun, and, as in the noun, is adjectival in form. *Maiṅ*, "I," is derived by Trumpp from the Prākrit *mam*, the accusative of *aham*; but it seems more probable that it is, as Beames shows, the instrumental *maiṃ* of the Prākrit, and = S. *mayā*. In the genitive *merā*, "my," the affix *rā* added to the Prk. base *me* is, there can be little doubt, connected with the affix *kā*, used in forming the genitive of nouns; the form *karā*, by elision of *k*, would naturally yield *rā*, which we may observe is the genitive affix of *nouns* also in the Marwārī dialect of Hindī. The oblique form *mujh* is derived from the Prākrit *majjha*, one of the forms of the genitive. The dative-acc. *mujhe* of the modern Hindī is formed by adding *e* to *mujh*, this *e* being the usual sign of the oblique in nouns. *Ham*, "we," = Prk. *amhe* by transposition of *h*. This is now commonly used as the oblique form of the plural (*e. g.*, *ham-ko*, *ham-par*); but the oblique *hamoṅ*, = Prk. gen. plur. *amhāṇam*, is also to be met with. The genitive plural *hamārā* is probably from Prk. *amha* + *karo*, by elision of *k*.

The pronoun *tū*, "thou," = Prk. *tumam tuäm*, = S. *tvam*. A form *taiṅ*, parallel to *maiṅ*, and similarly derived, is also in use. The oblique *tujh* is from the Prākrit *tujjha*, one of the forms of the genitive. The sources from and the processes by which the remaining forms are obtained are precisely parallel to those employed in the pronoun of the first person.

The pronouns of the third person are identical with the demonstrative pronouns *yah* or *yih*, "this," and *wah* or *wuh*, "that," of which the older forms are *ih* and *uh*. The origin of these forms has not yet been discovered. All that can be gathered respecting them is that they are probably connected with one or other of the Prākrit forms *aäm*, *iäm*, *inam*, *im*, etc. = S. *ayam*, m., *iyam*, f., *idam*, n., etc., and are to be referred to primitive bases *i* and *a* or *u*. The oblique forms of these pronouns, however, point clearly to the Prākrit genitive, *e. g.*, *is* = Prk. *assa*, S. *asya*.

The relative pronoun *jo*, "he who" = Prk. *jo*, base *ja*, = S. *ya*. The other form in use, *jaun*, = Prk, *jo-uṇa* (= S. *punah*). The singular oblique form *jis* = Prk. *jissa* (the fem. base *ji* being used in place of the masc. *ja*), = S. *yasya*. The oblique form of the plural, *i. e.*, *jin* = Prk. *jānam* (by weakening of the vowel), = S. *yānam*.

The correlative *so* = Prk. *so* = S. *sah*. Its remaining forms may be made on the model of *jo* by substituting *t* for *j*.

The interrogative pronoun has *k* for its typical letter, just as the relative has *j*, and is in all respects as uniform as the relative and correlative. *Kaun*, "who" = *ko* + *uṇa* (= S. *punah*); the oblique form *kis* = Prk. gen. *kassa* (with change of base from masc. *ka* to fem. *ki*), = S. *kasya*.

The indefinite pronoun *koī*, "some one," = Prk. *kobi*, = S. *ko* + *api*. "The oblique form *kisī* shows the oblique of the interrogative with the *ī*, whose origin has been forgotten, so that it is regarded as a mere emphatic particle" (see Beames, *Comp. Gram.*). *Kuchh*, "something" = Prk. *kimchi* = S. *kimchit*.

The reflexive pronoun *ap*, "self" = Prk. *appā*, *āpā*, = S. *ātmā*.

Verbs and Tenses.—The verbal stems are, generally speaking, derived from the Prākrit present tense of Sanskrit neuter verbs, or from the Prākrit passive past participle. In the formation of the tenses, as in the declension of nouns, the synthetical or inflectional system of the Prākrit and the Sanskrit has given place to the analytical. Still wrecks of the old inflections remain.

The tenses of the modern verb may be naturally classed under three heads—(1) the simple tenses, which are the exact modern equivalents of corresponding tenses in the Prākrit verb, and in which traces of the old synthetic method still linger; (2) tenses formed of a participle, either the imperfect or the perfect participle; (3) tenses formed of a participle and an auxiliary verb.

The tenses of the first class are two in number,—the aorist (which corresponds to the present indicative of the old languages), and the imperative, which is derived from the Prākrit imperative.

The terminations of the aorist are:—

Singular.	*Plural.*
1. *ūṅ* = Prk. *āmi* = S. *āmi*.	1. *eṅ* = Prk. *āma, ama* = S. *āmaḥ*.
2. *e* = Prk. *asi* = S. *asi*.	2. *o* = Prk. *aha* = S. *atha*.
3. *e* = Prk. *adi, aï* = S. *ati*.	3. *eṅ* = Prk. *anti* = S. *anti*.

The imperative closely resembles the aorist or old present. The second person sing. is the bare verbal stem, and the second person plur. is identical with that of the aorist.

From the aorist the Hindūstānī and the Hindī form the simple future by the addition of *gā* (= Prk. *gaö, gado*, = S. *gatah*, perf. part. of the root *gam*, "to go"), *e. g.*, *kahūṅ-gā*, "I will tell," etc. The termination *gā* (which is masc.) becomes *gī* for the feminine, and *ge* for the plural, after the analogy of nouns of the first declension.

Of the tenses of the second class little need be said. The participles (which like other vocables are derived from the Prākrit) are the imperfect and the perfect, or what are vulgarly termed the present and the past. An example of each will suffice to show the construction: *wah boltā*, "he says;" *maiṅ bolā*, "I said;" *wah bolī*, "she said;" *we bole*, 'they said." Such is the construction in the case of neuter and intransitive verbs. But if the verb be active transitive, the tenses formed of the perfect passive participle are passively construeted; the place of the nominative is taken by the instrumental or case of the agent, and the participle inflects so as to agree with the object, if this be expressed, and appear in the form of the nominative; but if the object is not expressed, or if when expressed it assumes the dative form, the participle is constructed impersonally and appears in the masc. sing. form; *e. g.*, *maiṅ-ne-kahā*, "by me it was said," "I said;" *us-ne chiṭṭhī likhī*, "the letter was written by him," "he wrote the letter"; *rājā-ne shernī-ko mārā*, "the king killed the tigress;" lit. "as regards the tigress, it was killed by the king." This

[1] *Journal of the Asiatic Society of Bengal*, 1872, pt. 1, p. 174, *et seq.*
[2] *Ibid*, p. 124.

construction, as we have already remarked, is commonly employed in the Sanskrit.

The tenses of the third class are formed by adding to the participles already mentioned the various tenses of certain auxiliary verbs, as *honā*, "to be;" *jānā*, "to go;" and the fragmentary forms *hūṅ* (with its remaining persons) and *thā*; *e.g.*, *maiṅ jātā hūṅ*, "I am going;" *wah parhtī hai*, "she is reading;" *wah baiṭhā thā*, "he was seated," "he was sitting;" *we chale honge*, "they will have started."

Of these auxiliaries *honā* (*ho-* = Prk. *ho-*, = S. *bhū*) and *jānā* (*jā* = Prk. *jā*, = S. *yā*) need not detain us. Both verbs are in use in all their tenses in the modern languages, and the preceding remarks on the verbal forms and tenses apply equally to them. *Jānā* is that which is employed to form the passive voice, *e.g.*, *wah mārā jāegā*, "he will be killed." It is also used for other purposes, such as intensifying a root to which it is attached, etc.

The auxiliaries *hūṅ* (with its other persons) and *thā* stand on a different footing. The former is derived from the present indicative of the root *as*, "to be," in the old languages:—

Singular.	*Plural.*
1. *huṅ* = Prk. *amhi* = S. *asmi*.	1. *haiṅ* = Prk. *asma* = S. *smaḥ*.
2. *hai* = Prk. *asi* = S. *asi*.	2. *ho* = Prk. *attha* = S. *stha*.
3. *hai* = Prk. *atthi* = S. *asti*.	3. *haiṅ* = Prk. *santi* = S. *santi*.[1]

The latter is derived from the Prākrit *thio*, = Sanskrit *sthitaḥ*, the perfect participle of the root *sthā*, "to stand." Besides being used as auxiliaries, both are employed to express simple existence, as *maiṅ hūṅ*, "I am," "it is I;" *wah hai*, "he or it is;" *wah thā*, "he was;" *wah thī*, "she was." (J. T. P.)

HINDUSTANI LITERATURE. Hindustani literature falls into two great divisions, of which the first is comprehensively styled Hindī, the second Urdū. Both of these forms of speech are, in their application to literary purposes, at first intruders upon the ground already occupied by the learned languages, Sanskrit and Persian. At no time during modern Indian history has Sanskrit altogether ceased to be used for composition by the class who regard culture and literature as their special heritage, although during the last two centuries it has much fallen from its former estate; and Persian has been still less neglected by learned Muhammadans and their Hindu imitators in India. But there is this difference between them that, whereas Hindī has been raised to the dignity of a literary language chiefly by impulses of revolt against the monopoly of the Brahmans, Urdū has been cultivated with good will by authors who have themselves highly valued and dexterously used the polished Persian. Both, however, represent the popular side of the national culture, and in the present day they are almost in sole possession of the field. The subject may be conveniently divided as follows:—

1. Early Hindī, of the period during which the language was being fashioned as a literary medium, represented by the old heroic poems of Rājpūtānā and the literature of the *Bhagats* or Vaishnava reformers, and extending from about 1200 to 1570 A. D.

2. Middle Hindī, representing the best age of Hindī poetry, and reaching from about 1570 to 1750 A. D.

3. The rise and development of literary Urdū, beginning about the end of the 16th century and reaching its height during the 18th.

4. The modern period, marked by the growth of a prose literature in both dialects, and dating from the beginning of the present century.

1. Early Hindī literature has as yet been very insufficiently explored. Chand's *Prithwīrāj Rāsau* is the only specimen of the heroic ballads of which any portion has been published, other ancient metrical chronicles of the same character being known to us only from the use made of them by such writers as Colonel Tod in his *Annals of Rajasthan*, and Major Pogson in his *History of the Boondelas*. Chand was the bard of Prithwīrāj, the last Hindu king of Dehli, whose life and death he has related. He was himself a native of Lahore, which had for nearly 200 years (since 1023) been under Musalmān domination at the time when the poem may be supposed to have been written. His language exhibits a considerable proportion of Persian words, but little of the distinctive features of what is now Panjābī. His work is probably, with the exception of a fragment by Jaideo (the author of the Sanskrit *Gītā-Govinda*), preserved in the *Ādi-Granth*, the oldest specimen of Hindī which we possess: but it is impossible to suppose that he was the first to attempt poetical composition in that language. The metrical perfection of his verse alone shows that he must have had many predecessors; and rude and rough though his utterance, it abounds in poetic conventionalisms which must have been the common stock of many singers of his class. The story is told in sixty-nine books, of which some are interludes and digressions, but most are occupied with the exploits of the hero and his warriors. Considering the early date of the poem, and the opportunities of knowing the truth which the author (if he was really Prithwīrāj's bard) possessed, it is remarkable how much legend and fiction is mixed up with history in the chronicle. The repeated conflicts between the rājā and Sultān Shihābuddīn of Ghor, in which the latter always, except in the last great battle, comes off the worst, and is released on payment of a ransom, seem to be entirely unhistoric, our authorities knowing only one encounter (that of Tiraurī near Thānesar, fought in 1191) in which the sultān was defeated, and there even he escaped uncaptured to Lahore. The Mughals (Book xv.) are brought on the stage more than thirty years before they actually set foot in India (1222), and are related to have been vanquished by the redoubtable Prithwīrāj. These and other points make it questionable whether we have here, at least in its entirety, a genuine contemporary work; but we may concede, as indeed we are justified in doing by the language of the poem, that it is one of our earliest documents in Hindī.

It is very difficult for us now to form a just estimate of Chand's poem: the language, essentially transitional in character, abounds in strange forms which have long since died out of the vernacular speech; few if any Hindus, even the most learned, are able to interpret him; and his meaning must be sought by investigating the processes by which Sanskrit and Prākrit words have been transfigured in their progress into Hindī. But upon the whole he may be said to exhibit both the merits and defects of ballad-chroniclers in general. There is much that is lively and spirited in his descriptions of fight or council; and the characters of the Rājpūt warriors who surround his hero are not unfrequently sketched in their own words with skill and animation. The sound, however, too often predominates over the sense, and we find abundantly exemplified in his poem the wearisome iteration, uninventive sameness of machinery, and tedious unfolding of familiar themes and images which distinguish nearly the whole of Indian narrative poetry. His value, for us at least, is linguistic rather than literary.

The other class of composition which is characteristic of the period of Old Hindī, the literature of the *Bhagats*, both possesses more intrinsic interest and has exercised a more important influence on subsequent literary endeavor. The heroic chronicles, with perhaps the single exception of a famous saga relating the history of Padmāvati, wife of Ratan Sen Rājā of Chītor, who in 1303 at the taking of that fortress by Sultān 'Alā-ud-dīn burnt herself and (so says the tale) 13,000 other women rather than fall into the hands of the conqueror, which has been several times handled by poets outside the pale of Rājpūt traditions, and especially in a still highly esteemed work by Jaisī under Sher Shāh (1540), had only a local currency, and contributed but little to the furtherance of literature outside the limits of Rājpūtānā. The Vaishnava reformers, on the other hand, exercised the most powerful influence both upon the national speech and upon the themes chosen for poetic treatment. Nearly the whole of subsequent Hindī literature is impressed with one or other form of Vaishnava doctrine; a very large proportion of the poets whose works are still current among the people were Vaishnava saints or *bhagats*; and to their initiative is due the almost exclusive use as a poetic dialect of that form of archaic Hindī known as Braj-bhākhā. Vaishnavism was essentially a reaction against Brahmanical influence and the chains of caste, a claim for the rights of humanity against the monopoly which the "twice-born" asserted of learning, of worship, of righteousness. As Śiva was the peculiar deity of the Brahmans, so was Vishṇu of the people; and while the literature of the Śaivas and Śāktas is almost entirely in Sanskrit, and exercised little or no influence on the popular mind, that of the Vaishnavas is mainly in Hindī, and in itself constitutes the great bulk of what has been written in that language.

The Vaishnava doctrine is commonly carried back to Rāmānuja, whose appearance is placed by Wilson about the

[1] Beames (*Comp. Gram.*, vol. iii. p. 171, *et seq.*) thinks it difficult, if not impossible, to derive these modern forms from the old ones given above, and would postulate the existence of a present tense of the root *as* conjugated after the *bhū* type, thus—(sing.) 1. *asāmi*; 2. *asasi*; 3. *asati*; (plur.) 1. *asāmaḥ*; 2. *asatha*; 3. *asanti*. The objection to this, however, is that no such forms have been found to exist.

middle of the 12th century. He was a native of Southern India, and had few immediate followers in the north. In the latter region the new opinions were spread by Rāmānand, whom the *Bhaktamālā* makes the fourth head of the sect, and other authorities the fifth; both Wilson and Trumpp place him about 1400 of our era. Nothing in Hindī by Rāmānuja has come down to us; of Rāmānand we have one short poem in the *Granth* (Introduction, p. cxxiv.). Between Rāmānuja and Rāmānand (though not in the line of teachers descending direct from the former) we may place Jaideo (about 1250) and Nāmdeo (about 1300), of the first of whom we have a fragment in the *Granth*, and of the second six pieces have been similarly preserved. Jaideo was a Brahman, and well acquainted with Sanskrit; but Nāmdeo (or Nāmā) was a *chhīpī* or calico-printer, a very despised class, and was perhaps the first to proclaim among the followers of the new doctrine the essential unity of mankind as worshippers of Hari. Kabīr comes next, and is incomparably the greatest, in the order of Vaishnava teachers. He was a weaver by caste, and in all probability originally a Musalmān. He is counted among the twelve disciples of Rāmānand; but he seems himself to trace his spiritual paternity rather to Jaideo and Nāmā.[1] He dwelt first at Benares and afterwards at Magahar, in the present district of Gorakhpur, during the reign of Sikandar Shāh Lodī (1488–1517), and was probably dead before the end of the 15th century. Nānak, the first Guru of the Sikhs, whose *Granth* is little more than a paraphrase of Kabīr's writings, was born in 1469 and died in 1538; and from the relation between the two it seems necessary to suppose that Kabīr was several years the senior.

The works attributed to Kabīr are very numerous; they are preserved complete at the headquarters of the sect, the *Kabīr chaurā* at Benares, and many portions of them have been separately printed and lithographed in India. The best known are those entitled the *Sākhīs*, *Sabds*, and *Rekhtas*, which have a wide popularity even among those who are not professed disciples of the saint. Several of the compositions enumerated under the name of Kabīr are, however, not by him, but by his disciples: as the lesser *Bījak*, by Bhago-Dās, the *Sukh-Nidhān*, by Srut-Gopāl, etc.; it was the custom (as also that of Kabīr's religious heirs, the Sikh Gurus) for the successors in the guruship to speak in the name of him whose successors they were. The doctrine of Kabīr[2] was philosophically a form of pantheism, accounting for the existence of phenomena (the reality of which was denied) by the agency of a *Māyā*, or illusion, emanating from the Supreme. The varied lot of men in life, their differences of faith and aim, their desires, fears, hopes, loves, are all the work of this *Māyā*, to know which, and to recognize beneath all the Supreme, is the only means of emancipation from the chains of illusion. Neither austerities, ritual, nor works of any kind are necessary to obtain the highest end; this is only to be gained by *bhakti*, "faith," and perpetual meditation on the Supreme—His names, *Hari*, *Rām*, *Govind*, being ever on the lips and in the heart. The highest end is absorption in the Supreme, reunion with Him from whom all proceeded and who exists in all. Little place is left in this somewhat barren doctrine for a social code, since works are naught; but negatively, at least, it is inoffensive, commanding respect for all forms of life, and quiet performance of duty without self-seeking or desire for gain.

Of the spiritual followers of Kabīr many have left memorials in literature; one of the most eminent of these was Dādū, founder of a sect very prevalent in Rājpūtānā. A translation of two chapters from the *Granth* or scripture of this *Bhagat* will be found in a note to Wilson's *Religious Sects of the Hindus*, pp. 106–113, and will repay perusal. But those whose compositions, if not most excellent from a literary point of view, have at any rate wrought most in history, were the Gurus or spiritual heads of the Sikhs of the Panjāb. The *Ādi Granth*, or Book of the first five Gurus (from Nānak, who died in 1538, to Arjun, who died in 1601), is described by its translator as "perhaps the most shallow and empty book that exists, in proportion to its size;" and certainly the translation is not attractive reading. But the doctrines, reiterated with the most painful diffuseness, are essentially those of Kabīr, much of whose writings has been incorporated in the volume. The language is rather Old Hindī than Old Panjābī, and thus the work falls within the scope of this article; though Panjābī words and idioms frequently occur, the grammar is Hindī; and the authors evidently aimed at propagating their tenets rather among the Hindī-speaking races of Hindostan proper than (as actually happened) among the Panjābī-speaking tribes of the West and South-West. The *Granth* consists of six parts: I., the *Japjī*, the only portion as yet published in Europe in the original Hindī; II., III., and IV., arrangements for devotional purposes of extracts from Part V., the *Rāgs* or body of the *Granth;* of these *Rāgs* there are thirty-one, but only four, *Srī Rāg*, *Mājh*, *Gauṛī*, and *Āsā*, have been rendered by Trumpp; the remaining twenty-seven are described as "a second gathering or gleaning, as materials offered themselves, no attention being paid to the contents, but only to the bulky size of the *Granth*;" VI., the *Bhog* or conclusion, containing verses by various authors, among them Kabīr and Shekh Farīd of Pākpaṭṭan, a famous Indian *Ṣūfī*, and panegyrics of the five Gurus by fifteen *bhaṭṭs* or bards. At the end of each Rāg is a collection of sayings of the *Bhagats*, chiefly of Kabīr, in confirmation of the doctrines set forth by the Gurus; and it is in these additions that the literary importance of the work, as a treasure of specimens of early Hindī, mainly consists.

Another of the following of Rāmānand, though considerably later in time than Kabīr, was Sūr-Dās. Of his life little is known: as some of his verses are included in the *Granth*, he must have lived before its redaction (about 1600); if he be the same as a saint of that name mentioned in the *Bhaktamālā*, as is probable, he was a Brahman, *amīn* or revenue collector of the *parganah* of Sanḍīlā in Oudh during the reign of Akbar, who is related to have appropriated the collections of his district for the service of the temple of Madan-Mohan at Bṛindāban, sending to the treasury instead chests filled with stones. When his delinquency was discovered, he was pardoned by Akbar, but thenceforth abandoned the world, and, becoming blind, led a wandering life as a singer of the praises of Vishṇu. His stanzas, generally of four lines (*padas*), are said to number no less than 125,000; they are collected in a huge volume entitled the *Sūr-Sāgar*, and are extremely popular.

While the sects of which Rāmānand may be considered the spiritual father adore the Deity chiefly under the names of *Rāma*, *Hari*, *Govind*, and dwell but little on the *avatārs* or human incarnations of the Hindu god whom they have selected as the type of the Supreme, there is another division of the Vaishnavas which is not less important in Hindī authorship, and counts its adherents by millions, whose worship is of a different character. The sects belonging to this division take Kṛishṇa as their favorite type of the godhead, and, accepting the whole mass of legends (most of them probably of comparatively late origin) relating to this incarnation, inspire themselves with fervor by the contemplation chiefly of Krishṇa's childhood and his youth in the society of the herd-maidens of Braj. As the doctrine and object of worship are, so also is the mode of life. The Rāmānandīs are for the most part men of ascetic and unworldly life, not indeed given to self-torture or needless rigor, but caring nothing for the wealth of the world, and living quietly and soberly in the possession of what they deem the truth. The worshippers of Kṛishṇa and his mistress Rādhā, or of the infant Bāl-Gopāl, on the other hand, are no ascetics, but persons of luxurious and often opulent lives; among women especially this form of devotion is widespread. The chief sect of this denomination is the *Vallabhāchārīs*, or the following of the *Gokulastha Gosāīns*. Their founder was one Vallabha Swāmī, a Brahman from the south, who settled at Gokul near Mathurā, probably about the beginning of the 16th century. The best known works of this sect are the *Braj-bilās*, a description of Kṛishṇa's sports with the maidens of Brindāban, by Brajbāsī-Dās, and the *Vārttā*, a collection of legends regarding eighty-four teachers of the following, resembling the *Bhaktamālā*, which deals chiefly with the other division of Vaishnavas. The popularity of the *Brāj-bilās* is immense, and it is to be found in a lithographed form for sale in every bazaar. Its contents (as indeed many other pro-

[1] This may be concluded from a short poem in the *Granth* (p. 469), where Kabīr says (verses 4, 5):—"Let each one seek this Mind, O brother: when the body falls away, where shall the Mind be absorbed? By the favor of the Guru Jaideo and Nāmā through the love of Faith attained to knowledge of Him." (The *Mind* is the indwelling Rāma, *divinæ particula auræ*.)

[2] A tolerably full account will be found in H. H. Wilson's *Essay on the Religious Sects of the Hindūs* (*Works*, vol. i. pp. 68 *sqq.*); Dr. Trumpp's *Essay on the Religion of the Sikhs* (*Granth*, Introd., pp. xcvii. *sqq.*) may also be consulted.

ductions of the worshippers of Krishṇa) have been condemned by Europeans as indecent; but although containing much that seems at least outwardly licentious and prurient, it is a work the study of which is indispensable to one who would understand the religious temper of the Hindus. The mystic dwelling on the amours of Krishṇa and the *Gopīs* of Braj has been often compared to the mystical interpretation of the *Song of Solomon;* and in most religions we shall perhaps find at least one phase in which the sensual is curiously mingled with the spiritual, and faith and love towards the heavenly stimulated by thoughts and phrases drawn from earthly scenes of passion. Of the *Vārttā* we shall speak under the next division of our subject.

2. Middle Hindī reaches from about 1570 to 1750. To this age belong the best poets of Hindī literature, Kesav-Dās, Bihārī-Lāl, and Tulsī-Dās, whose writings are no less remarkable for skill and subtlety of language than for perfection of metrical form. The labors of their predecessors had wrought the language of western Hindustan into a medium worthy of being put to the highest poetic use; and we accordingly find in the poets of this period large borrowings from Braj, even where (as with Tulsī-Dās) that idiom is not the dialect of their own region. From their day onward Braj-bhākhā has been esteemed (in the words of Lallū-Lāl) "the standard language of sentiment (*mahārasa-mūl*), and equal to the speech of the gods" (*i. e.*, Sanskrit).

Kesav-Dās was a Brahman who lived under Jahāngīr and Shāhjahān. He was the author of a poem on Rāma, entitled the *Rāmachandrikā*, written in 1602; the *Kavipriya*, written in the same year, a treatise on the poetic art of much celebrity; the *Rasik-priya*, on rhetoric, written in 1592; the *Bhakta-līlāmṛita*, an exposition of the doctrine of Rāmānandī Vaishnavism; and several other works. Kesav-Dās's compositions are widely popular, and have been frequently lithographed in Northern India.

Bihārī-Lāl is renowned as the author of the *Sat-saī*, a collection of 700 distichs, which is perhaps the most celebrated work of Hindī poetic *art*, as distinguished from narrative and simpler styles. They are inspired by the Krishṇa side of Vishṇu-worship, and take the form of amorous dialogues between Rādhā and the other *Gopīs* and their lover. The author was a native of Goāliyār, and lived at Amber during the early part of the 17th century. Editions of this work, one of the most difficult in Hindī and abounding in subtle conceits, are very numerous. It has been commented on by a crowd of scholars, among them, strange to say, more than one Musalmān,—a sufficient proof of the value set by natives of India, irrespective of their creed, on its perfection of language. It has even been translated into Sanskrit.

Tulsī-Dās, though perhaps inferior in poetic skill to the two last mentioned, is undoubtedly the most popular Hindī poet. His *Rāmāyan* (originally named by the author *Rām-charit-mānas*, or "the Lake of Rāma's deeds") is perhaps better known among Hindus in Upper India than the Bible among the rustic population of England. He was a Kanaujī Brahman, and probably (from his language) a native of Oudh. The greater part of his life he spent at Benares; he died in 1624. His *Rāmāyan* was commenced at Ayodhyā in 1573. Besides this great work, he is the author of six other poems, all bearing more or less on the history and worship of Rāma, called the *Rām-gītāvalī*, the *Dohāvalī*, the *Kabit-sambandh*, the *Binay-patrikā*, the *Pad-Rāmāyan*, and the *Chhandāvalī*. Seven other minor works are attributed to him, but their authenticity is doubtful.

Tulsī's *Rāmāyan* is a rehandling of the great theme of Vālmīkī, but in no sense a translation of the Sanskrit poem; real translations are scarcely to be found in original Hindī literature, the vernacular authors permitting themselves great liberty of excision, adaptation, and addition. It consists of seven books, of which the first two, called the *Bāl-kāṇḍ* and *Ayodhyā-kāṇḍ*, make up more than half the work, and relates the birth and boyhood of Rāma and his brethren, his marriage with Sītā, their dwelling together in the forest, her abduction by Rāvan, the expedition to Lankā and the overthrow of the ravisher, and the life at Ayodhyā after the return of the reunited pair. It is written chiefly in *dohās*, *soraṭhās*, and *chaupāīs*, with here and there a *chhand* interspersed; the style is very even and well sustained, and the language, while fundamentally the Old Pūrbī of eastern Hindustan, borrows largely from Braj. The most admired portion of the work is the second book, *Ayodhyā*, which tells of the mischief wrought by Kaikeyī, one of the queens of Dasarath, Rāma's father, who had bound himself by a vow to grant her what boon she should ask, and whom by this bond she compelled to command Rāma and Sītā to go into exile in the great forest south of the Jumna, and to give the throne to her own son Bharat. In this trouble Dasarath dies, and his son obediently goes forth with his wife and his brother Lachhman to the southern wilderness. The sorrow of Dasarath, the sweet filial piety and perfect manhood of the divine Rāma, the valor and prompt affection of Lachhman, the sincerity and humility of Bharat, the purity and wifely obedience of Sītā, are themes which a Hindu reader is never tired of dwelling upon in Tulsī's pages. And unlike though the treatment be to our own standards of taste, overgrown with theological digressions and explanations, and stocked with conventional images and stereotyped phrases as the poem is, even a European may find in it something of literary achievement which appeals to him, however distantly, as the work of a master of the heart. The first two books of the *Rāmāyan* have been admirably rendered into English prose by Mr. F. S. Growse (Allahabad, 1877–78).

Tulsī, though essentially a Hindu and a Brahman in religious feeling, yet belongs to the class of Vaishnavas who count among them Rāmānand and Kabīr. He has little or nothing of the sensual passion of the devotees of Krishṇa and Rādhā; and in the commentary on the *Bhaktamālā* it is related that, when in his old age he paid a visit to Bṛindāban, the centre of the Krishṇa-cult, he refused to render homage to any other form of the god than Rāma. According to the legend, he was beguiled into a temple of Krishṇa, and bidden there to worship Rāma; he answered that he would only bow his head before one who should bear in his hand the bow and arrows of the king of Ayodhyā; hearing his speech, the image of the god, standing till then as Krishṇa with the flute (*Bansīdhar*), suddenly changed to the similitude of Rāma with the bow.

The *Bhaktamālā*, or "Roll of the *Bhagats*," is a celebrated work of this period, and is ascribed to Nābhājī a Vaishnava of the despised caste called *Ḍoms* or *Ḍomṛās*, who lived during the reign of Jahāngīr, and was a contemporary of Tulsī-Dās. The *Bhaktamālā*, in the form in which it is commonly met with, consists of a *mūl*, or original text, ascribed to Nābhājī, and a *ṭīkā*, or commentary, of which there are two, due respectively to Krishṇa-Dās and Priya-Dās, both stated to have been written in 1713, in verse, and many more in prose. The *mūl* is a short stanza (*chhappai*) for each saint, the first line of which is repeated again at the end, stating, in the briefest and most obscure language, his characteristics. The original work of Nābhājī was amplified and added to by Nārāyan-Dās, who lived during the reign of Shāhjahān. Mr. Growse justly says of it:—"The style (of the *mūl*) might be described as of unparalleled obscurity, were it not that each separate portion of the text is followed by a *ṭīkā*, or gloss, in which confusion is still worse confounded by a series of the most disjointed and inexplicit allusions to different legendary events in the saint's life." A considerable portion of the *Bhaktamālā* was printed in 1817 in Major Price's *Hindi and Hindustani Selections*, and it has been largely drawn upon by Wilson in his account of the religious sects of the Hindus. The saints treated in it are chiefly of the class of Vaishnavas addicted to the worship of Rāma; and the anecdotes of them contained in the work are generally insipid and extravagant in the extreme. "Such as it is, however, it exercises a powerful influence in Upper India on popular belief, and holds a similar place in the superstitions of this country to that which was occupied in the darkest ages of the Roman Catholic faith, by the *Golden Legend* and *Acts of the Saints*" (Wilson).

The other side of Vaishnavism, that devoted to the cult of the infant or youthful Krishṇa, with or without his mistress Rādhā, is represented by a work similar in character to the *Bhaktamālā*, called the *Vārttā*, or *Chaurāsī Vārttā*, already mentioned. Specimens of its contents will be found in Wilson's *Religious Sects of the Hindus*, p. 132. Its legends are of the most trivial and childish description; but, with the tenth chapter of the *Bhāgavata Purāṇa*, rendered into Braj-bhākhā by Chaturbhuj Misr, and into modern Hindī in 1804–10 by Lallū Lāl, they are neverthe-

less the inspirers of the greater part of the popular worship throughout the whole of Northern India. The universality of the cult of the infant Kṛishṇa may be judged by the enormous number of Hindu proper names which end in *Lāl*, meaning "child," all of which embody some reference to this deity in his youthful form. In Bengal especially the sect is extremely numerous, having there arisen out of the teaching of Chaitanya, who is said to have married a daughter of Vallabhāchārya, and is believed by his followers to have been himself an incarnation of Krishna.

Such, in the briefest outline, is the character of Hindī literature during the period when it grew and flourished through its own original forces. Founded by a popular impulse in many respects similar to that which gave rise to Buddhism nearly 2000 years before, and cultivated chiefly (though by no means exclusively) by authors not belonging to the Brahmanical order, it was the legitimate descendant in spirit, as Hindī is the legitimate descendant in speech, of the Prākrit literature which preceded it. Entirely in verse, it adopted and elaborated the Prākrit metrical forms, and carried them to a pitch of perfection which is too often overlooked by those who concern themselves rather with the substance than with the form of the works they study. The language of these compositions strikes us often as rude, abrupt, and ambiguous; undoubtedly in its earlier specimens it is wanting in clearness and definiteness of grammatical form; but the shackles of metre are frequently the explanation of uncouth forms of speech, and the necessity of filling out a metrical scheme led in too many cases to irregularities and amplifications which had perhaps no representatives in the uncompelled utterances of the vernacular tongue. Interesting when regarded in the mass, its attractions in detail are few. As in all Oriental literature, repetition and shallowness of idea overcome it, and render an extensive course of reading intolerable to a European. Conventional images, platitudes exhausted to the utmost degree of tenuity, barren philosophical and theological themes which in their wideness entirely overlook the study of detail,—such are, with few exceptions, its leading features; and one who has read two or three books has in truth made himself master of the whole secret of original Hindī literature.

3. The *origines* of Urdū as a literary language are extremely obscure. The popular account refers its rise to the time of Tīmūr (1398). Some authors even claim for it a higher antiquity, asserting that a *dīwān*, or collection of poems, was composed in *Rekhtah* by Mas'ūd, son of Sa'd, in the last half of the 11th and beginning of the 12th century, and that Sa'dī of Shīrāz and his friend Amīr Khusrau of Dehli likewise made verses in that dialect before the end of the 13th century. This, however, is very questionable; and the better opinion appears to be that these ancient compositions, if they existed at all, were written in Hindī according to the metrical forms of that language, rather than in what is properly called Urdū. That Muhammadans composed in Hindī, and used that language as their vernacular, is certain; and in many passages of Kabīr, which are nevertheless pure Hindī compositions, Persian words are used almost as freely as in the modern dialect. Much of the confusion which besets the subject is due to the want of a clear definition of what Urdū, as opposed to Hindī, really is.

Urdū, as a literary language, differs from Hindī rather in its form than in its substance. The really vital point of difference, that in which Hindī and Urdū are incommensurable, is the prosody. Hardly one of the metres taken over by Urdū poets from Persian agrees with those used in Hindī; in the latter language, it is the rule to give the short *a* inherent in every consonant or group of consonants its full value in scansion, except occasionally at the metrical pause: in Urdū this is never done, the only somewhat analogous rule providing for the enunciation of a short *a* (the *nīm-fatḥah*) after a nexus of consonants which would otherwise be pronounced without it; the great majority of Hindī metres are counted by the number of syllabic instants or *mātrās* (the value in time of a short syllable): in Urdū the metres follow a special order of longs and shorts.

The question, then, is not—When did Persian first become intermixed with Hindī in the literary speech?—for this process began with the first entry of Muslim conquerors into India, and continued for centuries before a line of Urdū was composed;—nor, When was the Persian character first employed to write Hindī?—for the written form is but a subordinate matter. We must ask—When was the first verse composed in Hindī, whether with or without foreign admixture, according to the forms of Persian prosody and not in those of the indigenous metrical system? Then, and not till then, did Urdū come into being. If, then, it is really the case that poems were so composed as early as the 11th or the 13th century, the origin of Urdū literature must be carried back to that period. But Hindī itself was at that date, and for many decades later (as we see from Chand and our other earliest specimens of the language), in an unsettled and transition stage. Neither in its case-inflections nor in its verbal forms did it resemble the language which we know as Urdū. It abounded in short vowels and hiatuses, which could not accommodate themselves either to the Persian character (without the free use of vowel-signs and *hamzah*, which were seldom employed) or to Persian prosody; and its syntactical order was loose and unsettled. Urdū, as we know it, is the Hindī of the end of the 16th century enriched from Persian, not the Hindī of Chand and the early *Bhagats*.

The whole of Urdū poetry follows Persian models of composition; its themes are those which had already been worked (some might say, worked out) by writers in that language; and neither in form nor substance do we find the faintest flavor of originality from its commencement to the present day.

The paucity of themes and want of originality in Urdū verse has led to a most elaborate development of the system of rhetoric. Where the substance of what a poet has to say is identical with that which has been said by hundreds, nay thousands, of poets before him, it is of the highest importance that the way of saying it shall if possible be peculiar to himself. Rhetoric, accordingly, rather than poetic feeling, is the distinguishing feature of composition in Urdū. Pleasing hyperbole, ingenious comparison, antithesis, alliteration, carefully arranged gradation of noun and epithet, are the means employed to obtain variety; and few of the most eloquent passages of Urdū verse admit of translation into any other language without losing that which in the original makes their whole charm. Even in the *masnavīs*, or narrative poems, the story is usually quite a subordinate matter; it has in most cases been handled time after time, and is familiar to the reader in its minutest detail. Even when the names chosen for the actors are new, the intrigue is old, and the mode in which it is unfolded is the only thing which distinguishes one poem from another. The descriptions thus, confined within a narrow circle of incident and epithet, repeat each other with a monotony which to a European is inexpressibly fatiguing, but which in the East is deemed rather a merit than a defect. Differences of school, which are made much of by native critics, are to us hardly perceptible; they consist in the use of one or other range of metaphor and comparison, classed, according as they repeat the well-worn poetical stock-in-trade of the Persians or seek a slightly fresher and more Indian field of sentiment, as the old or the new style of composition.

These being the nature and features of Urdū poetry, it will be manifest that such an account of it as can be given here must be little more than a list of names and dates.[1]

The earliest Urdū authors lived and wrote in the Dakkhan, at the courts and under the patronage of the Muhammadan dynasties of Golkonda and Bījāpur, shortly before these dynasties were overthrown by the campaigns of Aurangzeb in the south. Shujā'uddīn Nūrī, a native of Gujarāt, a friend of Faizī and contemporary of Akbar, is mentioned by the native biographers as the most ancient Urdū poet after Amīr Khusrau. He was tutor of the son of the *wazīr* of Sultān Abu-l-Hasan Quṭb Shāh of Golkonda, and several *ghazals* by him are said to survive. Qulī Quṭb Shāh of Golkonda, who reigned from 1581 to 1586, and his successor 'Abdullāh Quṭh Shāh, who came to the throne in 1611, have both left collections of verse, including *ghazals*, *rubā'is*, *masnavīs* and *qaṣīdahs*. And during the reign of the latter Ibn Nishātī wrote two works which are still famous as models of composition in Dakhnī; they are *masnavīs* entitled the *Ṭūṭī-nāmah*, or "Tales of a Parrot," and the *Phūl-ban*. The first, written in 1639, is an adaptation of a Persian work by Nakhshahī, but derives ultimately from a Sanskrit original entitled the *Śuka-saptati*; this collection has

[1] The late M. Garcin de Tassy's *Histoire de la Littérature Hindouie et Hindoustanie*, and his annual summaries of the progress made from 1850 to 1877, afford all the materials which can be desired on this subject by one who does not care to refer to the original vernacular works; the peculiarities of the latter can be learned only from long-continued study and familiarity with Oriental modes of thought.

been frequently rehandled in Urdū, both in verse and prose, and is the original of the *Ṭoṭā-Kahānī*, one of the first works in Urdū prose, composed in 1801 by Muhammad Haidar-bakhsh Haidarī of the Fort William College. The *Phūl-ban* is a love tale named from its heroine, said to be translated from a Persian work entitled the *Basātīn*. Another famous work which probably belongs to the same place and time is the *Story of Kāmrūp and Kalā* by Tahsīnuddīn, a *masnavī* which has been published (1836) by M. Garcin de Tassy; what makes this poem remarkable is that, though the work of a Musalmān, its personages are Hindu. Kāmrūp, the hero, is son of the king of Oudh, and the heroine, Kalā, daughter of the king of Ceylon; the incidents somewhat resemble those of the tale of es-Sindibād in the *Thousand and One Nights;* the hero and heroine dream one of the other, and the former sets forth to find his beloved; his wanderings take him to many strange countries and through many wonderful adventures, ending in a happy marriage.

The court of Bījāpur was no less distinguished in literature. Ibrāhīm 'Adil Shāh (1579–1626) was the author of a work in verse on music entitled the *Nau-ras* or "Nine Savors," which, however, appears to have been in Hindī rather than Urdū; the three prefaces (*dībājahs*) to this poem were rendered into Persian prose by Maulā Zuhūrī, and, under the name of the *Sih nasr-i Zuhūrī*, are well-known models of style. A successor of this prince, 'Alī 'Ādil Shāh, had as his court poet a Brahman known poetically as Nusratī, who in 1657 composed a *masnavī* of some repute entitled the *Gulshan-i 'Ishq*, or "Rose-garden of Love," a romance relating the history of Prince Manohar and Madmālatī,—like the *Kāmrūp*, an Indian theme. The same poet is author of an extremely long *masnavī* entitled the *'Alīnāmah*, celebrating the monarch under whom he lived.

These early authors, however, were but pioneers and feelers of the way; the first generally accepted standard of form, a standard which has suffered little change in two centuries, was established by Walī of Aurangābād (about 1680–1720) and his contemporary and fellow-townsman Sirāj. The former of these is commonly called "the Father of Rekhtah"—*Bābā-e Rekhtah;* and all accounts agree that the immense development attained by Urdū poetry in Northern India during the 18th century was due to his example and initiative. Very little is known of Walī's life; he is believed to have visited Dehli towards the end of the reign of Aurangzeb, and is said to have there received instruction from Shāh Gulshan in the art of clothing in a vernacular dress the ideas of the Persian poets. His *Kulliyāt* or complete works have been published by M. Garcin de Tassy, with notes and a translation of selected passages (Paris, 1834–36), and may be commended to readers desirous of consulting in the original a favorable specimen of Urdū poetical composition.

The first of the Dehli school of poets was Zuhūruddīn Hātim, who was born in 1699 and died in 1792. In the second year of Muhammad Shāh (1719), the *dīwān* of Walī reached Dehli, and excited the emulation of scholars there. Hātim was the first to imitate it in the Urdū of the north, and was followed by his friends Nājī, Mazmūn, and Ābrū. Two *dīwāns* by him survive. He became the founder of a school, and one of his pupils was Rafī'us-Saudā, the most distinguished poet of Northern India. Khān Ārzū (1689–1756) was another of the fathers of Urdū poetry in the north. This author is chiefly renowned as a Persian scholar, in which language he not only composed much poetry, but one of the best of Persian lexicons, the *Sirāju-l-lughāt;* but his compositions in Urdū are also highly esteemed. He was the master of Mīr Taqī, who ranks next to Saudā as the most eminent Urdū poet. Ārzū died at Lakhnau (Lucknow), whither he betook himself after the devastation of Dehli by Nādir Shāh (1739). Another of the early Dehli poets who is considered to have surpassed his fellows was In'āmullāh Khān Yaqīn, who died during the reign of Ahmad Shāh (1748–54), aged only twenty-five. Another was Mīr Dard, pupil of the same Shāh Gulshan who is said to have instructed Walī; his *dīwān* is not long, but extremely popular, and especially esteemed for the skill with which it develops the themes of spiritualism. In his old age he became a *darwesh* of the *Naqshbandī* following, and died in 1793.

Saudā and Mīr Taqī are beyond question the most distinguished Urdū poets. The former was born at Dehli about the beginning of the 18th century, and studied under Hātim. He left Dehli after its devastation, and settled at Lakhnau, where the Nawāb Āṣafuddaulah gave him a *jāgīr* of Rs. 6000 a year, and where he died in 1780. His poems are very numerous, and cover all the styles of Urdū poetry; but it is to his satires that his fame is chiefly due, and in these he is considered to have surpassed all other Indian poets. Mīr Taqī was born at Agra, but early removed to Dehli, where he studied under Ārzū; he was still living there at the time of Saudā's death, but in 1782 repaired to Lakhnau, where he likewise received a pension; he died at a very advanced age in 1810. His works are very voluminous, including no less than six *dīwāns*. Mīr is counted the superior of Saudā in the *ghazal* and *masnavī*, while the latter excelled him in the satire and *qaṣīdah*. Sayyid Ahmad, an excellent contemporary authority, and himself one of the best of modern authors in Urdū, says of him in his *Asāru-ṣ-Sanādīd:*—"Mīr's language is so pure, and the expressions which he employs so suitable and natural, that to this day all are unanimous in his praise. Although the language of Saudā is also excellent, and he is superior to Mīr in the point of his allusions, he is nevertheless inferior to him in style."

The tremendous misfortunes which befell Dehli at the hands of Nādir Shāh (1739), Ahmad Shāh Durrānī (1756), and the Marṭāhās (1759), and the rapid decay of the Mughal empire under these repeated shocks, transferred the centre of the cultivation of literature from that city to Lakhnau, the capital of the newly founded and flourishing state of Oudh. It has been mentioned how Ārzū, Saudā, and Mīr betook themselves to this refuge and ended their days there; they were followed in their new residence by a school of poets hardly inferior to those who had made Dehli illustrious in the first half of the century. Here they were joined by Mīr Hasan (died 1786), Mīr Soz (died 1800), and Qalandar-bakhsh Jur'at (died 1810), also like themselves refugees from Dehli, and illustrious poets. Mīr Hasan was a friend and collaborator of Mīr Dard, and first established himself at Faizābād and subsequently at Lakhnau; he excelled in the *ghazal, rubā'ī, masnavī*, and *marsiyah*, and is counted the third, with Saudā and Mīr Taqī, among the most eminent of Urdū poets. His fame chiefly rests upon a much admired *masnavī* entitled the *Siḥru-l-bayān*, or "Magic of Eloquence," a romance relating the loves of Prince Be-nazīr and the Princess Badr-i Munīr; his *masnavī* called the *Gulzār-i Iram* ("Rose-garden of Iram," the legendary 'Ādite paradise in Southern Arabia), in praise of Faizābād, is likewise highly esteemed. Mīr Muhammadī Soz was an elegant poet, remarkable for the success with which he composed in the dialect of the harem called *Rekhtī*, but somewhat licentious in his verse; he became a *darwesh* and renounced the world in his later years. Jur'at was also a prolific poet, but, like Soz, his *ghazals* and *masnavīs* are licentious and full of double meanings. He imitated Saudā in satire with much success; he also cultivated Hindī poetry, and composed *dohrās* and *kabitts*. Miskīn was another Lakhnau poet of the same period, whose *marsiyahs* are especially admired; one of them, that on the death of Muslim and his two sons, is considered a masterpiece of this style of composition. The school of Lakhnau, so founded and maintained during the early years of the century, continued to flourish till the dethronement of the last king, Wājid 'Alī, in 1856. Ātash and Nāsikh (who died respectively in 1847 and 1841) are the best among the modern poets of the school in the *ghazal;* Mīr Anīs, a grandson of Mīr Hasan, and his contemporary Dabīr, the former of whom died in December, 1875, and the latter a few months later, excelled in the *marsiyah*. Rajab Alī Beg Surūr, who died in 1869, was the author of a much-admired romance in rhyming prose entitled the *Fasānah-e 'Ajāib* or "Tale of Marvels," besides a *dīwān*. The dethroned prince Wājid 'Alī himself, poetically styled Akhtar, is no mean poet; he has published three *dīwāns*, among them a quantity of poetry in the rustic dialect of Oudh which is philologically of much interest.

Though Dehli was thus deserted by its brightest lights of literature, it did not altogether cease to cultivate the poetic art. Among the last Mughals several princes were themselves creditable poets. Shāh 'Ālam II. (1761–1806) wrote under the name of Āftāb, and was the author of a romance entitled *Manzūm-i Aqdas*, besides a *dīwān*. His son Sulaimān-shikoh, brother of Akbar Shāh II., who had at first, like his brother authors, repaired to Lakhnau, returned to Dehli in 1815, and died in 1838; he also has left a *dīwān*. Lastly, his nephew Bahādur Shāh II., the last titular emperor of Dehli (died 1862), wrote under the name of Zafar, and was a pupil in poetry of Shaikh Ibrāhīm Zauq, a distinguished writer; he has left a voluminous *dīwān*, which has been printed at Dehli. Mashafī (Ghulām-i Hamdānī), who died about 1814, was one of the most distinguished of the revived poetic school of Dehli, and was himself one of its founders. Originally of Lakhnau, he left that city for Dehli in 1777, and held conferences of poets, at which several authors who afterwards acquired repute formed their style; he has left five *dīwāns*, a *Tazkirah* or biography of Urdū poets, and a *Shāh-nāmah* or account of the kings of Dehli down to Shāh 'Ālam. Qāim (Qiyāmuddīn 'Alī) was one of his society, and died in 1792; he has left several works of merit. Ghālib, otherwise Mirzā Asadullāh Khān Naushāh, laureate of the last Mughal, who died in 1869, is undoubtedly the most eminent of the modern Dehli poets. He wrote chiefly in Persian, of which language, especially in the form cultivated by Firdausī, free from intermixture of Arabic words, he was a master; but his Urdū *dīwān*, though short, is excellent in its way, and his reputation was spread far and wide. To this school, though he lived and died at Agra, may be attached Mīr Walī Muhammad Nazīr (recently dead in 1832); his *masnavīs* entitled *Jogī-nāmah, Kauṛī-nāmah, Banjāre-nāmah*, and *Buṛhāpe-nāmah*, as well as his *dīwān*, have been frequently reprinted, and are extremely popular. His language is less artificial than that of the generality of Urdū poets, and some of his poems

have been printed in Nāgarī, and are as well known and as much esteemed by Hindus as by Muhammadans.

4. While such, in outline, is the history of the poetic schools of the Dakkhan, Dehli, and Lakhnau, a fourth, that of the Fort William College at Calcutta, was being formed, and was destined to give no less an impulse to the cultivation of Urdū prose than had a hundred years before been given to that of poetry by Walī. At the commencement of the present century Dr. John Gilchrist[1] was the head of this institution, and his efforts were directed towards getting together a body of literature suitable as text-books for the study of the Urdū language by the European officers of the administration. To his exertions we owe the elaboration of the vernacular as an official speech, and the possibility of substituting it for the previously current Persian as the language of the courts and the government. He gathered together at Calcutta the most eminent vernacular scholars of the time, and their works, due to his initiative, are still unsurpassed as specimens of elegant and serviceable prose composition, not only in Urdū, but also in Hindī. The chief authors of this school are Haidarī (Sayyid Muhammad Haidar-bakhsh), Husainī (Mīr Bahādur 'Alī), Mīr Amman Lutf, Hafīzuddīn Ahmad, Sher 'Alī Afsos, Nihāl Chand of Lahore, Kāzim 'Alī Jawān, Lallū Lāl Kavi, Mazhar 'Alī Wilā, and Ikrām Alī.

Haidarī died in 1828. He composed the *Ṭoṭā-Kahānī* (1801), a prose redaction of the *Ṭūṭī-nāmah* which has been already mentioned; a romance named *Ārāish-i Mahfil* ("Ornament of the Assembly"), detailing the adventures of the famous Arab chief Hātim-i Ṭai; the *Gul-i Mayhfirat* or *Dah Majlis*, an account of the holy persons of the Muhammadan faith; the *Gulzār-i Dānish*, a translation of the *Bahār-i Dānish*, a Persian work containing stories descriptive of the craft and faithlessness of women; and the *Tārīkh-i Nādirī*, a translation of a Persian history of Nādir Shāh. Husainī is the author of an imitation in prose of Mīr Hasan's *Sihru-l-bayān*, under the name of *Nasr-i Benazīr* ("the Incomparable Prose," or "the Prose of Benazīr," the latter being the name of the hero), and of a work named *Akhlāq-i Hindī*, or "Indian Morals," both composed in 1802. The *Akhlāq-i Hindī* is an adaptation of a Persian work called the *Mufarrihu-l-qulūb* ("the Delighter of Hearts"), itself a version of the *Hitopadeśa*. Mīr Amman was a native of Dehli, which he left in the time of Ahmad Shāh Durrānī for Patna, and in 1801 repaired to Calcutta. To him we owe the *Bāgh o Bahār* (1801–2), an adaptation of Amīr Khusrau's famous Persian romance entitled the *Chahār Darwesh*, or "Story of the Four Dervishes." Amman's work is not itself directly modelled on the Persian, but is a rehandling of an almost contemporary rendering by Tahsīn of Etāwā, called the *Nau-ṭarz-i Muraṣṣa'*. The style of this composition is much admired by natives of India, and editions of it are very numerous. Amman also composed an imitation of Husain Wā'iz Kāshifī's *Akhlāq-i Muhsinī* under the name of the *Ganj-i Khūbī* ("Treasure of Virtue"), produced in 1802. Hafīzuddīn Ahmad was a professor at the Fort William College; in 1803 he completed a translation of Abu-l-Fazl's *'Iyār-i Dānish*, under the name of the *Khirad-afroz* ("Enlightener of the Understanding"). The *'Iyār-i Dānish* ("Touchstone of Wisdom") is one of the numerous imitations of the originally Sanskrit collection of apologues known in Persian as the *Fables of Bīdpāī*, or *Kalīlah and Damnah*. Afsos was one of the most illustrious of the Fort William school; originally of Dehli, he left that city at the age of eleven, and entered the service of Qāsim 'Alī Khān, Nawāb of Bengal; he afterwards repaired to Haidarābād in the Dakhhan, and thence to Lakhnau, where he was the pupil of Mīr Hasan, Mīr Soz, and Mīr Haidar 'Alī Hairān. He joined the Fort William College in 1800, and died in 1809. He is the author of a much esteemed *dīwān;* but his chief reputation is founded on two prose works of great excellence, the *Ārāish-i Mahfil* (1805), an account of India adapted from the introduction of the Persian *Khulāṣatu-t-tawārīkh* of Sujān Rāe, and the *Bāgh-i Urdū* (1808), a translation of Sa'dī's *Gulistān*. Nihāl Chand translated into Urdū a *masnavī*, entitled the *Gul-i Bakāwalī*, under the name of *Mazhab-i 'Ishq* ("Religion of Love"); this work is in prose intermingled with verse, was composed in 1804, and has been frequently reproduced. Jawān, like most of his collaborators, was originally of Dehli and afterwards of Lakhnau; he joined the College in 1800. He is the author of a version in Urdū of the well-known story of Sakuntalā, under the name of *Sakuntalā Nāṭak;* the Urdū was rendered from a previous Brajbhākhā version by Nawāz Kabīshwar, made in 1716, and was printed in 1802. He also composed a *Bārah-māsā*, or poetical description of the twelve months (a very popular and often-handled form of composition), with accounts of the various Hindu and Muhammadan festivals, entitled the *Dastūr-i Hind* ("Usages of India"), printed in 1812. Ikrām 'Alī translated, under the name of the *Ikhwānu-ṣ-ṣafā*, or "Brothers of Purity" (1810), a chapter of a famous Arabian collection of treatises on science and philosophy entitled *Rasāilu Ikhwāni-ṣ-ṣafā*, and composed in the 10th century. The complete collection, due to different writers who dwelt at Baṣrah, has recently been made known to European readers by the translation of Dr. F. Dieterici (1858–1879); the chapter selected by Ikrām Alī is the third, which records an allegorical strife for the mastery between men and animals before the king of the *Jinn*. The translation is written in excellent Urdū, and is one of the best of the Fort William productions.

Srī Lallū Lāl was a Brahman, whose family, originally of Gujarāt, had long been settled in Northern India. What was done by the other Fort William authors for Urdū prose was done by Lallū Lāl almost alone for Hindī. His *Prem Sāgar* and *Rājnīti*, the former a version in pure Hindī of the 10th chapter of the *Bhāgavata Purāṇa*, detailing the history of Kṛishṇa, and founded on a previous Braj-bhākhā version by Chaturbhuj Misr, and the latter an adaptation in Braj-bhākhā prose of the *Hitopadeśa* and part of the *Pancha-tantra*, are unquestionably the most important works in Hindī prose. The *Prem Sāgar* was begun in 1804 and ended in 1810; it enjoys immense popularity in Northern India, has been frequently reproduced in a lithographed form, and has several times been printed. The *Rājnīti* was composed in 1809; it is much admired for its sententious brevity and the purity of its language. Besides these two works, Lallū Lāl was the author of a collection of a hundred anecdotes in Hindī and Urdū entitled *Laṭāif-i Hindī*, an anthology of Hindī verse called the *Sabhā-bilās*, a *Sat-saī* in the style of Bihārī-Lāl called *Sapta-Satika*, and several other works. He and Jawān worked together at the *Singhāsan Battīsī* (1801), a redaction in mixed Urdū and Hindī (Devanāgarī character) of a famous collection of legends relating the prowess of King Vikramāditya; and he also aided the latter author in the production of the *Sakuntalā Nāṭak*. Mazhar 'Alī Wilā was his collaborator in the *Baitāl Pachīsī*, a collection of stories similar in many respects to the *Singhāsan Battīsī*, and also in mixed Urdū-Hindī; and he aided Wilā in the preparation in Urdū of the *Story of Mādhūnal*, a romance originally composed in Braj-bhākhā by Motī Rām.

The works of these authors, though compiled and published under the superintendence of Dr. Gilchrist, Captain Abraham Lockett, Professor J. W. Taylor, Dr. W. Hunter, and other European officers of the College, are essentially Indian in taste and style, and owe to this character a popularity and wide reputation which have been gained by no other work (and there have been many) undertaken under British initiative. If not absolutely the first works in Urdū and Hindī prose, they were at any rate the first literary standards in those languages; and almost the whole of recent prose authorship is due either to their influence or to one of two other impulses, the first of which was almost synchronous with the Fort William productions, and the other not many years posterior to them. These were the reform in Islām led by Sayyid Ahmad, and the introduction of lithography and a newspaper press.

Sayyid Ahmad was born in 1782, and received his early education at Dehli; his instructors were two learned Muslims, Shāh 'Abdu-l-'Azīz, author of a celebrated commentary on the Qur'ān (the *Tafsīr-i 'Azīziyyah*), and his brother 'Abdu-l-Qādir, the writer of the first and best translation of the Holy Volume into Urdū. Under their guidance Sayyid Ahmad embraced the doctrines of the Wahhābīs, a sect whose preaching appears at this time to have first reached India. He gathered round him a large number of fervent disciples, among others Ismā'īl Hājī nephew of 'Abdu-l-'Azīz and 'Abdu-l-Qādir, the chief author of the sect. After a course of preaching and apostleship at Dehli, Sayyid Ahmad set out in 1820 for Calcutta, attended by numerous adherents. Thence in 1822 he started on a pilgrimage to Mecca, whence he went to Constantinople, and was there received with distinction and gained many disciples. He travelled for nearly six years in Turkey and Arabia, and then returned to Dehli. The religious degradation and coldness which he found in his native country strongly impressed him after his sojourn in lands where the life of Islām is stronger, and he and his disciples established a propaganda throughout Northern India, reprobating the superstitions which had crept into the faith from contact with Hindus, and preaching a *jihād* or holy war against the Sikhs. In 1828 he started for Peshāwar attended by, it is said, upwards of 100,000 Indians, and accompanied by his chief followers, Hājī Ismā'īl and 'Abdu-l-Hayy. He was furnished with means by a general subscription in Northern India, and by several Muhammadan princes who had embraced his doctrines. At the beginning of 1829 he declared war against the Sikhs, and in the course of time made himself master of Peshāwar. The Afghāns, however, with whom he had allied himself in the contest, were soon disgusted by the rigor of his creed, and deserted him and his cause. He fled across the Indus and took refuge in the mountains of Pakhlī and Dhamtor, where in 1831 he encountered a detachment of Sikhs under the command of Sher Singh, and in the

[1] [John Borthwick Gilchrist (1759–1841), surgeon of Edinburgh, compiled Hindustani Dictionary and Grammar; was Oriental teacher in London from 1804 until his death.—Am. Ed.]

combat he and Hājī Ismā'īl were slain. His sect is, however, by no means extinct; the Wahhābī doctrines have continued to gain ground in India, and to give rise to much controversial writing, down to our own day.

The translation of the Qur'ān by 'Abdu-l-Qādir was finished in 1803, and first published by Sayyid 'Abdullāh, a fervent disciple of Sayyid Ahmad, at Hūghlī in 1829. The *Tambīhu-l-ghāfilīn*, or "Awakener of the Heedless," a work in Persian by Sayyid Ahmad, was rendered into Urdū by 'Abdullāh, and published at the same press in 1830. Hājī Ismā'īl was the author of a treatise in Urdū entitled *Taqwiyatu-l-Īmān* ("Confirmation of the Faith"), which had great vogue among the following of the Sayyid. Other works by the disciples of the *Tarīqah-e Muhammadiyyah* (as the new preaching was called) are the *Targhīb-i Jihād* ("Incitation to Holy War"), *Hidāyatu-l-Mūminīn* ("Guide of the Believers") *Mūzihu-l-Kabāir wa-l-Bid'ah* ("Exposition of Mortal Sins and Heresy"), *Naṣīhatu-l-Muslimīn* ("Admonition to Muslims"), and the *Mi'at Masāil*, or "Hundred Questions."

Printing was first used for vernacular works by the College Press at Fort William, and all the compositions prepared for Dr. Gilchrist and his successors which have been already mentioned were thus made public; but the expense of this method of reproduction long precluded its extensive use in India, and the ungraceful characters used as types were not appreciated by the natives. In 1837 the first lithographic press was set up at Dehli, and from that date onwards the publications, original or editions of older works, issued in this shape annually may be counted by hundreds. The newspaper press soon followed the introduction of lithography, and there are at present about two hundred journals in Urdū and Hindī printed in India, the majority in the North-Western Provinces, the Panjāb, and Oudh, but a few at Madras, Haidarābād, Bangalore, Bombay, and Calcutta. The extension taken by vernacular literature during the last thirty years is enormous, and to describe it adequately would require a volume. The reader is referred for the best account of it to M. Garcin de Tassy's *Annual Summaries* from 1850 to 1877, where he will also find much interesting information regarding the nature and value of the newspapers now so numerous. Here a few names only can be mentioned which seem the most prominent among the crowd of writers who daily, by the cheap and simple agency of a lithographic stone and bāzār paper, make their ideas public in Northern India.

Sayyid Ahmad Khān Bahādur, C. S. I. (not to be confounded with the Wahhābī reformer), is perhaps the most eminent and eloquent among contemporary writers of Urdū. He is the author of numerous works, among others of the *Āsāru-s-Sanādīd* ("Vestiges of Princes"), an excellent account of Dehli and its monuments which has passed through three editions (1847, 1854, 1876). His fame, however, chiefly rests upon his persevering efforts to raise the standard of civilization and culture among his co-religionists, for which purpose he has since 1870 issued a most valuable journal entitled the *Tahzību-l-Akhlāq*, or "Muhammadan Social Reformer" (which, unlike almost all its competitors, is printed with movable types). The articles in this publication, chiefly of a religious or educational character, are of a high order of excellence, and display most effectively the resources of the Urdū language as a means of expressing modern ideas. Maulavī Nazīr Ahmad of Dehli is the author of two excellent stories named *Mir'ātu-l-'arūs* ("the Bride's Mirror") and *Taubatu-n-Naṣūh* ("the Repentance of Nasūh;") and Pandit Kāshīnāth of Agra has written a good treatise on ethics, founded on Persian compilations on the subject, called *Akhlāq-i Kāshī*. These three works have received rewards from the Government of the North-Western Provinces, and enjoy much popularity. The officers of the educational department have been prolific in school-books of various degrees of excellence. Mr. H. S. Reid and his assistants, Qamaruddīn Gulāb Khān, Chiranjī Lāl, Pandit Bansīdhar, Srī Lāl, and Mohan Lāl, were at work from 1851 to 1860 in this direction, and several good translations and compilations are due to them. In the Panjāb Zukāullāh Khān of Dehli, and Karīmuddīn and Pandit Ajodhyā Parshād of Lahore, have been no less active; and Northern India is now well supplied with the means of elementary education in the vernacular in literature, history, geography, and mathematics. Science, owing to the difficulties of technical nomenclature, is less efficiently represented, and the controversy regarding the best method of clothing its vocabulary in a vernacular dress is hardly yet solved. Owing to the fortunate circumstance that Urdū is able to draw for its vocabulary upon Persian and Arabic as well as upon its native Indian resources, the attempts which have been made in Egypt, Turkey, and other countries where these languages are in use to provide vernacular equivalents for scientific terminology will, it may be hoped, work not only for the benefit of those countries, but also for that of India, and thus in time provide a satisfactory means of raising vernacular education in science to the level of other branches of culture.

In Hindī also there is much activity, though not so much as in Urdū. The pure or "High" Hindī, which rejects all foreign words, and supplies its vocabulary exclusively from Sanskrit, is a recent creation, and cannot even yet be said to represent the language of any large class of the population. A good specimen of this dialect is Nīlkanṭh Shāstrī Gore's *Shaḍ-Darshan Darpan*, or "Mirror of the Six (orthodox) Schools (of Hindu philosophy)," a controversial work by a converted Brahman. The genuine Hindī of the old literature, used now exclusively for poetry, is represented by an excellent publication issued weekly at Benares by Bābū Harish-Chandra, entitled *Kabi-bachan-Sudhā*, or "Ambrosia of the Words of Poets." In this will be found much good original work, and a vast quantity of old Hindī poetry now for the first time published. The translations of the *Mahābhārata* and *Harivansa*, made by Pandit Gokulnāth of Benares, and printed at Calcutta in 1829, deserve mention; and one of the most important collections of Hindī poetry, the *Rāg-Kalpadrum* of Krishnānand Vyāsadev Rāg-Sāgar, was printed at the same place in 1842–45 in an immense volume of 1800 pages.

English education has naturally had a vast influence on modern vernacular literature, though not wholly a beneficial one. More than a half of the new works issued within the last thirty years are translations or adaptations from English; the journals, the great popularizers of new ideas, take their matter chiefly from English newspapers; the courts, where Urdū has since 1832 become the official language, contribute to the spread of the stiff and difficult phraseology of the Acts of the legislature, as different from the natural idiom of the people as can well be imagined. Literature in India has always owed much to the fostering influence of Government. It has been seen how the schools of Dehli and Lakhnau rose and declined with the fortunes of the Mughal empire and the kingdom of Oudh, and how that of Calcutta similarly owed its existence to British initiative. At the present day the patronage of the rulers of India is no less influential in determining the course of literary activity. Poetical composition is little practised, both because of the exhaustion of its themes and the little appreciation which it meets with from Europeans. More solid studies, politics, science, philosophy, morals, history, and especially controversial theology, are the topics now in favor; and, though much that is published is of the slightest possible intrinsic value, the resources of the language are being gradually cultivated and enlarged to meet the needs of the day. There is thus no reason to doubt that Hindostan will in time possess a body of literature worthy of the flexible and expressive speech of its people, and reflecting faithfully the standard of culture which it owes to its western rulers. (C. J. L.)

HINGANGHÁT, a town in the Wardha district, Central Provinces, India, 21 miles S. W. of Wardha, in 20° 33′ 30″ N. lat., and 78° 52′ 30″ E. long., with a population in 1877 of 9415. It is a main seat of the cotton trade, the Hinganghát cotton produced in the rich Wardha valley being esteemed one of the best indigenous staples of India. The principal native traders are Márwárís, many of whom have large transactions and export on their own account; but the greater number merely act as middle-men between the cultivators and the large merchants. The municipal committee have opened a large gravelled market-place and storage-yard, with raised platforms, and scales for weighing the cotton. The place consists of Old and New Hinganghát,—the former, a straggling town, liable to be flooded by the river Waná; the latter, in which the better classes reside, laid out in broad streets and avenues.

HINOJOSA DEL DUQUE, a town of Spain, in the province of Cordova, from which city it is distant about 58 miles N. by W. The manufacture of linens and woollens is carried on to some extent; the population is estimated at about 10,400.

HINTON, James (1822–1875), aural surgeon and author, son of John Howard Hinton, Baptist minister and author of the *History and Topography of the United States*, and other works, was born at Reading in 1822. He was educated at his grandfather's school near Oxford, and at the Nonconformist school at Harpenden, and in 1838, on his father's removal to London, was apprenticed to a woollen-draper in Whitechapel, where he came into contact with a phase of human life in its miserable and degraded forms which influenced powerfully the whole cast of his after thought. After retaining this situation about a year he became clerk in an insurance office. The most of his

evenings were spent by him in intense study, and this, joined to the ardor, amounting to morbidness, of his interest in moral problems, so affected his health that in his nineteenth year he resolved to seek refuge from his own thoughts by running away to sea. His intention having, however, been discovered, he was sent, on the advice of the physician who was consulted regarding his health, to St. Bartholomew's Hospital to study for the medical profession. After receiving his diploma in 1847, he was for some time assistant surgeon at Newport, Essex, but the same year he went out to Sierra Leone to take medical charge of the free laborers on their voyage thence to Jamaica, after which his interest in their welfare prompted him to remain a year on the island. After his return to England in 1850, he entered into partnership with a surgeon in London, where he soon had his interest awakened specially in aural surgery, and gave also much of his attention to physiology and to problems bearing on the relation between mind and body. In his practice he became convinced that in the immense majority of cases of ill-health it was the hope of cure rather than the drug that effected the remedy, a fact which explained to him much of the success of homœopathy, and induced him to lay the principal stress on moral methods of cure. He made his first appearance as an author in 1856 by contributing a series of papers on physiological and ethical subjects to the *Christian Spectator;* and the success of his work *Man and his Dwelling Place*, which appeared in 1858, determined him, notwithstanding that he had married in 1852, to give up his medical practice in order to devote his whole attention to writing on those practical moral problems which chiefly occupied his thoughts. A series of papers entitled "Physiological Riddles," which he contributed to the *Cornhill Magazine*, and afterwards published under the title *Life in Nature*, as well as another series entitled *Thoughts on Health*, written for the same periodical and collected and published separately in 1871, gave evidence of great aptitude in popular scientific exposition; but his interest in speculation was too absorbing to permit him to apply himself with sufficient pertinacity to literary work, and after a year's trial of it he found it necessary to resume his profession. In 1863 he obtained the appointment of aural surgeon to Guy's hospital, after which he speedily acquired a lucrative west-end practice, and the reputation of being the most skilful aural surgeon of his day, a reputation fully borne out by his works, *An Atlas of Diseases of the Membrana Tympani* and *Questions of Aural Surgery*, which are regarded as the chief authorities in this branch of surgery. The skill he had now obtained in his profession seemed to justify him in 1869 in resuming his philosophical studies, but the mental excitement thus produced, added to his professional labors, appears to have inflicted permanent injury on his brain; and, although by giving up his practice in 1874 he obtained partial relief, he began to suffer from sleeplessness and depression, and died of acute inflammation of the brain, 16th December, 1875.

In addition to the works already mentioned, Hinton was the author of the *Mystery of Man*, and *The Place of the Physician*. On account of their fresh and vigorous discussion of many of the important moral and social problems of the time, his writings have had a wide circulation on both sides of the Atlantic. He contributed also several papers to the *Contemporary Review* and other periodicals. His *Life and Letters*, edited by Ellice Hopkins, with an introduction by Sir W. W. Gull, appeared in 1878.

HIOGO, or FIOGO, a seaport town of Japan, in the island of Nipon and province of Setsu, on the western shore of the Idzumi Sea, or Bay of Osaka about 40 miles S. W. of Kioto, with which it has had railway communication since 1874. It was opened to foreign commerce in 1860, and since that date it has risen with the maritime suburb of Kobe (the Gate of God) to be a place of 50,000, or according to other authorities, 80,000 or 90,000 inhabitants. Its harbor, formerly dangerous, has by the construction of a costly breakwater been rendered one of the most serviceable in the kingdom. The best anchorage is found in front of Kobe, which has been chosen as the locale of the foreign settlement. Since the opening of the port great improvements have been effected in the native town, and the value of land and house property has greatly increased. The settlement, which consists of 162 lots, has been regularly laid out; its streets are macadamized and lighted with gas; and it possesses a bank, municipal buildings, and the largest warehouses yet erected by foreigners on Japanese soil There is a recreation ground open to both natives and foreigners, with a cricket field and a croquet lawn. The population of the settlement was 169 in 1876, that of Kobe in 1874 was upwards of 8500. The trade of Hiogo consists mainly in the exportation of tea (1,599,199 dollars in 1877), silk, copper, camphor, wax, tobacco, ginseng, isinglass, and dried fish, and the importation of European manufactured goods, woollens, cotton, glass, etc. Most of the tea goes to New York, very little to London. The total value of the imports in 1874, 1875, 1876, and 1877 was respectively 6,030,239, 5,354,917, 3,748,967, and 4,313,641 dollars (the dollar being worth about 4s.), and the corresponding figures for the exports were 4,956,724, 2,813,102, 3,401,230, and 4,518,570. The industrial establishments comprise a shipbuilding yard, an iron-foundry, and a factory for the manufacture of paper pulp or "half stuff." There is a busy traffic maintained by ferry steamers between Hiogo and Osaka. The number of foreign ships that entered and cleared from the port in 1875 was 335, with a burden of 453,958 tons. Population in 1903, 22,500.

Hiogo was built in the days of the glory of the Taira family, and its name is equivalent to arsenal. At Minato Gawai near Kobe a small temple marks the spot where Kusunoki Masashige, the mirror of Japanese loyalty, met his death; and in Kobe itself there is a temple erected on the site of the ancient fane built by Jingu Kogo on her return from Corea.

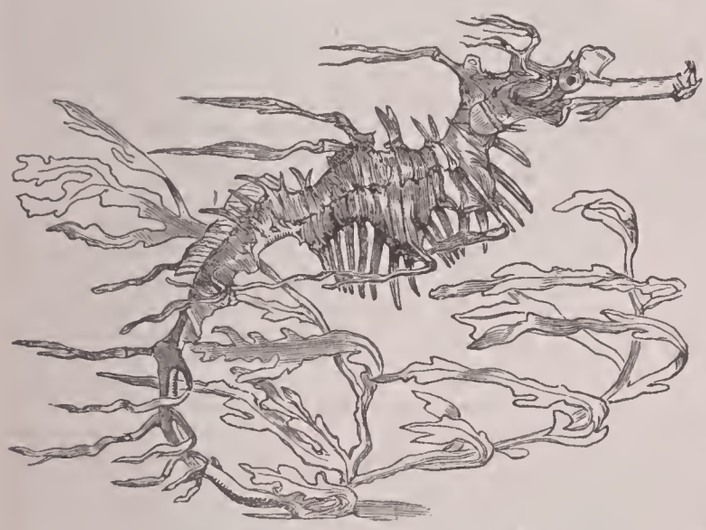
HIPPARCHUS, the founder of mathematical astronomy, was born at Nicæa in Bithynia. The years of his birth and death are both unknown, but the period of his activity, according to the evidence of his observations, which have been preserved by Ptolemy, must have been between 160 and 125 B. C. Of his writings only one has come down to us, *Τῶν Ἀράτου καὶ Ἐνδόξου φαινομένων ἐξηγήσεων βιβλία γ'*, published by Vittorius at Florence, 1567, and by Petavius in his *Uranologia*, Paris, 1630. For a notice of his discoveries see ASTRONOMY, vol. ii. p. 654.

HIPPEL, THEODOR GOTTLIEB VON (1741–1796), a German author, known chiefly as a humorist, was born on the 31st January, 1741, at Gerdauen in East Prussia, where his father was rector of a school. In his sixteenth year he went to Königsberg to study theology; but through the influence of the Dutch councillor of justice, Woyt, he was induced to devote himself to jurisprudence. A Russian lieutenant, Von Keyser, whose acquaintance he made in Königsberg, took him in 1760 to St. Petersburg, where he might have had a brilliant career had not his love for his country made it impossible for him to live away from it. Returning to Königsberg he became a tutor in a private family; but, falling in love with a young lady of high position, he, as the readiest means of enabling him to marry her, gave up his tutorship and devoted himself with enthusiasm to legal studies. He was successful in his profession, passing from one grade to another, until in 1780 he was appointed burgomaster and director of police in Königsberg, and in 1786 privy councillor of war and president of the town; as he rose in the world, however, his inclination for matrimony vanished, and the lady who had stimulated his ambition was forgotten. To write books in his country house near Königsberg was his favorite amusement, and some of them have still a certain popularity. Perhaps the best known is his *Ueber die Ehe* (Concerning Marriage). He has also works on *The Social Improvement of Woman*, and on *Female Education*. Another curious book of his is *Lebensläufe nach aufsteigender Linie, nebst Beilagen A, B, C* (Careers according to an ascending line, with supplements A, B, C). His name is attached to several political writings of a satirical turn, and he was the author of a comedy *Der Mann nach der Uhr*, which was fortunate enough to win the applause of Lessing. Hippel was a friend of Kant, who admired his ingenuity and resource in forming and executing plans. Before the publication of Kant's *Kritik*, Hippel was made familiar with its main conclusions, and in his *Lebensläufe* he did his utmost to prepare the way for their reception. In nearly all his writings he had a serious purpose, but disliking a cold, systematic style, he communicated his ideas in what he intended to be a light and witty form. Much of his wit is rather crude, but he gave sufficient evidence of a lively fancy to justify his success as an author. His private

character presented some curious contrasts. He shared the enthusiasm of his age for passionate friendships, but none of his friends were treated with confidence; endowed with a clear and penetrating intellect, he had a strong tendency to superstition; he seemed to have generous sympathies, yet his conduct was often hard and selfish; and although he incessantly praised simplicity of life, no one could be more fond of pomp and show. He died on the 23d April, 1796, leaving a considerable fortune. In 1827–38 a collected edition of his works in 14 vols. was issued at Berlin.

HIPPO. See BÔNE.

HIPPOCAMPUS, or SEA-HORSE. The small fishes thus named constitute, together with the Pipe-fishes or *Syngnathi*, a distinct order of the class of fishes, that of Lophobranchs or fishes with the gills arranged in tufts. The name "Sea-horse" has been given from the singular horselike shape of the head and fore-part of the body. The head is compressed, and is prolonged into a flat snout, at the end of which opens the small mouth. The eye occupies the same position as in the horse, and the head is joined at an angle to a narrow and curved neck, which posteriorly is dilated into the broader body. As in all the fishes of this order, the body is not covered with soft skin or scales, but encased in a mail composed of hard and tough scutes, which are of a more or less quadrangular shape, and generally armed with tubercles or spines. The tail is long, flexible, and prehensile, without caudal fin. These fishes are very bad swimmers, their locomotion being entirely dependent on the long dorsal fin which slowly propels them by a rapidly undulating screw-like motion; placed in the middle of the back of a body which generally occupies a vertical or oblique position in the water, this organ of locomotion has a propelling power far inferior to that of a terminal caudal fin. By means of their prehensile tail the sea-horses attach themselves to the stems of sea-weed or corals, which they resemble so closely in their outward appearance that it is difficult to distinguish them,—a resemblance which is still more increased in a group of sea-horses (*Phyllopteryx*) in which many of the spines and tubercles bear long tapering bands like the fronds of sea-weeds. Originally littoral fishes, sea-horses are, nevertheless, frequently found in mid-ocean, attached to floating substances on which they are carried away by currents far from their native shore. In the Sargasso Sea they are common. Like the other Lophobranchs, they take care of their progeny till the young have attained sufficient size and strength to shift for themselves. The male receives the eggs immediately after oviposition in a pouch situated on the lower part of his tail, where they are hatched, and where indeed the young remain until hunger compels them to leave their parent in search of food. More than twenty different species are known from the tropical and the warmer parts of the temperate zones. They are all of small size; that seen in our aquaria is the *Hippocampus antiquorum*, common on many parts of the French coast and farther south.



Phyllopteryx eques, attached to sea-weed.

HIPPOCRATES, termed the "Father of Medicine," was born, according to Soranus, in Cos, in the first year of the 80th Olympiad, *i. e.*, in 460 B.C. He was a member of the family of the Asclepiadæ, and was believed to be either the nineteenth or seventeenth in direct descent from Æsculapius. It is also claimed for him that he was descended from Hercules through his mother, Phænarete. He studied medicine under Heraclides, his father, and Herodicus of Selymbria; in philosophy Gorgias of Leontini and Democritus of Abdera were his masters. His earlier studies were prosecuted in the famous Asclepion of Cos, and probably also at Cnidos. He travelled extensively, and taught and practised his profession at Athens, probably also in Thrace, Thessaly, Delos, and his native island. He died at Larissa in Thessaly, his age being variously stated as 85, 90, 104, and 109. The incidents of his life are shrouded by uncertain traditions, which naturally sprang up in the absence of any authentic record; the earliest biography was by one of the Sorani, probably Soranus the younger of Ephesus, in the 2d century; Suidas, the lexicographer, wrote of him in the 11th, and Tzetzes in the 12th century. In all these biographies there is internal evidence of confusion; many of the incidents related are elsewhere told of other persons, and certain of them are quite irreconcilable with his character, so far as it can be judged of from his writings and from the opinions expressed of him by his contemporaries; we may safely reject, for instance, the legends that he set fire to the library of the temple of health at Cnidos, in order to destroy the evidence of plagiarism, and that he refused to visit Persia at the request of Artaxerxes Longimanus, during a pestilential epidemic, on the ground that he would in so doing be assisting an enemy. He is referred to by Plato (*Protag.*, p. 283; *Phædr.*, p. 211) as an eminent medical authority, and his opinion is also quoted by Aristotle. The veneration in which he was held by the Athenians serves to dissipate the calumnies which have been thrown on his character by Andreas, and the whole tone of his writings bespeaks a man of the highest integrity and purest morality.

Born of a family of priest-physicians, and inheriting all its traditions and prejudices, Hippocrates was the first to cast superstition aside, and to base the practice of medicine on the principles of inductive philosophy. It is impossible to trace directly the influence exercised upon him by the great men of his time, but one cannot fail to connect his emancipation of medicine from superstition with the widespread power exercised over Greek life and thought by the living work of Socrates, Plato, Æschylus, Sophocles, Euripides, Herodotus, and Thucydides. It was a period of great intellectual development, and it only needed a powerful mind such as his to bring to bear upon medicine the same influences which were at work in other sciences. It must be remembered that his training was not altogether bad, although superstition entered so largely into it. He had a great master in Democritus, the originator of the doctrine of atoms, and there is every reason to believe that the various "asclepia" were very carefully conducted hospitals for the sick, possessing a curious system of case-books, in the form of votive tablets, left by the patients, on which were recorded the symptoms, treatment, and result of each case. He had these records at his command; and he had the opportunity of observing the system of training and the treatment of injuries in the gymnasia. One of his great merits is that he was the first to dissociate medicine from priestcraft, and to direct exclusive attention to the natural history of disease. How strongly his mind revolted against the use of charms, amulets, incantations, and such devices appears from his writings; and he has expressly recorded, as underlying all his practice, the conviction that, however diseases may be regarded from the religious point of view, they must all be scientifically treated as subject to natural laws (*De Aere*, 29). Nor was he anxious to maintain the connection between philosophy and medicine which had for long existed in a confused and confusing fashion.[1] His knowledge of anatomy, physiology, and pathology was necessarily defective, the respect in which the dead body was held by the Greeks precluding him from practising dissection; thus we find him writing of the tissues without distinguishing between the various textures of the body, confusing arteries, veins, and nerves, and speaking vaguely of the muscles as "flesh." But when we come to study his observations on the natural history of disease as presented in the living subject, we recognize at once the presence of a great clinical physician. Hippocrates based his principles and practice on the theory of the existence of a spiritual restoring essence or principle, φύσις, the *vis medicatrix naturæ*, in the management of which the art

[1] "Hippocrates Cous, primus quidem ex omnibus memoria dignus, ab studio sapientiæ disciplinam hanc separavit, vir et arte et facundia insignis" (Celsus, *De Medicina*).

of the physician consisted. This art could, he held, be only obtained by the application of experience, not only to disease at large, but to disease in the individual. He strongly deprecated blind empiricism; the aphorism "ἡ πεῖρα σφαλερὴ, ἡ κρίσις χαλεπή" (whether it be his or not), tersely illustrates his position. Holding firmly to the principle, νοῦσων φύσιες ἰητροί, he did not allow himself to remain inactive in the presence of disease; he was not a merely "expectant" physician; as Sydenham puts it, his practice was "the support of enfeebled and the coercion of outrageous nature." He largely employed powerful medicines and blood-letting both ordinary and by cupping. He advises, however, great caution in their application. He placed great dependence on diet and regimen, and here, quaint as many of his directions may now sound, not only in themselves, but in the reasons given, there is much which is still adhered to at the present day. His treatise Περὶ ἀέρων, ὑδάτων, καὶ τόπων (*Airs, Waters, and Places*) contains the first enunciation of the principles of public health. Although the treatises Περὶ κρισίμων cannot be accepted as authentic, we find in the Προγνωστικόν evidence of the acuteness of observation in the manner in which the occurrence of critical days in disease is enunciated. His method of reporting cases is most interesting and instructive; in them we can read how thoroughly he had separated himself from the priest-physician. Laennec, to whom we are indebted for the practice of auscultation, freely admits that the idea was suggested to him by study of Hippocrates, who, treating of the presence of morbid fluids in the thorax, gives very particular directions, by means of succussion, for arriving at an opinion regarding their nature. Laennec says, "Hippocrate avait tenté l'auscultation immédiate." Although the treatise Περὶ νούσων is doubtfully from the pen of Hippocrates, it contains strong evidence of having been the work of his grandson, representing the views of the Father of Medicine. Although not accurate in the conclusions reached at the time, the value of the method of diagnosis is shown by the retention in modern medicine of the name and the practice of "Hippocratic succussion." The power of graphic description of phenomena in the Hippocratic writings is illustrated by the retention of the term "facies Hippocratica," applied to the appearance of a moribund person, pictured in the *Prognostics*. In surgery his writings are important and interesting, but they do not bear the same character of caution as the treatises on medicine; for instance, in the essay *On Injuries of the Head*, he advocates the operation "of trephining" more strongly and in wider classes of cases than would be warranted by the experience of later times.

The *Hippocratic Collection* consists of eighty-seven treatises, of which a part only can be accepted as genuine. The collection has been submitted to the closest criticism in ancient and modern times by a large number of commentators. (For full list of the early commentators, see Adams's *Genuine Works of Hippocrates*, Sydenham Society, vol. i. pp. 27, 28.) The treatises have been classified according to (1) the direct evidence of ancient writers, (2) peculiarities of style and method, and (3) the presence of anachronisms and of opinions opposed to the general Hippocratic teaching,—greatest weight being attached to the opinions of Erotian and Galen. The general estimate of commentators is thus stated by Adams:—"The peculiar style and method of Hippocrates are held to be conciseness of expression, great condensation of matter, and disposition to regard all professional subjects in a practical point of view, to eschew subtle hypotheses and modes of treatment based on vague abstractions." The treatises have been grouped in the four following sections:—(1) genuine; (2) those consisting of notes taken by students and collected after the death of Hippocrates; (3) essays by disciples; (4) those utterly spurious. Littré accepts the following thirteen as absolutely genuine:—(1) *On Ancient Medicine* (Περὶ ἀρχαίης ἰητρικῆς); (2) *The Prognostics* (Προγνωστικόν); (3) *The Aphorisms* (Ἀφορισμοί); (4) *The Epidemics*, i. and iii. (Ἐπιδημιῶν ά καὶ γ'); (5) *On Regimen in Acute Diseases* (Περὶ διαίτης ὀξέων); (6) *On Airs, Waters, and Places* (Περὶ ἀέρων, ὑδάτων, καὶ τόπων); (7) *On the Articulations* (Περὶ ἄρθρων); (8) *On Fractures* (Περὶ ἀγμῶν); (9) *The Instruments of Reduction* (Μοχλικός); (10) *The Physician's Establishment, or Surgery* (Κατ' ἰητρεῖον); (11) *On Injuries of the Head* (Περὶ τῶν ἐν κεφαλῇ τρωμάτων), (12) *The Oath* (Ὅρκος); (13) *The Law* (Νόμος). Of these Adams accepts as certainly genuine the 2d, 6th, 5th, 3d (7 books), 4th, 7th, 8th, 9th, and 12th, and as "pretty confidently acknowledged as genuine, although the evidence in their favor is not so strong," the 1st, 10th, and 13th, and, in addition, (14) *On Ulcers* (Περὶ ἑλκῶν); (15) *On Fistulæ* (Περὶ συρίγγων); (16) *On Hemorrhoids* (Περὶ αἱμορῥοίδων); (17) *On the Sacred Disease* (Περὶ ἱερῆς νούσου). According to the sceptical and somewhat subjective criticism of Ermerins, the whole collection is to be regarded as spurious except *Epidemics*, books i. and iii. (with a few interpolations), *On Airs, Waters, and Places*, *On Injuries of the Head* ("insigne fragmentum libri Hippocratei"), the former portion of the treatise *On Regimen in Acute Diseases*, and the "obviously Hippocratic" fragments of the *Coan Prognostics*. Perhaps also the *Oath* may be accepted as genuine; its comparative antiquity is not denied. The *Aphorisms* are certainly later and inferior. In the other non-Hippocratic writings Ermerins thinks he can distinguish the hands of no fewer than nineteen different authors, most of them anonymous, and some of them very late.

The earliest Greek edition of the Hippocratic writings is that which was published by Aldus and Asulanus at Venice in 1526 (folio); it was speedily followed by that of Frobenius, which is much more accurate and complete (fol., Basel, 1538). Of the numerous subsequent editions, probably the best was that of Foesius (Frankfort, 1595, 1621, Geneva, 1657), until the publication of the great works of Littré, *Œuvres complètes d'Hippocrate, traduction nouvelle avec le texte grec en regard, collationnée sur les manuscrits et toutes les éditions, accompagnée d'une introduction, de commentaires médicaux, de variantes, et de notes philologiques* (10 vols., Paris, 1839–61), and of F. Z. Ermerins, *Hippocratis et aliorum medicorum veterum reliquiæ* (3 vols., Utrecht, 1859–64). See also Adams (as cited above), and Reinhold's *Hippocrates* (2 vols., Athens, 1864–67). Daremberg's edition of the *Œuvres choisies* (2d ed., Paris, 1855) includes the *Oath*, the *Law*, the *Prorrhetics*, book i., the *Prognostics*, *On Airs, Waters, and Places*, *Epidemics*, books i. and iii., *Regimen*, and *Aphorisms*. Of the separate works attributed to Hippocrates the editions and translations are almost innumerable; of the *Prognostics*, for example, seventy editions are known, while of the *Aphorisms* there are said to exist as many as three hundred. For some notice of the Arabic, Syriac, and Hebrew translations of works professedly by Hippocrates (Ibukrat or Bukrat), the number of which greatly exceeds that of the extant Greek originals, reference may be made to Flügel's contribution to the article "Hippokrates" in the *Encyklopädie* of Ersch and Gruber. They have been partially catalogued by Fabricius in his *Bibliotheca Græca*. (J. B. T.)

HIPPOLYTUS, an ecclesiastical writer belonging to the first half of the 3d century. Of the details of his life little that is authentic is known. He appears to have been born in the latter half of the 2d century. From the fact that he employs Greek as his mother tongue, it has been supposed that he belonged to the eastern portion of the Roman empire; but this conclusion is by no means stringent, and there are various indications in his writings that he had passed some at least of his early years in Rome. On the apparently trustworthy authority of Photius (cod. 121), he is believed to have been while still a youth a personal disciple of Irenæus, perhaps in Rome, but most likely in Lyons. By inference from the vivid minuteness with which he relates details of the personal history of Callistus in the 9th book of his *Refutation* he is believed to have been in Rome from the beginning of the episcopate of Victor (189–199). It is certain that in the early years of the 3d century he was stationed in that city as a presbyter conspicuous for energy, zeal, eloquence, and learning. He was a prominent defender of Victor's view on the much vexed Paschal controversy, but came into collision with Victor's successors, Zephyrinus and Callistus, on several questions of ecclesiastical dogma and discipline. As regarded the relation between the Father and the Son in the Trinity, for example, Hippolytus defended what is known as subordinatianism against the patripassianism of the bishops, he accusing them of Noetianism while they retorted upon him with a charge of ditheism. Again, in the dispute as to whether the lapsed could ever be lawfully restored to the fellowship of the church visible, Hippolytus took the severer and Callistus the milder view. So also on the subject of clerical marriages. From his own language in the 9th book of the *Refutatio*, combined with his designation of himself in the proem, it appears that Hippolytus ultimately came to occupy in Rome the position of a bishop (*cf.* Euseb., *H. E.*, vi. 20), although not in communion with the "Catholic" party; and the difficulty of reconciling this with the strong evidence we have that Portus (*i. e.*, the Roman harbor opposite Ostia, and not Portus Romanorum or Aden, as Le Moyne and others, founding upon a misunderstanding of Eusebius, have conjectured) was the scene of his activity is probably best got over if we assume that as dissenting bishop he undertook the episcopal superintendence of his adherents in both places, but took his title from the smaller. As regards the close of his life our most trustworthy information is derived from the chronographer of 354 (Mommsen, *Ueber den Chronographen von Jahre 354*, Leipsic, 1850), according to whom "the presbyter" Hippolytus in the time of Alexander Severus (235) was banished along with the Roman bishop Pontianus to Sardinia, where, it seems to be suggested, he died.

In 1551 a marble statue of Hippolytus "Portuensis," of un-

certain date but not later than the 5th century, was dug up in Rome; it is now to be seen in the Vatican. He is represented as seated upon an episcopal throne, wearing the Greek pallium, over which the Roman toga is thrown. On the sides of the throne is inscribed in Greek the rude Easter Cycle of which he is known to have been the author; behind is given an imperfect list of his numerous works. The catalogues given by Eusebius, Jerome, and Nicephorus differ slightly in details; but all bear witness to his diligence as a writer. The extant fragments were first collected by Fabricius (*Hippolyti Opera gr. et lat.*, 2 vols. fol., Hamburg, 1716–18), and were afterwards reprinted by Galland in the second volume of his *Bibliotheca Veterum Patrum* (1766). See also Migne, *Curs. Patr. gr.*, vol. x. They include fragments of commentaries on various books of Scripture, a treatise "On Christ and Antichrist," an "expository" (ἀποδεικτική) discourse "To the Jews," a fragment "To the Greeks" or "On the Universe," tracts "Against Noetus," "Against Beron and Helix," and "On the Holy Theophany," fragments of homilies (in which kind of composition he particularly excelled), and a few short quotations preserved by the author of the *Chronicon Paschale*. The appendix in Fabricius, containing doubtful or spurious pieces, includes "A Discourse on the End of the World, and on Antichrist, and on the Second Coming of our Lord Jesus Christ," also a short account of the twelve apostles, stating where each of them labored and where each of them died, a list of the seventy apostles, heads of the canons of Abulides or Hippolytus as used by the Æthiopian Christians, and the canons of the Church of Alexandria. Of the spuriousness of the last mentioned at least there can be no doubt. A new interest in Hippolytus as an ecclesiastical writer was awakened among scholars about 1851 in connection with his *Omnium Hæresium Refutatio*, which has an interesting history. As an anonymous MS. of the 14th century it had in 1842 been brought among various other manuscripts from Mount Athos to Paris by Minoides Mynas, a learned Greek who had been commissioned by the French Government to search for such treasures, and had been deposited in the great national library where it was registered as a work *On all Heresies*. It failed for some time to attract any special notice; but the attention of M. Emmanuel Miller, an official of that institution, having been at length excited by some fragments of Pindar and of an unknown lyric poet which it contained, he was led to examine it more closely and to adopt the conclusion that it was the continuation of the fragment entitled *Philosophumena*, printed in the Benedictine edition of Origen as the work of that author. Under this persuasion he offered it for publication to the university of Oxford, from whose press it appeared in 1851 under his editorship, bearing the title *Originis Philosophumena, sive Omnium Hæresium Refutatio*. It was at once welcomed by the learned world as a literary treasure of singular value; but it was almost immediately perceived that, though Miller had certainly judged rightly in affirming it to be a continuation of the fragmentary *Philosophumena*, he had as certainly erred in attributing its composition to Origen, whose authorship of the previously known portion had already been disputed by Huet, Heumann, and Gale. By Jacobi and Duncker in 1851, who were speedily followed by Gieseler, Bunsen, Wordsworth, and Döllinger, it was with increasing confidence claimed for Hippolytus, to whom it is now attributed with almost entire unanimity by critics,—the arguments of Baur (*Theol. Jahrbb.*, 1853) in favor of the presbyter Caius, and still more those of Armellinus (*De prisca refutatione hæreseon*, Rome, 1863) in favor of Novatian, having been found to be quite unconvincing.

Originally it consisted of ten books, of which, however, only eight survive, namely, the first and the fourth to the tenth inclusive. Book i. gives an account of the different schools of ancient philosophy—Greek, Indian, and Druidical; books ii. and iii. appear to have dealt with the doctrines and mysteries of the Egyptians and Chaldæans respectively; book iv. (which is slightly defective at the commencement) treats of Chaldæan horoscopy and Egyptian theurgy; books v.–ix. dispose of the various heresies which had asserted themselves within the Christian Church. These are taken up in chronological order and arranged in five main groups, the Ophite, Simonist, Basilidean, Valentinian or Docetic, and Noetian. Whether they be regarded as attempts to Christianize paganism, to conciliate Judaism, or to gnosticize Christianity, their unscriptural character is invariably insisted on. The entire work is summarized in book x. The value of the *Refutation* as a whole, in its bearing on the history of the apostolic and subapostolic ages, and on the critical problems arising out of that history, can hardly be overestimated.

Since its first publication by Miller (Oxford Clarendon Press, 1851) it has been edited by Lagarde (*Hippolyti Romani quæ feruntur omnia Græce*, Göttingen, 1858), by Duncker and Schneidewin (Göttingen, 1859), and by Cruice (Paris, 1860). The *Refutation* as well as the other extant *Works* and *Fragments* of Hippolytus are to be met with in an English translation in the "Ante-Nicene Christian Library" (Edin., 1868–69).

See Bunsen, *Hippolytus and his Age* (1852; 2d ed., 1854; Germ. ed., 1853); Döllinger, *Hippolytus u. Kallistus* (1853; Engl. transl., Edin., 1876); Wordsworth, *St. Hippolytus and the Church of Rome in the Third Century* (1853); Cruice, *Études sur de nouveaux documents historiques empruntés au livre des Philosophumena et relatifs au commencement du Christianisme* (1853); Volkmar, *Hippolytus u. die römische Zeitgenossen* (1855); Lipsius, *Zur Quellenkritik des Epiphanios* (1865), and *Quellen der ältesten Ketzergeschichte* (1875); Harnack, *Zur Quellenkritik der Geschichte des Gnosticismus* (1873–74). Lipsius and Harnack occupy themselves largely with the question as to the relation between the *Refutatio* and a shorter treatise which can be shown to have formed the basis of the works of Epiphanius and Philaster. See also Jacobi, art. "Hippolytus," in Herzog-Plitt's *Real-Encyclopädie* (1880).

HIPPOLYTUS, St., according to the Roman breviary, was one of St. Lawrence's converts, who, when summoned before the emperor Valerian on account of the practice of his religion, made a public profession of Christianity. First beaten with rods, he was finally delivered over along with all his family to death, the mode of execution in his case being similar to that by which Hippolytus the son of Theseus perished. The mythical character of this legend, which, however, can in part be traced as far back as to Prudentius (*Hym.* 11), is recognized by Döllinger (see his *Hippolytus u. Kallistus*, chap. ii.). This saint, along with Casianus, is commemorated by the Roman Church on August 13. He is the patron of Mexico.

HIPPONAX, of Ephesus, a poet placed third, after Archilochus and Simonides, among the classic iambic poets of Greece. Expelled from Ephesus in 540 B. C. by the tyrants Athenagoras and Comas, he took refuge in Clazomenæ. There his deformed figure and malicious disposition exposed him to the caricature of the Chian sculptors Bupalus and Athenis; and he revenged himself by issuing against them a series of satires. These, though keen and bitter, are in thought and execution much inferior to the similar works of his predecessor Archilochus. His coarseness of thought and feeling, his rude vocabulary, his want of grace and taste, and his numerous allusions to matters of merely local interest prevented his becoming a favorite in Attica. He invented epic parody, and the four opening lines of a parody on the *Iliad* have been preserved in Athenæus (xv. 698 B). He was also the inventor of a peculiar metre, used after him by many writers, called the *scazon* or *choliambus*, which substitutes a spondee for the final iambus of an iambic senarius. His works, which were annotated by Hermippus of Smyrna, were at an early date mingled and confused with those of Ananius, for whom some even claim the invention of the choliambus.

HIPPOPOTAMUS, a family (*Hippopotamidæ*) of artiodactyle ungulate mammals comprising two genera, each containing a single living species. Of these the best known is the hippopotamus (*Hippopotamus amphibius*), occurring only in Africa, where it abounds in many of the river courses. It is a huge unwieldy creature, measuring in the largest specimens fully 14 feet from the extremity of the upper lip to the tip of the tail, while it ordinarily attains a length of 12 feet, with a height of 5 feet at the shoulders, and a girth round the thickest part of the body almost equal to its length. Its remarkably small ears are exceedingly flexible, and are kept in constant motion when the animal is seeking to catch a distant sound. Its eyes are placed high up on the head, and but little below the level of the ears; its gape is wide, and its upper lip thick and bulging so as to cover over even the largest of its teeth when the mouth is closed. It is provided with a considerable number of molar teeth adapted for grinding vegetable substances, and a formidable array of long spear-like incisors and curved chisel-edged canines or tusks which, according to Baker, root up the rank grass like an agricultural implement. Its legs are short, so that the body is but little elevated above the ground; and its feet, which are small in proportion to the size of the animal, terminate in four short toes each bearing a small hoof. With the exception of a few tufts of hair on the lips, on the sides of the head and neck, and at the extremity of the short robust tail, the skin of the hippopotamus, some portions of which are 2 inches in thickness, is entirely destitute of covering. It is usually of a dark fleshy red color, irregularly marked with blackish spots. The hippopotamus is a gregarious animal, living in herds of from 20 to 40 individuals on the banks and in the beds of rivers, in the neighborhood of which it most readily finds its appropriate food. This consists chiefly of grass and of aquatic plants, of which it consumes enormous quantities, the stomach of one of these creatures being capable of containing from 5 to 6 bushels. They feed principally by night,

remaining in the water during the day, although in districts where they are little disturbed by man they are less exclusively aquatic. In such remote quarters they put their heads boldly out of the water to blow, but when rendered suspicious by man's persecution, they become exceedingly cautious in this respect, only exposing their nostrils above the water, and even this they prefer doing amid the shelter of water plants. In spite of their enormous size and uncouth form, they are expert swimmers and divers, and can, it is said, remain easily under the water from five to eight minutes. They are also said to walk with considerable rapidity on the bottoms of rivers, beneath at least a foot of water. At night-fall they come on land to feed; and when, as often happens on the banks of the Nile, they reach cultivated ground, they do immense damage to growing crops, destroying by their ponderous tread even more than they devour. To scare away these unwelcome visitors the natives in such districts are in the habit of kindling great fires at night. Although they do not willingly go far from the water on which their very existence depends, occasionally they have been found to travel long distances by night in search of food, and in spite of their clumsy appearance they are able, according to Baker, to climb up steep banks and precipitous ravines with astonishing power and ease. Of a wounded hippopotamus which that traveller once saw leaving the water and galloping inland, he says, "I never could have imagined that so unwieldy an animal could have exhibited such speed. No man could have had a chance of escape." The hippopotamus does not confine itself to rivers only, but when opportunity occurs of exercising choice it has been known to prefer the waters of the ocean as its home during the day. Of a mild and inoffensive disposition, it seeks to avoid collision with man; when wounded, however, or in defence of its young, it is wont to exhibit the greatest ferocity, and the native canoes are frequently capsized and occasionally demolished by its infuriated attacks, its usual bellowing grunt then becoming loud enough to be heard a mile away. As among elephants, so also among hippopotami there are "rogues"—old bulls which, having been expelled from the herd, have become soured in solitude; these are at all times dangerous. Assuming the offensive on every occasion, they attack all and sundry without shadow of provocation; the natives, therefore, are careful to avoid the haunts of these *solitaires*, which are usually well known.

Hippopotamus.

The rifle of the European has proved the most potent destroyer of the hippopotamus; but to prove effective it must be aimed at the head, the most vulnerable points in that region being immediately behind the ear and in the eye. Everywhere regarded as a valuable prize, the natives employ a variety of methods in order to secure it, the most common of these being the use of an iron harpoon attached to a line. Allowing themselves to float down stream on a raft, the hippopotamus hunters no sooner reach the sleeping herd than the expertest of them plunges his harpoon deep into the body of the selected victim. The light canoes are then launched from the raft, and with all speed the hunters make for the shore, bearing with them the line attached to the harpoon, which they further secure by giving it a turn round the trunk of a tree. Unable to free itself, the hippopotamus wastes its strength in impotent rage, its persecutors meanwhile assailing it with a shower of javelins under which its life blood gradually ebbs away, until at last it is hauled up dead or dying on the shore. Another native method of destroying these animals is by means of a trap known as the "downfall," consisting of a heavy wooden beam armed at one end with a poisoned spear-head and suspended by the other to a forked pole or overhanging branch of a tree. The cord by which the beam is suspended descends to the path beneath, across which it lies in such a manner as to be set free the instant it is touched by the foot of the passing hippopotamus; the beam thus liberated immediately descends, and the poisoned weapon passes into the head or back of the luckless beast, whose death in the adjacent stream takes place soon after. Such "downfalls" are placed over the paths by which the animals are in the habit of reaching their nightly feeding grounds. They are also occasionally taken by means of ordinary pitfalls, so dexterously concealed as often to entrap the unwary traveller. Although inferior in sagacity to the elephant, the hippopotamus is very far from being stupid, as is frequently proved by its remarkable adroitness in the discovery and avoidance of traps and pitfalls, as well as in its timely migration from localities which, owing to the prevalence of the rifle, have become no longer tenable. It is said to be possessed of a remarkably tenacious memory, so that, according to Sir Andrew Smith, when once it has been assaulted in its watery dwelling and injured through incautiously exposing itself, it will rarely be guilty of the same indiscretion a second time, even although a very long period should elapse before its haunts are revisited. The female is less in size than the male, and is exceedingly shy, taking to the water with her young, which she usually carries astride on her neck, on the slightest alarm. It is only after long practice that the young become able to remain as long under the water as their parents, and for this reason the females while tending them come much oftener to the surface than their own necessities require. The period of gestation, as observed in females confined in the Zoological Gardens of London and Paris, extends to nearly eight months; the young reach maturity in five years; and the full term of life in the species is believed to extend to thirty years. The male hippopotamus which recently (1878) died in the Zoological Gardens, London, was captured in August, 1849, when only a few days old; it had thus nearly attained the age of twenty-nine, while an examination of its dead body disclosed, says Professor Owen, "no special morbid appearance to suggest that death from old age had been anticipated" (*Annals and Magazine of Nat. Hist.*, September, 1879). The flesh of the hippopotamus is generally considered a delicacy both by natives and colonists, although according to Livingstone there are certain tribes on the Zambesi who have as great an abhorrence of hippopotamus meat as Mahometans have of swine's flesh. The fatty matter lying between the skin and the muscles is one of the purest of animal fats, and was formerly in great request among the Cape colonists when as yet those amphibians abounded in the rivers of that colony. The skin of the hippopotamus is turned to profitable account in the manufacture of elastic whips, which are in great demand throughout the African continent. The skin, according to Schweinfurth, when fresh is cut into long quadrilateral strips, which when half-dried are trimmed with a knife and afterwards hammered out, like iron on an anvil, into round whips. As several hundreds can be made from a single hide, that part is of considerable commercial value. Still more valuable are the tusks and incisor teeth, which, from their extreme hardness and the fact that they do not readily become yellow, are now largely used in the manufacture of artificial teeth. The hippopotamus formerly abounded in such rivers as the Nile, the Niger, the Senegal, and most of the rivers of South Africa. It is now, however, becoming gradually more restricted in its distribution, having disappeared altogether from the Egyptian Nile,—although still abundant in its Abyssinian tributaries,—as well as from the rivers of Cape Colony.

The Liberian hippopotamus (*Chœropsis liberiensis*), the only other existing member of the family, is exceedingly rare, having been only known until recently from the two skulls on which the genus and species were founded. It differs from the common species in possessing only one pair of incisors in each jaw instead of two, and in several other minor points. A few years ago a young specimen of this rare species was brought alive to England from the Scarcies river, north of Sierra Leone, but it died soon after landing. The species is found on the west coast of Africa and on certain of the rivers flowing into Lake Chad.

Although there are thus only two living species, both of which are confined to Africa, the hippopotamus family was both larger and more widely distributed in former periods of the earth's history, fossil remains of at least nine species having been found in the Tertiary deposits of Europe and India. In Europe they occur as far north as Belgium and the south of England, but they are found nowhere in such abundance as in the island of Sicily, from which they were formerly exported in shiploads to England and France, where they were used in the manufacture of lamp-black and manure. The occurrence of these animals in a place which they could not possibly have reached had it always been an island, is regarded as one of the many proofs that dry land existed during some portion at least of the Tertiary period between Italy and Africa. (J. GL)

END OF VOLUME ELEVENTH.

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day per man, which sum included salaries for all officers, employees, commissioners, medical attendance, etc., as well as subsistence and clothing. The territory sustains four charitable hospitals, one at Santa Fé, one at Las Vegas and two at Silver City, where indigent persons are supported at the expense of the public.

In 1900 taxes were levied on property of the total equalized value of $39,090,501. The total amount of taxes levied was $304,636, for the following purposes: For territorial expenses, $233,683; for casual deficit, bond interest, $10,288; for territorial institutions, $58,435; for cattle indemnity, $2,227. Debt of territory (1901), $1,180,800.

The National Guard of the territory of New Mexico consists of five companies of infantry and three troops of cavalry. One of the latter consisted of La Guna Indians, officered by Americans, and had made an enviable record against the renegade Indians, headed by Victorio and Geronimo. The membership of the other companies consisted largely of frontiersmen who have served the territory whenever their services have been required. No appropriation had ever been made up to 1896 for the support and maintenance of the National Guard, and in the campaigns in which many of the companies have been engaged, some of which lasted for periods of upward of four months, they furnished their own horses and had subsistence supplied by the citizens.

In 1890 there were, in New Mexico, 463 church organizations, 381 edifices, a membership of 105,749, which constituted 68.85 per cent of the population, and church property of the value of $531,925. There were 12 different denominations, the most prominent, in point of numbers, being the Regular Baptists, North, 15 organizations (the only Baptists in the territory); Roman Catholics, 317 organizations; all Methodists, 60; all Presbyterians, 39; and Protestant Episcopal, 16.

March 30, 1905, there were 61 newspapers and other periodicals published in the territory, of which 4 were daily, 56 weekly, and 1 monthly. Papers were published in 20 of the 25 counties, and in 33 of the cities, towns, and villages, of which 15 were county seats.

The principal cities and towns of New Mexico, with their populations as given in the census of 1900, are given herewith: Santa Fé, 5,603; Albuquerque (city), 6,238; Las Vegas, 3,552; Silver City, 2,735; Albuquerque (old), 1,191; Socorro, 1,512; Raton, 3,540; and Roswell, 2,006.

The following is a list of the governors of New Mexico since the organization of the territory, with their respective terms of office: James S. Calhoun, 1851–52; William C. Lane, 1852–53; Solon Borland, 1853; David Merriwether, 1853–57; Abraham Rencher, 1857–61; Henry Conolly, 1861–65; Robert B. Mitchell, 1865–67; W. F. M. Army (acting), 1867–69; William A. Pile, 1869–71; Marsh Giddings, 1871–76; Samuel B. Axtel, 1876–78; Lewis Wallace, 1878–81; L. A. Sheldon, 1881–85; E. G. Ross, 1885–89; L. B. Prince, 1889–93; W. T. Thornton, 1893–97; Miguel A. Otero, 1897–1901, reappointed in 1901 for term 1902–6; George Curry, 1907–11.

NEW MEXICO, UNIVERSITY OF, a state institution of learning at Albuquerque, provided for by an act of the legislature of 1888–89, and organized in 1892. It is equipped and supported by territorial appropriations. It is expected that when New Mexico receives statehood the institution will receive a liberal grant of public lands, as has been the practice in regard to similar institutions in other states. Owing to the sparse population, the board of regents found it advisable to receive students many of whom properly belong in high schools, thus repeating the history and experience of other youthful institutions. There is attached to the university a preparatory school of a two years' course, from which scholars can proceed to the university itself. In 1904 there were 15 instructors and 165 students; and the total income was $18,800.

NEW MILFORD, a town of Litchfield County, Connecticut, in the western part of the state. It lies on the Housatonic River, a few miles from the New York line, and is reached by the Housatonic branch of the New York, New Haven and Hartford railroad. It had in 1900 a population of 4,804. W.F.J.

NEWNAN, Georgia, the seat of Coweta County; a manufacturing city and agricultural trade center, on the Atlantic & West Point, and Central of Georgia railroads, 38 miles S.W. of Atlanta. It has flour, cotton and oil mills, machinery and building material factories. Population, 1890, 2,859; 1900, 3,654. C.L.S.

NEW NETHERLANDS, THE FOUNDING OF. See UNITED STATES, Vol. XXIII, p. 780.

NEWNHAM COLLEGE, England, an institution for the higher education of women, founded at Cambridge in 1871, consequent on the success of the systematic courses of lectures delivered by professors of the university to women in the preceding year on various branches of literature and science. The lectures resulted in the formation of an association to maintain and develop the system and to provide pecuniary assistance to enable promising students to continue their education. A small house provided for students was soon found inadequate in its accommodation, and in 1874 a company was formed for the purpose of erecting Newnham Hall, which was opened the following year and is now known as the South Hall of Newnham College, the success of the undertaking having called for additional buildings. Since 1874, informally, and since 1881, officially, students are admitted to the university tripos examinations, receiving, however, certificates instead of degrees. The faculty numbers 15 resident and 37 non-resident teachers. C.L.S.

NEW ORLEANS, the chief city of Louisiana. Jan. 1, 1890, the municipal debt aggregated $17,009,209.82. The real and personal property of the city was listed at $122,000,000 and the rate of taxation fixed at 20 mills per $100.

The principal manufacturing industries, as reported by the United States census of 1900, show the following figures. These are the figures as given in the comptroller's report for the year. The total assessment valuation includes both real and personal property:

Principal Manufacturing Industries. (1900.)	No. of Establishm'ts Rep'ting	Aggregate Capital Invested.	Wages Paid.	Total Value of Products.	Average Number of Employees.
Carriages and wagons, including custom work and repairing ..	24	$ 149,489	$ 93,514	$ 269,491	221
Clothing, men's, factory products	24	1,154,956	386,809	2,036,069	2,045
Cooperage.....	55	245,017	120,830	515,835	317
Cotton, cleaning and rehandling.	....	.....	.....	.....	....
Cotton, compressing	....	.....	.....	.....	....
Cotton, ginning...	....	.....	.....	.....	....
Foundry and machine-shop products.....	39	2,235,868	525,783	2,199,854	1,015
Furniture, factory products.....	6	256,420	78,152	312,923	238
Liquors, malt.....	6	3,299,326	224,985	1,472,062	374
Lumber and other mill products from log or bolt.....	10	1,345,907	205,084	1,403,343	543
Lumber, planing-mill products, including sash, doors and blinds	9	485,957	127,157	552,250	321
Rice, cleaning and polishing.....	9	855,234	78,346	2,924,564	153
Sugar and molasses refining.....	10	17,773,184	407,859	22,684,920	781
Oil, cottonseed and cake.....	5	670,736	64,786	1,043,623	158
Tobacco, cigars and cigarettes ..	27	502,518	402,934	1,388,305	1,176

As a shipping-point, New Orleans stands as one of the most important in the country. The following statistics from the United States census of 1898 will show some of the most important facts in regard to the city's traffic by water.

Tons of freight moved and miles covered by the passenger and freight-carrying vessels, exclusive of ferry-boats:

Coal.	Lumber.	Stone.	Ice.
3,580	415,128	1,974	299

Cement, Brick and Lime.	All Other Commodities.	Total.	Miles Covered.
12,955	467,689	901,625	821,236

Summary showing the amount of freight moved and miles traveled by the passenger and freight-carrying vessels in the various traffic districts: Tons of freight moved, 1,144,754; number of miles traveled, 1,288,267.

Equipment, occupation and construction; equipment of fleets in general:

Total of All Crafts.			Steamers.		
Numb'r.	Tonnage.	Valuation.	Numb'r.	Tonnage.	Valuation.
283	36,304	$1,910,060	56	31,407	$1,712,700

Sailing-Vessels.			Unrigged Crafts.		
Numb'r.	Tonnage.	Valuation.	Numb'r	Tonnage.	Valuation.
214	4,247	$194,360	13	650	$300

Financial account in general; gross earnings, expenses and net earnings of the passenger and freight-carrying vessels, exclusive of ferry-boats:

Total.			Steamers.		
Gross Earnings.	Expenses.	Net Earnings.	Gross Earnings.	Expenses.	Net Earnings.
$1,943,309	$1,439,731	$503,578	$1,685,854	$1,231,311	$454,543

Sailing-Vessels.			Unrigged Crafts.		
Gross Earnings.	Expenses.	Net Earnings.	Gross Earnings.	Expenses.	Net Earnings.
$254,655	$206,420	$48,235	$2,800	$2,000	$800

Employees' wages; total wages paid during the year to employees making ordinary crews of the passenger and freight-carrying vessels, exclusive of ferry-boats:

All Crafts.		Steamers.	
Number Making Ordinary Crews.	Wages Paid During Year.	Number Making Ordinary Crews.	Wages Paid During Year.
1,041	$303,456	500	$172,796

Sailing-Vessels.		Unrigged Crafts.	
Number Making Ordinary Crews.	Wages Paid During Year.	Number Making Ordinary Crews.	Wages Paid During Year.
538	$129,220	3	$1,440

The most notable building of New Orleans is the United States custom-house, the largest public building in the United States excepting the capitol and treasury buildings at Washington, built of Quincy (Massachusetts) marble; next is the city hall, on St. Charles Street, built of white marble; then come the Tusco-Doric court-houses, on Jackson Square; the Roman Catholic Cathedral of St. Louis; the Merchants' Exchange, built of marble; the Masonic and Odd Fellows' halls; St. Patrick's hall, with a seating-capacity of three thousand five hundred; the Hotel Royal; Exposition hall; Mechanics' Institute; Sugar and Produce exchanges; new Cotton Exchange; Howard Memorial Library, erected by Miss Annie Howard in memory of her father; Sophie Newcomb Memorial College; Charity Hospital; United States Marine Hospital; the Hotel Dieu; French opera-house; Academy of Music; National, Varieties and St. Charles theaters, and the French market.

The following railroads run into New Orleans: The Illinois Central; the Louisville and Nashville; the New Orleans, Fort Jackson and Grand Isle; the New Orleans and North Eastern; the New Orleans and Southern; and the Southern Pacific.

In 1890 there were 180 churches, including almost every denomination: 55 Baptist, 31 Roman Catholic, 11 Methodist Episcopal, 11 Lutheran, 6 Evangelical Protestant, 5 Congregational, 5 Hebrew, 1 Unitarian, 1 Christian, 1 Greek.

The census of 1890 showed 54 grammar-schools and 3 high-schools, besides numerous private colleges, schools and academies; the Tulane University (q.v., in these Supplements); New Orleans University; the Jesuit College; the Southern University, a state institution; the Leland University; and the Straight University (q.v., in these Supplements), which is exclusively for colored students.

There are six lines of street-railways, amounting in distance to about one hundred and fifteen miles.

New Orleans has 8 daily papers, 28 weekly, 3 semi-weekly, 5 monthly and 2 semimonthly. Population 1890, 242,099; 1900, 287,104. See NEW ORLEANS, Vol. XVII, p. 412.

NEW ORLEANS, BATTLE OF, occurred Jan. 8, 1815, at New Orleans, Louisiana, between the troops of Great Britain under General Pakenham and the United States troops under General Andrew Jackson. The British forces had been concentrating at Lake Borgne, near New Orleans, preparatory to an attack upon the city. Their movements were watched closely by Jackson, and, as they began the march toward the city in December, 1814, he advanced to meet them on a plain called Chalmette, five miles from the city. There, Dec. 23d, 28th and Jan. 1st, sharp engagements took place, in which Jackson was victorious. Pakenham was reinforced, and Jan. 8, 1815, with 10,000 men attacked the fortifications of the city, manned by only 5,000 men. Jackson had valuable assistance from the gunboat *Louisiana*, which bombarded the British camp. The British made a fierce attack upon the breastworks, but were met by such a musketry-fire that they fell back in great disorder. The three British generals were wounded severely, one of them mortally. The loss to the Americans was 8 killed and 13 wounded; to the British, 700 killed, 1,400 wounded and 500 taken prisoners.

NEW PHILADELPHIA, a city and the county seat of Tuscarawas County, Ohio, in the central-eastern part of the state. It is on the Tuscarawas River and the Ohio and Erie canal, and is reached by the Cleveland, Lorain and Wheeling and the Pennsylvania railroads. It is largely given to coal, iron and salt industries, and to varied manufactures. Its population in 1900 was 6,213. W.F.J.

NEWPORT, a village of Jackson County, central-northeastern Arkansas, 32 miles E. of Harrisburg, on the White and Black River Valley railroad; has saw, shingle and planing mills; stair, oil and stave works; also foundries and machine-shops. Population, 1890, 1,571; 1900, 2,866.

NEWPORT, Kentucky, a city and the county seat of Campbell County, in the extreme northern part of the state. It lies on the Ohio River, opposite Cincinnati, Ohio, and is an important commercial and manufacturing center, having a large river trade and being reached by the Chesapeake and Ohio and the Louisville and Nashville railroads. It is at the mouth of the Licking River, which separates it from Covington. Its population in 1900 was 28,301. W.F.J.

NEWPORT, New Hampshire, a town and the county seat of Sullivan County, in the western part of the state. It is thirty-three miles west by north from Concord, on the Boston and Maine railroad, and is near Mount Sunapee and Lake Sunapee, and thirteen miles from the Connecticut River and Mount Ascutney in Vermont. Its situation makes it a favorite summer resort, and it also has extensive industries. Its population in 1900 was 3,126. W.F.J.

NEWPORT, a borough of Perry County, eastern-central Pennsylvania, 6 miles N.E. of New Bloomfield and 28 miles N.W. of Harrisburg on the Juniata River, the Pennsylvania Canal, and the Pennsylvania and the Newport and Sherman Valley railroads; is in an agricultural region, and has a tannery, a planing-mill, a furnace, foundry, pottery, and glue factory. Population, 1900, 1,734.

NEWPORT, Rhode Island, the county seat of Newport County, formerly one of the capitals of the state, lies on the southern end of Aquidneck or Rhode Island, between Narraganset Bay (q.v.) and the Sakonnet River, also fronting upon the Atlantic Ocean. It has long been the most fashionable summer resort of America, and is a great center of yachting. It is the site of the United States Naval War College. It is reached by steamers from New York and by the New York, New Haven and Hartford railroad. Its population in 1900 was 22,034. W.F.J.

NEWPORT, Vermont, a township and village of Orleans County, on the northern border of the state. The village lies at the mouth of Black River and at the head of Lake Memphremagog. It is reached by the Central Vermont and Boston and Maine railroads, and had in 1900 a population of 1,874. W.F.J.

NEWPORT NEWS, a town and the county seat of Warwick County, Virginia, in the south-east corner of the state. It lies on the north shore of the great estuary of the James River, is reached by the Chesapeake and Ohio railroad, is the seat of one of the chief shipbuilding yards of America, and is rising into prominence as a shipping point for grain and other commodities, being now the fourth largest grain port of the United States. Its population in 1900 was 4,449. W.F.J.

NEW PROVIDENCE. See BAHAMAS, Vol. III, p. 204.

NEW RED SANDSTONE. See GEOLOGY, Vol. X, p. 311.

NEW RICHMOND, a village of Clermont County, southwestern Ohio, 11 miles S.W. of Batavia, on the Cincinnati, Georgetown and Portsmouth railroad; has woolen-mills, brick and furniture works, flour-mills and other industries. Population, 1890, 2,379; 1900, 1,916.

NEW RICHMOND, a village of St. Croix Co., eastern Wisconsin, 15 miles N.E. of Hudson and 90 miles E.N.E. of Eau Claire, on Willow River, and on the Chicago, St. Paul Minneapolis and Omaha rail-

road. It has water-power, running a large flour-mill. Pine and hardwood timber is abundant in the district, and pine lumber is largely manufactured here. Population 1900, 1,631.

NEW ROCHELLE, a residence city of Westchester County, New York, on Long Island Sound, 18 miles from New York, on the New York, New Haven and Hartford railroad. It was founded by French Huguenots. Its population in 1900 was 14,720. W.F.J.

NEW SIBERIAN ISLANDS. See SIBERIA, Vol. XXII, p. 10.

NEW SOUTH WALES. For history, geography, etc., see NEW SOUTH WALES, Vol. XVII, pp. 418–422.

GOVERNMENT. The constitution vests the legislative power in a Parliament of two houses, the first called the Legislative Council, and the second the Legislative Assembly. The Legislative Council consists of not less than 21 members (69 in 1901), appointed by the crown for life, and the Assembly of 125 members in 1901. The duration of a Parliament is not more than three years. By an act of Sept. 21, 1889, each member of the legislative assembly is paid $1,500 per annum. To be eligible or entitled to vote, a man must be of age, a native or naturalized subject of the British sovereign and have resided one year in the colony and three months in his electoral district before an election. The holder of real property in any constituency also is allowed to vote. The voting is taken by secret ballot. In 1898 there were 324,338 electors enrolled, or 24.28 per cent of the population. At the last general election, in 1898, 56.41 per cent of the electors on the roll voted. The executive is in the hands of a governor, appointed by the imperial government, who has a salary of $35,000. The governor is assisted by a cabinet of ten ministers.

AREA AND POPULATION. The area of the colony is 310,700 square miles. The population, according to census January 1, 1901, was 1,359,943. According to the census of 1891, of the total population only 73-100 of one per cent were aborigines, and the white persons born in the colony formed 64 per cent. The population of Sydney, the capital, in 1901, was 488,968 including suburbs.

JUDICIARY. The legal business of the colony is under the Department of Justice, administered by the Minister of Justice, to whom the supreme, circuit and district courts are responsible. There is a supreme court, with a chief justice and six puisne judges. All prisoners charged with capital crimes are tried by a jury of twelve persons. Circuit courts are held at the principal towns in the colony twice a year. District courts are established for the trial of civil causes in which the amount claimed does not exceed $1,000. They are presided over by judges specially appointed, who also perform the duties of chairmen at quarter sessions, at which prisoners charged with other offenses than capital crimes are tried. In the metropolitan district, police courts are presided over by stipendiary magistrates; in the country districts, police magistrates and justices of the peace adjudicate. The licensing of houses for the sale of spirituous and fermented liquors is transacted by magistrates specially appointed for that purpose.

RELIGION. Since 1862 there has been no aid given to any church by the state. The principal denominations are Church of England, Roman Catholic, Presbyterian and Methodist. The Salvation Army has also a strong following.

EDUCATION. In 1880 state aid to denominational schools was abolished and instruction made compulsory, between the ages of 6 and 14 years; the children of the poor are educated free. There are not only primary public schools, but also high schools for both sexes. There were, in 1900, 2,745 state schools, with an enrollment of 238,382 pupils and 5,063 teachers. The gross expenditure for the year was about $3,905,275. Of private schools there were 912, with 3,352 teachers and 60,327 pupils. Of these, 325 schools, with 1,617 teachers and 40,136 pupils, were Roman Catholic. The University of Sydney was founded in 1852, and its degrees in arts, law and medicine are recognized as on an equality with those of the United Kingdom. The Government grants a yearly subsidy of $60,000. The total revenue for 1900 was $183,775. There were 583 students attending during session, 1899–1900. There are 50 professors and lecturers. There is a free public library at Sydney, with 154,140 volumes in 1901. In addition there were 6 schools of a charitable character, with 26 teachers and 801 pupils.

FINANCE. The revenue for 1899–1900, arising from taxation, land revenue, and services (railway, postal, telegraph, etc.), was $49,800,000, while the expenditure aggregated $49,550,000. At the census of 1898 the estimated public wealth of the colony was $850,000,000, the estimated private wealth was $1,890,580,000, making the total wealth of the colony $2,739,107,500. The public debt of the colony, June 30, 1900, was about $325,000,000.

DEFENSE. In 1900 the land force of the colony comprised 9,231 men, of whom 726 formed the regular military force, and 8,505 volunteers, most of whom were partially paid. The naval force is composed of 614 men. The military expenditure of the colony in 1899–1900 was $1,300,000.

AGRICULTURE. In 1900 there were 2,440,968 acres, or a little less than one per cent of the area of the colony under cultivation. The cultivated land is principally to be found in small holdings of less than 500 acres. The area sold is not to exceed 200,000 acres annually, and the maximum area for purchasers is 640 acres.

In 1900, 1,426,166 acres sown to wheat produced 13,604,166 bushels; 214,697 acres planted with maize produced 5,976,022 bushels; 29,125 acres sown to oats produced 627,904 bushels. Sugar-cane was raised to the amount of 169,068 tons. Vineyards, with an area of 8,278 acres, produced 740,000 gallons of wine, 9,624 gallons of brandy, and 3,652 tons of table-fruit. The principal fruit-culture of the colony is that of the orange. There were in 1900, 14,533 acres in oranges, with an estimated production of 6,440,000 dozen. On Jan. 1, 1900, the colony had 36,213,514 sheep, 1,967,081 horned cattle, 482,200 horses, 239,973 pigs. In 1887 a forest conservation department was created, and attached

to one of the principal state departments. There are 1,084 state forests, covering 5,946,355 acres.

MINERAL PRODUCTION. The mineral products are many, and mining forms a very important industry. Gold, known in 1823, was worked first in 1851, near Bathurst. It is found over an area of 70,000 square miles, in granite, porphyry, diorite, quartz, breccias and alluvial deposits. Dry-blowing is employed by miners where water is scarce. Often gold is mixed with silver, copper, or tin, and the metal is worth, according to purity, from $18 to $20 an ounce. The output to the end of 1906 was about $271,570,000, that for 1899 being about $8,750,000. Silver, found at Boorook, Sunny Corner, etc., abounds in the Barrier Ranges near South Australia, at Silverton, Thackaringa, etc., where there are over four thousand miners. Discovered in 1883, in an almost rainless region, the silver area is 100 miles by 12. In 1906 the product of silver was 284,994 ounces, worth $183,655. Copper, first mined in 1858, yielded $3,947,630 in 1906, its ore being known to extend over 8,000 sq. miles. Tin, worked since 1872, from streams and lodes in granite, has fields of equal area, with a total 30 years' yield of $30,000,000. Lead is chiefly obtained from silver mines. Antimony, manganese, bismuth, etc., are mined. Iron is abundant, but not profitable to work, owing to the cost of labor. Precious stones, as the diamond, emerald, zircon, sapphire, topaz, etc., occur in granite localities. Asbestos, zinc, mercury, cobalt and alum are exported. Graphite, kaolin, and building-stone enrich industry. Coal is the most valuable mineral of New South Wales. It extends over 24,000 square miles; $251,783,000 worth was mined during 1860–1906. The yield for 1906 was about $11,680,000 from 7,626,362 tons. Kerosene shale, rich in the Blue Mountains, yielded 150 gallons crude oil per ton. Its product for one year was $383,335.

MANUFACTURES. The report of 1906 gives the number of factories of various classes as 3,828, employing 77,758 hands, with a capital invested in 1906 of $66,325,000.

IMPORTS AND EXPORTS. The imports for 1899 amounted to $128,000,000, and the exports to $142,000,000.

ROADS, RAILROADS, TELEGRAPH, ETC. In 1899 there were 16,932 miles of government roads formed, metaled, and graveled; 7,127 cleared and properly drained; also 7,988 miles of roads in municipalities.

The following are particulars of the railways in the colony, June 30, 1900: Lines open for traffic, 2,771 miles owned by the government, and 85 miles of private railways. The total amount of money expended on railway construction to June 30, 1900, was $192,385,000. The net earnings for the year 1899–1900 amounted to $7,060,000.

The tramways are the property of the government. There were on June 30, 1900, 71 miles open for traffic, the capital cost being $9,300,000.

In 1900 there were 1,668 post-offices.

At the end of the year 1900 there were 41,494 miles of telegraph wire in operation, the cost of constructing which amounted to $5,657,375; and 945 stations.

BANKS. The bank assets of New South Wales amounted in 1900 to $215,976,070, about four-fifths being discounts. The Savings Bank of New South Wales, established in 1832, of which the governor is president, in 1900 had 12 branches. There are also post-office savings banks. Both institutions in 1900 had 282,643 depositors, whose aggregate deposits amounted to $54,656,910, giving an average account of nearly $195.

The colony controls 14 lighthouses, one of which, the Macquaerie, was the first south of the equator to employ electric lighting.

*NEWSPAPERS IN THE UNITED STATES, are periodical publications containing records of current events and items of public interest, and are issued at regular intervals, i.e., daily, semi-weekly, weekly, etc. (For the origin and early history of newspapers, see NEWSPAPERS, Vol. XVII, pp. 422–449.) Periodicals devoted to the dissemination of news in its various forms are more properly called newspapers, as they publish the most important happenings in the various walks of business, social and religious life, with or without comment. They also include in their columns advertisements of the various articles of trade and commerce of the country in which they are published, as well as many from foreign parts. The great "art of journalism" is to be first in obtaining all legitimate news, first in accuracy and in the fairness in which it is stated, and first in securing the freshest, brightest and most picturesque features for the general reader. These are some of the requirements of the modern newspaper. There should be, in addition to this, a sound moral force underlying all the editorial comment,—a force that first and above all is American, believes in our institutions, is in favor of our Constitution and the Declaration of Independence, and that never forgets that the flag of the Republic must ever be regarded as the symbol of a government that has for its fundamental principles equality, fraternity and liberty.

It is only within a comparatively few years that practically all the people read newspapers. But a decade ago it was considered a luxury not to be indulged to subscribe for a daily paper, except in cities and large towns. Newspapers were then for the classes, and the classes that habitually read daily prints were people chiefly interested in the large affairs of life; in the dignified, the moral, the esthetic side of life. It was then not only easy for the newspapers to observe all the proprieties and exclude everything that savored of sensation, but it was necessary for them to do so.

It is different now. Newspapers have spread over the whole world. Everybody reads them. Where one copy was sold a quarter of a century ago, thousands now go out among the people. No one is too poor, none live too remote, to have a daily newspaper. They must now be made for the masses instead of for the classes, and they must be made as the masses want them made.

A newspaper must stand for something: if it stands for business alone, the world will know it; if it stands for character and principle, for purity in public and private life, for honesty and fairness in our relations with our fellow-men, the newspaper is

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an educating power for good in all that makes men and women better. If a newspaper stands for nothing but success, gained at whatever cost, its influence as an educator will be a cipher. If an editor is indifferent as to whether the world grows better, his newspaper must reflect that spirit. If he has faith in humanity, in the power of human love to make this life look bright and cheerful, unconsciously he will mold his editorial words to deepen and broaden that faith.

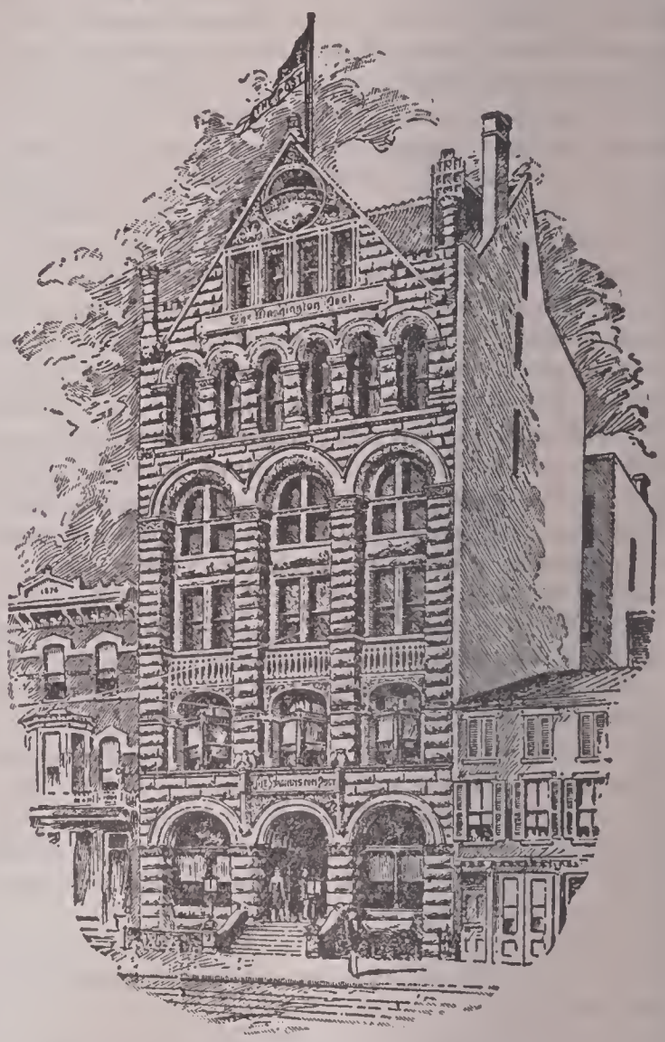
Primarily, the publication of a newspaper is a business enterprise. The world recognizes and applauds success. Self-preservation requires that the editor and his family shall be fed and clothed, and happiness must come in this way. But there are successful newspapers—in the conduct of which sensation is held to be enterprise—which we do not wish to admit to our homes.

American newspapers are improving. The number of those which resort more to argument and less to vilification and abuse is increasing. As intelligence becomes more widespread, the moral character of American newspapers improves. The most influential newspaper in any American field to-day is the one that is run upon the highest intellectual and moral plane, the one that uses the best sense and the best morals. Gradually the paper that is guided by no moral or political principle is losing its hold. It is dropping to the rear. The best paper in every field—the paper with a moral purpose—is forging ahead and leaving the time-serving, characterless sheet in the rear, where it of right belongs.

There is but one other desideratum of a perfect newspaper, and that is, that it should give all the news. To do this the news journal must also contain advertisements. These are news, the freshest, the most constantly varied, the most interesting news of all. Without advertisements successful newspapers would be impossible and they would perish from the earth. By their means all can learn where best and cheapest to supply their wants, and by advertisements all can make their wants known. It is the task of the journalist to furnish his readers with a paper which shall combine the double functions of a narrator of the story of the world from day to day and of an epitome of commercial information. To render his paper an acceptable medium to the public who want to sell or to buy, the journalist must offer the advantage of an extensive circulation. To obtain this circulation he must provide the news-seeking public with the best and fullest information gathered from every corner of the earth. The gathering and publishing of news is an expensive process, but for this the advertising columns furnish the "sinews of war." The first-class newspaper attracts the first-class advertisements; the advertisements, in a large measure, enable the publisher to create and maintain the first-class newspaper.

The methods of gathering news for the great commercial dailies or the country weeklies vary only in degree. The publications of the larger cities require a corps of writers whose duty it is to cover all departments of news which may be of interest to the reading public. The possibilities, therefore, of city journalism are almost unlimited; while in the smaller cities the opportunities for enterprise are somewhat restricted.

In the making of a metropolitan daily there are certain positions which are allotted to specialists, and these, in a measure, become fixtures on the papers with which they are identified. The person upon whom supreme responsibility rests in a daily newspaper office is generally known as the editor-in-chief. He represents more directly the publisher or the proprietors of the newspaper than does any other individual. It is his duty to see that the paper con-



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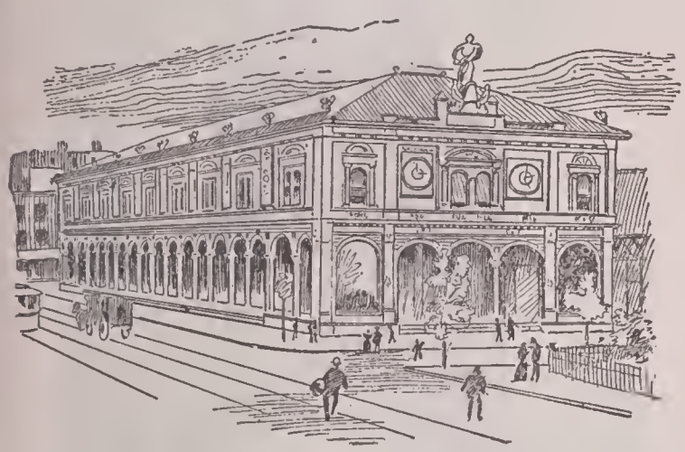
forms to the general policy decided upon by the owners of the paper, and that the proper persons are employed to carry out these instructions. Next in importance is the managing editor, upon whom the real labor of getting out a newspaper devolves. He has the selection, in almost all cases, of the personnel of editorial writers, city editor, exchange editor, and the many other assistants which vary considerably in different newspaper offices. It is customary, among the larger metropolitan dailies, to hold daily conferences, during which the views of the more important representatives of the paper are presented, public matters discussed and a general policy outlined, which then is followed out as nearly as possible by the subordinates.

The city editor is vested with the control of the "local" or city staff—reporters who gather and write what is known as "the local news," which includes

nearly everything that is printed in the paper that does not come by telegraph or appear on the editorial page. These reporters are given definite assignments throughout the day, and go from their respective offices with a fixed object to accomplish, and are not sent out on a roving commission to see what they can find, as has popularly been supposed. The work of gathering city news has been simplified greatly during the last 15 years by the establishment of local city press associations, to cover what is known as routine news, i. e. the courts, police, hospitals and other headquarters where news is to be obtained daily by keeping a close watch on public affairs and awaiting new developments. On important papers there is a day city editor and a night one. There are office men also to read copy, prepare headings and keep a schedule. Reportorial work is divided according to the amount of news going. The city editor enters on his assignment-book, days and weeks in advance, all regular meetings of civic bodies, clubs and organizations of which he can obtain knowledge, and deputes reporters to attend to them. The court reporters spend the day



"NEW YORK HERALD" BUILDING.

at the courts, prepare the records and report all cases of importance. Men are detailed specially for trials, for the city council, the county board and other municipal centers. One man attends to all routine railroad matters, another to the lake, river or ocean marine.

The telegraph editor on a newspaper has the responsibility of caring for all of the news matter which comes over the wires into the newspaper office, whether it be from press associations or from special correspondents throughout the country. These special correspondents represent the newspaper with which they are identified, in the cities in which they live, and are paid, in most instances, for the amount of news they furnish from week to week or month to month. In cases of news of supreme importance, it is customary for newspapers to send special representatives from headquarters to other cities, they making a report for their individual paper of the event which they are assigned to cover. This may be a cyclone horror, a national convention, a great fire in another city, a railroad wreck, a political gathering, or may be for the purpose of getting more complete details on some subject which the particular paper upon which the correspondent is engaged is interested.

Of other departments of a newspaper, the more important not yet mentioned are those of the exchange and news editors. The exchange editor is generally a man of considerable experience, and his work is to select from the "exchanges" all kinds of matter for use by the various departments. He clips horse and baseball, and similar notes for the sporting-editor; notices of change of pastorates for the religious column; musical and dramatic gossip, short stories, matters relating to local celebrities, important news items of which only brief mention has been made in the telegraph columns, etc. The news editor takes care of news items, and in most cases has control of the out-of-town correspondents. Most newspapers make a feature of treating exhaustively sporting-matters in their various forms, the drama, household affairs, insurance and banking, trade and financial reviews, and real estate. These subjects are handled by specialists, who devote a large portion of their time to familiarizing themselves with the news features of their particular department. There is a musical and dramatic critic on nearly all newspapers, and on some a religious editor is maintained, while the doings of secret societies and benevolent organizations form a department of many of them, and others make a specialty of reporting labor movements.

Once the news of the day has been gathered into the newspaper office, in various forms, the process of editing then begins. This work is done by professionals, who are experts in preparing "copy" for the printer. The copy thus prepared is then turned over to the foreman of the composing-room, whose duty it is to see that the manuscript which comes into his hands is put into type; and this, after proofs have been taken, is carefully read by proof-readers who compare the proofs of the compositors' work with the original manuscript, and mark for correction any errors that may be discovered in the process of type-setting. This step being accomplished, the corrected type is then placed in galleys and taken to an imposing-stone, where it is deposited. It is then ready for "making-up" into the form in which it will appear in the newspaper. In this work of "making-up," all matter relating to the different departments is kept separate; and, when the work of arranging the type is completed, the pages are then full and are "locked up" ready for the forms to be sent to the stereotyping-room. Great improvement has been effected in the process of duplicating the types, so that it is not necessary to print newspapers direct from the type. Instead, *papier-maché* matrices are now made, which serve as molds, and from these a casting is made in exact duplicate of the original type; from this casting the newspaper is printed. These metal plates can be duplicated in quantities, and thus a large edition can be run from extra sets, so that within a short time fifty to one hundred thousand copies of a newspaper may be printed and ready for distribution through the various channels through which newspapers are circulated.

In the mechanical economy of making the modern newspaper much saving in the cost of production has been made by the recent adoption of type-set

ting machines, which reduce the cost of composition about fifty per cent. These machines are rapidly taking the place of hand-labor, especially in the larger cities. Some opposition on the part of labor-unions followed their initial introduction; but this has been removed by a rule which requires the machine-operators to become members of the typographical unions in the cities in which the operators work, and by the adoption of a fixed scale of prices.

Newspapers are circulated through the mails as second-class mail matter, and postage is charged at the rate of one cent a pound. Under the present postal regulations, however, copies of a publication issued less frequently than once a week, addressed to a person residing in the city in which it is published, must be prepaid by stamps, at the rate of a cent for four ounces or four cents a pound. The weeklies and dailies go through the mails at a regular pound rate without the affixing of stamps, bills being rendered by the postal authorities and settlements made weekly or monthly according to the frequency of the publication.

Newspapers frequently vary in size (number of pages) from day to day, according to the volume of news and the pressure of advertisers for space. It is the common custom to adjust the size of a newspaper to meet the requirements of the advertising columns, and when the advertising patronage is light the size of the newspaper is reduced in accordance and the news made to suit these conditions, unless news matters of unusual importance are before the public, in which event the question of the advertising patronage cuts little or no figure with the publisher or editor of the paper. In addition to the regular issues, many newspapers, especially those issued in the evening, get out "extras," in which the more important and later news features are displayed prominently, and which, in many cases, have a large sale; especially is this so where some event of unusual importance is chronicled. In addition to these extras, many newspapers have special editions, some to emphasize the importance to their readers, and those whom they seek to become such, of their particular paper and its desire to cater to the reader's special wants.

Illustrations now form a most important part in the make-up of a complete newspaper. While there are a great many publications which do not use cuts to illustrate their news and other features, the majority of them do so, and the number is increasing rapidly. Some newspapers do not go beyond the use of portraits of prominent personages; others illustrate every article possible. These illustrations are made by what is known as the zinc-etching process, the original of the picture being drawn with pen and ink and reproduced by photography on glass and then transferred to metal. Chalk-plates, formerly in common use, are used but little now.

The growth of the Sunday newspaper has been very rapid during recent years, and has reached abnormal proportions. It is not an unusual occurrence for a metropolitan daily to issue more than fifty pages on Sunday. The presence and rapid growth of these Sunday newspapers has brought some antagonism from the religious element, who have declared that the Sunday papers "rob the employees of newspaper offices of their Sunday rest." It is a fact, however, that the work of preparing a Sunday newspaper begins early in the week, and is almost finished when Sunday begins. The effect of the circulation of newspapers on Sunday is quite another issue, and one which can be defended less successfully.

Another important change in the making of newspapers has been the recent reduction in price. Practically, the day of the five-cent newspaper is past, one cent being the prevailing price now

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charged for morning and evening papers. This change has already taken its course westward, until now the Pacific Slope has been reached and penny newspapers are increasing rapidly in California, where a few years ago no coin whatever of less value than five cents was in circulation.

The country newspaper of to-day is vastly superior to that of a few years ago, on account of the introduction of what is known as "plate-matter" and "patent insides." The former is prepared in large cities by concerns generally known as newspaper unions, who make a business of editing and compiling late news matter from the metropolitan dailies, putting it into plate form, column width, and forwarding the plates to their various subscribers, who are

generally publishers of papers of small circulation. These plates, when received, are arranged according to the peculiarities and make-up of the particular papers receiving them, and are used in lieu of type set at place of publication. "Patent insides," so called, are sheets printed on one side only, local matter being set and printed at the office of publication. By these methods of securing news small country publishers are enabled to have the benefit of the exchanges of the world, and at a less expense than the composition alone would amount to if prepared in their own offices.

The rapid growth and phenomenal success of a number of American newspapers has caused many of

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them to invest their surplus capital in handsome fireproof buildings, which in most cases are used for general office purposes, as well as for the home of the newspaper. These huge structures in many cases represent the highest skill in the builder's art, and are a desirable addition to the architectural beauties of the cities in which they are located. Among the more prominent of these buildings are the New York *Herald*, *Times*, *World*, *Tribune*, *Mail and Express*, Washington *Post*, Chicago *Herald*, St. Paul *Globe*, San Francisco *Chronicle*, Seattle *Post-Intelligencer*, and Portland *Oregonian*.

What is known as the "business office" of a newspaper is that portion of the publication which has more directly to do with the actual publication of a newspaper. In each newspaper office there is what is generally known as a "business manager," whose duty it is to make contracts with advertisers, purchase the necessary supplies with which to publish the newspaper, see that proper accounts are kept, including records of the circulation, etc., and that the employees are paid their salaries. While the two departments, business and editorial, of a newspaper, are working to the same end, i.e., the successful publication of a newspaper according to the ideas of the owners, they are sometimes in conflict and not infrequently the cause of more or less contention as to the individual rights of each; but probably no more so than occurs in other large establishments devoted to mercantile pursuits.

Another form of supplying reading-matter to American newspapers is by the syndicate system. The persons conducting these syndicates make arrangements with authors and specialists in certain lines for signed articles. These are re-sold to the newspapers—one only in a city—and generally are published simultaneously. By this plan one paper in each city is often able to secure an article of unusual merit, and from the pens of eminent persons, at a nominal figure, sometimes as low as one dollar and a half a column, whereas, if they contracted directly with the author, they would be compelled to pay many times the cost. By selling the same article to different newspapers, a large profit is sometimes made in this way by the newspaper syndicates, which are growing in number and importance. Some writers syndicate their work direct without the aid of the middleman.

The aggressiveness of some newspapers has caused a frequency of libel suits, out of which has grown various libel laws, good, bad and indifferent. The frequent attempts of lawmakers to "muzzle the press" have not met with the success of former days; and although the efforts of the class most interested in curbing the spirit of the press and curtailing its liberties are not less frequent on account of failure, they are getting perceptibly weaker and shorter in scope. Of course there are instances—and no one regrets the fact more than the newspaper men themselves—in which flagrant violations of good sense in printing the news occurs; but these exceptions are not common, and the spirit in which they are met and denounced by other newspapers generally acts as a preventive of their recurrence.

Efforts have been made, from time to time, to adopt the custom of printing the signature of the writers who contribute to the daily press, but no great success has been attained in this direction, except in occasional instances. Signed articles have, however, had a tendency to secure for the publisher critical and technically correct contributions from specialists, which are deemed more able and worthy of attention than those supplied by the average editor, who is an expert in no profession, and yet must write of them all. It is hardly possible that the system of signed articles, even if adopted, will be carried so far that the publisher may avoid the responsibility for libel suits for the statements made in signed articles; and yet this has been discussed as a possibility. While the plan has many advantages, as well as drawbacks, the signed article in the newspaper is becoming more and more familiar, and marks another departure in modern journal-

ism; and in so far as it secures better and more careful—that is to say, more responsible—work, it is to be commended.

Newspaper writers are now measured according to their merits, and the measure is taken very swiftly, whether the individual be man or woman. Women are succeeding, and have succeeded, in every branch of journalism, from the mere setting of the type to the absolute control of a great publication. Men as a class are apt to employ slang, colloquialisms, technical phrases and business language. Women, on the other hand, seldom fall into these errors, but sin on the side of brilliant rhetoric and so-called "fine writing." They have a natural inclination toward qualifying things that they like with pretty words: a girl is always "pretty" or "charming"; a gown "elegant" or "lovely"; a book "delightful" or "splendid." As between the two faults, the woman's is less objectionable. Few newspaper women care to report fights, accidents, or other facts involving shame, suffering or disgrace; men, on the other hand, have a natural aversion to spending much time upon details. They are much quicker, however, to perceive news and to secure it. The practice known as "faking" is not uncommon with newspaper men, but is very rare with newspaper women. The feeling between the two sexes is very amicable, each recognizing where the other can do better work. The great increase of newspaper women is due, not to any competition between men and women, but to the fact that the development of the modern newspaper necessitates the gathering of news where women are more qualified to act than men. This kind of news includes the description of social events, interviews with distinguished women, women's clubs, women's colleges, women's industries, and women's work in art, literature and music. A few of the larger dailies have women employed as editorial writers, and in one or two instances they have attained remarkable success in this line of work, although the tendency of their thoughts and inclinations is generally to lighter veins.

Attempts have been made from time to time to establish schools of journalism, but without signal success. Joseph Medill, the distinguished editor of the Chicago *Tribune*, has said: "You will not go far astray if you lay down as your major postulate that the real journalist, like the real poet, must be born, and cannot be made by art." Very few of the more prominent newspaper editors are believers in schools of journalism, and think it would be a mistake to establish them in connection with universities and colleges. As has been well said by Colonel Charles H. Jones, of St. Louis: "That man is best equipped for the work of journalism who knows most of what is taught in all the schools. The best education for a journalist is the mental training which he gets from the widest possible range of studies in the colleges or universities—I mean the widest range of studies that he can really master; and after he has equipped himself with all the knowledge that can be obtained from this general curriculum, he will find it necessary, as soon as he begins the practical work of journalism, to widen his knowledge and enlarge his range of information in all possible ways."

To be a successful journalist, a man must have what is technically known in the profession as "a nose for news." Without this he cannot succeed with the best education that it is possible to give him.

Friendship for newspaper men has long been held to be a necessity in ratio to the success of the individual who follows a public career. Chauncey M. Depew is a brilliant example of the class of men who are most accessible to reporters. It is said that Mr. Depew sees more newspaper men, and oftener, than any other recognized prominent person in the metropolis of New York; they breakfast, dine and sup with him, or rather, that is what it

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amounts to. He has been called "the reporter's best friend." Russell Sage was formerly as accessible to reporters and the general public as is Dr. Depew, but since the Norcross incident has been of a more exclusive and retiring disposition.

Incomes of newspapers are difficult to get at. Vast fortunes have been made and lost in the launching of newspapers; as much as half a million dollars has been expended within a year or two in the building-up of a newspaper which has proved a failure, while much less sums judiciously expended have produced publications which have been successful from the start, and in many instances have brought their founders immense fortunes in a few years. The general impression is, that the most of the income of newspapers is from advertising; but according to the recent census the revenue is about equally balanced. The census figures are as follows:

From advertising, $71,243,087; from circulation, $72,343,361; the slight difference being in favor of the subscribers. The number of copies of newspapers printed during a year in the United States has reached the marvelous total of 4,681,113,530, and this is an increase of 2,600,000,000 over the figures obtained by the census of 1880. In the six years since the eleventh census was taken, the increase went on, and it is safe to say that the total of six thousand million has been passed. It is impossible to grasp all that this means. Perhaps the best illustration is, that if one person were invested with enough life, and were to give twelve hours a day to constant reading, he would be five or six thousand years old before he got through the papers and periodicals printed in the United States in a year.

The following table gives the number of newspapers and other publications that are known to have been issued in this country since 1869:

	Daily.	Triweekly.	Semiweekly.	Weekly.	Biweekly and Semi-monthly.	Monthly.	Bimonthly.	Quarterly.	Total.
1869	519	120	91	3,912	79	459	7	32	5,219
1870	574	107	115	4,295	96	622	13	49	5,871
1871	594	105	112	4,380	116	677	13	59	6,056
1872	525	107	113	4,808	113	690	4	55	6,519
1873	647	96	101	5,175	110	678	9	59	6,875
1874	678	83	92	5,554	120	744	11	57	7,339
1875	718	80	107	5,957	130	802	8	68	7,870
1876	738	70	121	6,235	138	747	13	67	8,129
1877	709	60	115	6,221	129	664	13	57	7,958
1878	729	59	120	6,540	114	708	15	55	8,340
1879	742	60	121	6,847	131	732	17	53	8,703
1880	845	58	129	7,590	166	868	14	55	9,723
1881	921	56	116	7,955	170	969	14	66	10,267
1882	996	51	120	8,183	200	976	14	71	10,611
1883	1,062	50	122	8,635	222	1,034	12	59	11,196
1884	1,178	43	142	9,492	290	1,427	23	76	12,671
1885	1,183	39	139	10,082	292	1,604	33	122	13,494
1886	1,216	41	152	10,685	313	1,603	26	124	14,160
1887	1,311	39	165	11,116	285	1,655	30	105	14,706
1888	1,423	42	177	11,785	290	1,704	25	109	15,555
1889	1,494	36	207	12,234	289	1,898	36	125	16,319
1890	1,536	29	202	12,603	342	2,076	37	123	16,948
1891	1,700	39	221	13,420	397	2,506	75	178	18,536
1892	1,759	33	209	13,404	307	2,754	56	192	18,714
1893	1,855	31	237	14,017	434	3,125	78	229	20,006
1894	1,942	32	246	14,662	379	2,639	70	199	20,169
1895	2,050	40	321	14,685	385	2,676	55	183	20,395
1896	2,205	43	394	14,614	431	2,723	58	162	20,630

From this table it will be seen that during the year 1896 there were 20,630 publications of various kinds issued. This is only 235 greater than was the issue for 1895. Dailies increased about seven per cent, tri-weeklies nearly ten per cent and semi-weeklies nearly twenty per cent. There was some slight increase in the number of bi-weeklies, semi-monthlies, monthlies and bi-monthlies. Quarterlies, semi-quarterlies and tri-monthlies fell off in number, and for the first time in nearly thirty years the number of weekly papers was smaller than for the preceding year. This decrease is due to the inroads which the cheap daily papers are making.

The table on following page shows the number and frequency of issue of newspapers and periodicals published in the United States, Dominion of Canada and Newfoundland during the year 1896.

To give their readers all the news of the world, the great newspapers of the United States now rely upon special news-gatherers in every news-center of the globe. Many of the noted journalists of the country are connected with these agencies, which distribute vast quantities of news to American papers. The phenomenal progress and success of the American newspaper can, in a large measure, be attributed to the methods of these news-gathering agencies, foremost among which is the "Associated Press." Its close identification with the newspapers of America for the past decade or more, and its history, is in a large measure the history of journalism in America. Without these news-gathering aids it would not be possible, even in this day of rapid news-distribution, with the mechanical perfection that has been attained in this profession, to print as complete newspapers from day to day as are now to be found in all large cities. A brief outline history, therefore, of the inception and growth of the Associated Press should be of interest to those who desire a more complete knowledge of American newspapers, and especially of their development.

Between the years 1835 and 1840, and before the Atlantic cable and telegraph were in use, the New York papers established "pony expresses" and similar means to get the news from Washington, which was then, as now, a great news-center. They also established a line of small, fast-sailing boats to run out and meet the incoming foreign sailing-vessels. Then when the telegraph came into use they enlarged that field somewhat. The New York papers rather monopolized this news-gathering feature of the business in the beginning. The New York *Herald*, New York *Sun*, Philadelphia *Public Ledger* and Baltimore *Sun* all were established about the same time—1835. The Philadelphia *Public Ledger* was established by people who left the New York *Sun;* so was the Baltimore *Sun;* and then the Albany papers came into existence. Finally, these outside papers went to New York and said: "We wish to use this news you are gathering, and we will pay for it; fix a price, and we will pay for it delivered at our office over the telegraph-wires." The New York papers assented to the arrangement, and established relations with these interior papers conditioned upon the interior papers' paying them a fixed charge per week, and also furnishing the news of their immediate vicinage in exchange. That was the way the Associated Press began, and has continued to grow into the great news-gathering organization that it now is. The New York papers then were serving papers in New England, in New York state, Pennsylvania, and in the West. As the business enlarged, the New England papers decided to organize an association called the New England Associated Press. It was a distinct body, and, instead of making individual contracts, made a contract as an organization with the New York papers. Then the New York papers organized themselves into an association called the New York Associated Press, and established their own agent or manager. Under their rules, all of the news that the New York *Herald*, the New York *Sun*

	Daily.	Triweekly.	Semiweekly.	Weekly.	Trimonthly.	Biweekly.	Semimonthly.	Monthly.	Semi-quarterly.	Bimonthly.	Quarterly.	Total
Alabama	20	--	4	167	--	3	3	15	--	--	----	212
Alaska	---	--	--	3	--	--	--	1	--	--	----	4
Arizona	10	--	--	35	--	--	--	1	--	--	----	46
Arkansas	26	--	1	198	--	--	5	18	--	--	2	250
California	113	1	9	450	--	5	9	87	--	--	----	674
Colorado	38	--	3	217	--	--	2	26	--	--	----	286
Connecticut	51	--	5	108	--	1	9	35	--	3	7	219
Delaware	5	--	--	28	--	--	1	4	--	--	----	38
District of Columbia	5	--	--	30	--	--	2	25	1	2	3	68
Florida	16	--	3	104	--	1	4	11	--	--	----	139
Georgia	28	--	2	252	--	--	6	38	--	--	1	327
Idaho	3	--	3	54	--	--	1	3	--	--	----	64
Illinois	162	2	29	1,060	1	7	36	252	1	5	16	1,571
Indian Territory	3	--	--	46	--	--	--	1	--	--	----	50
Indiana	137	--	16	575	--	--	10	78	--	1	1	819
Iowa	75	3	24	839	--	1	9	76	--	1	6	1,034
Kansas	48	--	7	567	--	1	7	63	--	1	2	696
Kentucky	29	1	13	214	--	3	7	32	--	--	1	300
Louisiana	18	--	2	145	--	--	4	10	--	--	----	179
Maine	18	--	2	113	--	1	4	47	--	--	7	192
Maryland	16	--	2	139	--	2	2	38	--	--	5	204
Massachusetts	88	--	7	325	--	7	10	166	1	2	21	627
Michigan	68	1	14	581	--	4	12	78	--	3	1	762
Minnesota	38	--	2	442	1	4	15	45	--	1	1	549
Mississippi	9	2	4	152	--	--	6	12	--	--	----	185
Missouri	87	2	14	709	--	5	16	117	--	3	8	961
Montana	13	1	2	73	--	--	1	6	--	--	----	96
Nebraska	32	1	7	501	--	1	7	33	--	--	1	583
Nevada	9	--	2	14	--	--	1	----	--	--	----	26
New Hampshire	15	1	1	80	--	--	--	13	--	--	1	111
New Jersey	47	1	2	277	--	3	9	49	--	3	2	393
New Mexico	5	1	1	43	--	--	--	3	--	--	----	53
New York	183	3	46	1,080	--	13	39	530	--	15	41	1,950
North Carolina	21	--	2	166	--	--	9	19	--	--	1	218
North Dakota	9	--	--	118	--	--	1	8	--	--	----	136
Ohio	158	7	36	766	--	4	16	142	--	2	13	1,144
Oklahoma	11	--	1	79	--	--	1	9	--	--	----	101
Oregon	18	--	8	139	--	--	2	20	--	--	1	188
Pennsylvania	200	4	34	899	1	7	21	239	--	7	10	1,422
Rhode Island	16	--	3	40	--	3	--	11	--	1	1	75
South Carolina	10	1	10	92	--	--	5	4	--	1	----	123
South Dakota	26	1	3	210	--	1	1	15	--	--	----	257
Tennessee	19	--	7	213	--	2	3	37	--	--	1	282
Texas	64	1	12	575	--	1	3	41	--	--	1	698
Utah	8	1	7	41	--	--	3	6	--	--	----	66
Vermont	4	--	1	66	--	--	1	13	--	--	----	85
Virginia	31	3	5	178	--	--	2	42	--	1	4	266
Washington	18	2	2	171	--	1	4	24	--	--	1	223
West Virginia	15	--	3	134	--	1	1	15	--	--	----	169
Wisconsin	63	--	5	486	--	4	6	40	--	1	1	606
Wyoming	4	--	1	28	--	--	--	----	--	--	----	33
Total United States	2,110	40	367	14,022	3	87	316	2,598	3	53	161	19,760
British Columbia	6	--	3	15	--	--	2	1	--	--	----	27
Manitoba	3	--	2	32	--	--	--	10	--	1	1	49
New Brunswick	8	--	2	28	--	--	1	5	--	--	----	44
Northwest Territories	2	--	2	17	--	--	--	--	--	--	----	21
Nova Scotia	8	2	3	48	--	1	1	5	--	--	----	68
Ontario	47	--	8	364	--	3	10	80	--	--	----	512
Prince Edward Island	3	--	2	11	--	--	--	--	--	--	----	16
Quebec	16	1	4	75	--	2	5	24	--	1	----	128
Total Canada	93	3	26	590	--	6	19	125	--	2	1	865
Newfoundland	2	--	1	2	--	--	--	--	--	--	----	
Grand total (1896)	2,205	43	394	14,614	3	93	335	2,723	3	55	162	20,630

or New York *Tribune* got they turned into a common pool; in other words, they "pooled their news." One copy of a piece of news was dispatched to the *Herald* office, or *Sun* office, or *Tribune* office, as the case might be, and another copy of the same thing—a duplicate—would go to the New York Associated Press office, the several papers simply combining to use their special service to maintain an association. After making this contract with the New England Associated Press, the larger association made one with the New York State Associated Press, then with the Baltimore Associated Press, the Washington

Associated Press, and finally with the Western Associated Press.

Some years later, or about 1870, the Western Associated Press, principally, as well as some of these tributary associations, grew restive. They did not want to continue to be simply tributary to the New York association. There were two reasons for this: one was that the New York association controlled absolutely the character of the news to be gathered, and was selling this "pooled news" at a price that made their own cost them practically nothing. The tributary associations wanted not only a voice in the management, but they wanted the plan rearranged so that the New York papers would pay their proportion for gathering this news. In 1882, after some controversy, the Western Associated Press formally severed its relations with the New York association papers, put its own agents in London and in Washington, and began a competitive service. That competition lasted but a few weeks, when the New York Associated Press threw up its hands, and a compromise was effected by which the New York Associated Press and Western Associated Press entered into an alliance, the Eastern organization naming two members, the Western naming two, of a joint executive committee to control the details of the business. It was really an amalgamation of the two associations. A fifth man on this joint executive committee was taken from New York, while the general manager was taken from the West. That plan of working together continued for ten years.

Meanwhile a rival association had grown up, because one of the features of the Associated Press organization was that it was a close monopoly. No news could be served to any new paper in any town without the consent of the existing press papers in that town—the unanimous consent. Each Associated Press paper had a veto upon any new paper coming in. The result was, that every now and then new papers would be started without the Associated Press service; and enough of them grew into positions important enough to enable them to establish a rival association, which was called the "United Press." This organization had been started under three or four names; it was called at one time the American Associated Press, then the National Associated Press, and finally it developed into the United Press. Not only was this new association fostered by the fact that there were papers outside of the Associated Press which required service, and which were willing to help support it, but there were also a number of rival telegraph companies, like the Mutual Union, the Baltimore and Ohio, the Postal, and others. The Associated Press was identified closely with the Western Union. These other telegraph companies came into existence as rivals of the Western Union, and the cost of service over their lines was very cheap; consequently it was an easy matter to establish a cheap news-service, and small papers could afford to pay for it. But it still remained true that the Associated Press held a commanding place.

In 1887 the United Press made a secret agreement with the executive committee of the Associated Press, the result of which was a practical union of the two organizations. The Associated Press was in the nature of a co-operative organization; that is, its membership, particularly the Western Associated Press, extended to every paper of importance: they were all shareholders in it. The United Press was started originally on the same plan, and by the sale of stock in its treasury and by virtue of the arrangement made with the Associated Press, the United Press stock was soon in the hands of two or three men — that is, enough to control it absolutely — and they sold at a nominal price some of this stock to the executive committee of the Associated Press. It became a dividend-paying stock at once, for this reason: that the terms of the agreement between the United Press and the Associated Press provided that the Associated Press report should be given to the United Press in exchange for its report. The United Press then had no expense for gathering news, and was a money-making venture. This ran on until the truth was discovered, in 1891, and steps were taken to repudiate the arrangement. Then open warfare came on between the two organizations. Naturally, those members of the executive committee who were repudiated by their fellow-members went into the United Press and undertook to destroy the Associated Press. The struggle ended in the assignment of the United Press, March 29, 1897. The Western Associated Press was reorganized into the Associated Press, was made a national organization, and from 1893 it has gone on building itself up, until it is now in the normal position it held before the fight began.

This outline represents the relations of the Associated Press with the newspapers it serves in America. For the purpose of gathering foreign news it now has correspondence with the foreign news agents—the Reuter, Havas, Wolf, and the different agencies all over the world. It has contract relations with Reuter and Havas, which cover Great Britain and her colonies, France, Belgium, Switzerland, Portugal and some parts of South America; with the Wolf Agency of Berlin, which covers Germany, Austria and Hungary; with the Stefanie Agency, which covers Italy; with the Nordisches Telegram Bureau, which covers Russia; with the Norsky Telegram Bureau, which covers Norway; with the Svenska Telegram Bureau, which covers Sweden; and with the Agence de Constantinople, which covers Turkey. The way they operate is this: Take, for instance, the Stefanie Agency. It gathers all the news of Italy into Rome, and redistributes it to all the cities of Italy. Then it sends a budget of news—it may be 100 words or 500 words —to London, and also to Paris, and receives from each of these places a budget, which it in turn also distributes to the different cities of Italy. The Associated Press does the same. It has Walter Neef in London, and Count Wolf von Schierbrand in Berlin. All the news that comes into the Wolf Agency at Berlin, Von Schierbrand sees, and makes up a budget and telegraphs it to London. Reuter gets his budget from his different European agencies, and Walter Neef and his staff look over Reuter's dispatches and send to America whatever may be of interest here. This in turn is sent out to

papers in the United States. On the other hand, Reuter has his agent in the New York Associated Press office, looking over its dispatches and sending to him whatever may be of interest to Europeans. By this means there is a perfect system of exchange of news by the Associated Press all over the world. It operates also with a system of leased wires that run all over the United States and to the City of Mexico. Then for Canada it has an exchange arrangement with the Canadian Pacific railway by which that company gathers all of the news on its line and delivers to the Associated Press at four points in this country—Bangor, Buffalo, Detroit and Seattle. And the association delivers its news to them at these points for use in Canada.

MELVILLE E. STONE.

TABLE SHOWING THE NUMBER, AND FREQUENCY OF ISSUE, OF NEWSPAPERS AND PERIODICALS PUBLISHED IN THE UNITED STATES AND TERRITORIES, THE DOMINION OF CANADA AND NEWFOUNDLAND, IN THE YEAR 1905.

	Daily.	Triweekly.	Semi-weekly.	Weekly.	Tri-monthly.	Biweekly.	Semi-monthly.	Monthly.	Semi-quarterly.	Bimonthly.	Quarterly.	Total.
Alabama	22	.....	2	187	.....	1	6	12	.....	1	.....	231
Alaska	4	.....	.....	10	.....	.....	.....	1	.....	.....	.....	15
Arizona	13	.....	.....	51	.....	.....	1	2	.....	.....	1	68
Arkansas	24	.....	6	242	.....	.....	.....	15	.....	.....	.....	287
California	128	2	22	462	.....	2	9	104	1	2	6	738
Colorado	37	1	5	277	.....	1	4	41	.....	.....	.....	366
Connecticut	37	.....	10	85	.....	2	.....	24	.....	.....	5	163
Delaware	4	.....	1	25	.....	.....	.....	5	.....	.....	.....	35
District of Columbia	3	.....	.....	25	.....	.....	1	43	.....	2	4	78
Florida	17	.....	4	125	.....	.....	.....	16	.....	1	.....	163
Georgia	25	.....	8	280	.....	.....	8	50	.....	1	1	373
Idaho	7	1	5	88	.....	.....	1	5	.....	.....	1	108
Illinois	181	4	55	1,104	.....	4	24	301	1	6	10	1,690
Indiana	148	.....	30	564	.....	1	6	71	.....	2	2	824
Indian Territory	12	.....	1	148	.....	.....	.....	5	.....	.....	.....	166
Iowa	66	6	49	905	1	2	7	89	.....	2	6	1,133
Kansas	58	.....	14	619	.....	.....	4	42	1	.....	1	739
Kentucky	29	2	13	239	.....	.....	7	34	.....	.....	3	327
Louisiana	26	.....	3	153	.....	.....	4	14	.....	.....	.....	200
Maine	17	.....	4	94	.....	.....	2	35	.....	.....	2	154
Maryland	16	.....	2	140	.....	1	3	27	.....	2	5	196
Massachusetts	83	.....	6	329	1	5	7	166	.....	1	34	632
Michigan	85	3	26	592	.....	1	7	92	.....	2	3	811
Minnesota	41	.....	7	647	.....	1	18	68	.....	2	1	785
Mississippi	17	.....	3	204	.....	.....	10	12	.....	.....	.....	246
Missouri	87	1	12	791	.....	6	10	155	.....	2	9	1,073
Montana	11	.....	5	82	.....	.....	1	6	.....	.....	.....	105
Nebraska	28	2	12	562	.....	.....	3	53	.....	.....	1	661
Nevada	10	.....	3	22	.....	.....	.....	.....	.....	.....	.....	35
New Hampshire	13	1	.....	69	.....	.....	1	10	.....	.....	1	95
New Jersey	52	.....	5	279	.....	1	4	44	.....	2	2	389
New Mexico	4	.....	.....	56	.....	.....	.....	1	.....	.....	.....	61
New York	210	6	44	1,025	.....	11	41	570	.....	15	50	1,972
North Carolina	29	1	14	195	.....	3	10	26	.....	.....	2	280
North Dakota	11	.....	1	233	.....	.....	1	9	.....	1	1	257
Ohio	171	6	38	779	.....	2	11	160	.....	5	10	1,182
Oklahoma	27	.....	.....	261	.....	.....	4	16	.....	.....	.....	308
Oregon	23	.....	17	172	.....	2	4	22	.....	.....	.....	240
Pennsylvania	214	7	33	926	.....	4	12	245	.....	10	23	1,474
Rhode Island	13	.....	3	29	.....	.....	2	10	.....	1	.....	58
South Carolina	13	1	12	113	.....	.....	.....	12	.....	1	.....	152
South Dakota	14	.....	3	269	.....	1	2	17	.....	.....	2	308
Tennessee	14	.....	3	234	.....	1	8	37	.....	2	10	309
Texas	90	1	18	682	.....	1	12	63	.....	1	.....	868
Utah	8	1	7	59	.....	.....	3	8	.....	.....	.....	86
Vermont	10	.....	.....	54	.....	.....	.....	13	.....	.....	1	78
Virginia	32	2	5	161	.....	1	7	35	.....	2	2	247
Washington	25	.....	6	225	.....	1	2	39	.....	.....	1	299
West Virginia	31	.....	3	168	.....	3	3	16	.....	.....	.....	224
Wisconsin	63	1	23	557	.....	.....	4	75	.....	2	9	734
Wyoming	4	.....	4	41	.....	.....	.....	2	.....	.....	.....	51
Total United States	2,307	49	547	15,639	2	58	274	2,918	3	68	209	22,074
British Columbia	9	.....	7	45	.....	.....	.....	4	.....	.....	.....	65
Manitoba	7	.....	1	77	.....	.....	4	5	.....	.....	.....	94
New Brunswick	10	.....	8	24	.....	1	2	6	.....	.....	.....	51
N. W. Territories	5	.....	1	59	.....	.....	1	.....	.....	.....	.....	66
Nova Scotia	11	1	2	55	.....	1	2	4	.....	.....	.....	76
Ontario	48	.....	7	410	.....	2	11	85	.....	1	2	566
Prince Edward Island	3	.....	2	11	.....	.....	.....	1	.....	.....	.....	17
Quebec	14	.....	.....	79	.....	.....	.....	30	.....	.....	.....	123
Total Canada	107	1	28	760	.....	4	20	135	.....	1	2	1,058
Newfoundland	3	.....	.....	8	.....	.....	.....	3	.....	.....	.....	14
Grand Total	2,417	50	575	16,407	2	62	294	3,056	3	69	211	23,146

NEWT, same as TRITON. See Vol. XXIII, p. 614.

NEW THOUGHT. A philosophy of life which may be defined as a mental grasp of the divine potentialities, in man and nature, which are susceptible of indefinite expansion along lines of progress and utility.

The history and origin of New Thought are as difficult to outline by definite data, as the name of the system or cult by which it is known is inadequate to denote its full compass or define its limits. The name is somewhat misleading, for much that is held as new in theory and practice is very old thought in all except its interpretation and application. Many of its ideas and teachings are new compared with the prevalent ideas of human power and destiny held in the latter part of the Nineteenth century, when its propagandists seem to have discovered new realms of mental activity and achievement. Apparently, therefore, there was a sufficient departure from old lines of thought in the mental and spiritual fields of speculation to justify the name of "New Thought." Whether this name was given it by the devotees of the doctrine or those who looked on the ideas promulgated as merely passing fads, it is enough to know that it came into vogue as a general designation of a philosophy recognizing the mind, when in harmony with the divine attributes of the infinite, as having surpassing power for individual betterment.

A number of prominent writers became advocates of the doctrine during the last years of the Nineteenth century and the first of the Twentieth, among whom were Ella Wheeler Wilcox and William Walker Atkinson; the latter a regular contributor to and editor of the *New Thought* magazine, established in Chicago in 1896. From these and contemporary writers, it may be inferred that New Thought has no set creed or dogma of its own to circumscribe lines of thought or hamper growth, and that it does not denounce any doctrine, creed or religion whose aim is to help humanity; that it is found to encourage belief in the immortality of the soul and the ultimate good of all things; that its course of action is to assimilate the good, leaving the evil to its own self-destruction; that it has no desire to proselyte or alienate any one from his church or cherished opinions, assuming that whatever is sacred and satisfying to a sincere believer in any doctrine may be made to reveal new beauties and greater efficiency by a clearer vision of the widening horizon of truth, and, that if advancing steps lead away from the old to the new, it will not be without adequate compensation for the change. It evidently recognizes, as a fundamental basis of sound doctrine, the brotherhood of man, and love for humanity as the noblest of motives prompting action, and furthermore, that love itself is the mightiest of forces pervading the universe. With due reverence for the good in each, it breaks through the walls of caste and sect, regarding exterior forms of faith, whether it be Hebrew, Buddhist or Christian, as classifications of great spiritual movements, but not assurances that the great bodies of their adherents will, in all cases, exemplify the high ideals of a divine life.

With regard to modern cults and their branches, or it may be later phases of old philosophies radiating into new fields of investigation such as theosophy, mental science, Christian science, telepathy, psychology, spiritualism, the uses and functions of the sub-conscious mind, mental healing and the different planes of mentation, New Thought obviously finds much in each that in modified form it may utilize in correlating the forces drawn from nature's power-house. It lays great stress upon the NOW and the potentialities within each living entity to accomplish all that enlightened reason places within the bounds of possibility in the acquisition of personal happiness, material prosperity and individual growth.

The New Thought doctrine adheres to no distinctive type of metaphysics, nor adopts as final authority any scientific theory of the origin of worlds, nor does it encourage speculation upon the destinies to be attained in the future eons of evolution when a new order of universes shall be born from the depths of infinity. The sciences that speculate upon the primitive matter of planets and the readjustment of stellar systems are left for the coming cycle of time to unfold, while the practical duties and efforts of the hour are made the all-sufficient concern of the present living, moving, aspiring soul. With neither regret for the past nor fear for the future, with faith in the efficacy of innate power and with wisdom gained from the lessons of experience and suffering, the neophyte is urged to seek light in the mental altitudes surmounting the planes of ignorance and superstition. He is admonished to banish the nightmare of fear and the myth of man's natural vileness and weakness and to rise to self-illumination and happiness by developing the divine within his own soul. The frequent assertion of self, with due regard for other selves, and the persistent exercise of the "I-can-and-I- will" determination, accompanied with proper effort, are recommended as the practices sure to lead from the gloom of despondency to the joy of fruition.

Different persons have given brief definitions of New Thought as follows: "The recognition, realization and manifestation of the God in Me"; "Fear nothing, love everything. Believe you can do anything"; "Being and doing one's best by repeatedly affirming one's ability"; "Attaining the ideal in life through thought concentration and assertion"; "The assumption of omnipotent properties of the mind capable of attracting the fulfilment of all desires, and capable of overcoming all adverse physical, mental and material conditions." Each of these definitions is incomplete in itself, but in connection with the preceding comments on the subject may aid in giving the reader a comprehensive view of the philosophy denominated New Thought. A. R. READ.

September, 1905.

NEW THEOLOGY, THE. A name that came to be applied to a change of theological views

relative to the accepted orthodoxy of the church. The new movement may be said to have been given its first authoritative recognition by the professors of Andover Theological Seminary in 1886, when they published a book called *Progressive Orthodoxy*, setting forth advanced views on Biblical interpretations. The new theology did not attempt to formulate set rules for guidance in future investigations, each one being allowed sufficient latitude to form his own judgment as to the best methods of arriving at the truth. In this school of divinity students, there has been general acceptance of the theory of evolution, as a part of the divine plan; a partial if not a total rejection of verbal inspiration and the substitution of revelation; the giving of more prominence to ethics and less to dogma, and the employment of the higher-criticism in deciding points involving the origin and authority of the Bible. A.R.R.

Akron, Ohio.

NEW TIPPERARY. HOME RULE, Vol. XXVII.

NEWTON, Illinois, a city and the county seat of Jasper County, in the southeastern part of the state. It lies on the Embarras River, 100 miles southeast of Springfield, and is reached by the Peoria, Decatur and Evansville and the Indiana and Illinois railroads. It is the center of an agricultural, dairying and coal-mining region. Its population in 1900 was 1,630. W.F.J.

NEWTON, Iowa, a city and the county seat of Jasper County, in the central part of the state. It lies in the farming region between Indian Creek and Skunk River, thirty miles east by north from Des Moines, and is reached by the Iowa Central and the Chicago, Rock Island and Pacific railroads. It is in an agricultural and horse-breeding country, and has considerable manufactures. Its population in 1900 was 3,682. W.F.J.

NEWTON, a city and the capital of Harvey County, central Kansas, 135 miles S.W. of Topeka, on the Atchison, Topeka and Santa Fé and the Missouri Pacific railroads; has a large carriage factory, flour-mills, planing-mills, and a machine factory. Valuable coal-mines and stone-quarries are in the vicinity; also a public library. Population 1890, 5,605; 1900, 6,208.

NEWTON, a city of Massachusetts. It has an electric street-railway to Boston via Boulevard, and to Waltham and Watertown; and on the Boston and Albany railroad. Newton Theological Seminary (Baptist) in 1907, had 9 instructors, 60 students, and a library of 30,000 volumes. The public library has 45,181 volumes. Population 1890, 24,379; 1900, 33,587. See also NEWTON, Vol. XVII, p. 449.

NEWTON, a town and the county seat of Sussex County, New Jersey, in the northern part of the state. It lies among the mountains, in a mining region, and has some manufacturing establishments. It is reached by the Lehigh and Hudson River railroad, and had in 1900 a population of 4,376. W.F.J.

NEWTON, a village and the capital of Catawba County, western North Carolina, 25 miles W. of Statesville and 24 miles N.N.W. of Charlotte, on the Western North Carolina, the Chester and Lenoir and the Southern railroads. It contains Catawba College (Reformed), a co-educational institution, founded in 1851, and having in 1901 10 instructors, 162 students, and a library containing 2,500 volumes. Population 1890, 1,038; 1900, 1,583.

NEWTON, ALFRED, a British ornithologist; born in Geneva, Switzerland, June 11, 1829. His parents were English, and he received his education in Magdalene College, Cambridge. He became professor of zoölogy and comparative anatomy in the University of Cambridge in 1866, and a recognized authority upon ornithology. He contributed the article on ORNITHOLOGY to this ENCYCLOPÆDIA, and numerous special articles on the various families of birds. Among his publications are *On the Zoölogy of Ancient Europe* (1862); *Zoölogy* (1875); he also edited Tunsall's *Ornithologia Britannica* (1880).

NEWTON, SIR CHARLES THOMAS, an English archæologist; born in Bredwardine, Herefordshire, in 1816. He was educated at Shrewsbury school and afterward at Christ's Church, Oxford. From 1840 to 1852 he was assistant in the Department of Antiquities in the British Museum which he then exchanged for the office of vice-consul at Mitylene, whither the possibilities of exploration attracted him. For seven years he prosecuted his researches on the coast of Asia Minor, and the results were the famous discoveries of the mausoleum and the sculptures at Halicarnassus, Cnidue and Branchidæ, which were acquired by the British Museum. He was appointed consul at Rome, June 10, 1859, which post he held until Jan. 16, 1861, when he resigned. He was then appointed head of the Department of Greek and Roman Antiquities in theBritish Museum. He was knighted in 1894 and died the same year, Nov. 28, at Westgate, England. W.M.C.

NEWTON, HUBERT ANSON, mathematician, was born at Sherburne, N. Y., on March 19, 1830, and was graduated from Yale College in 1850. Two years later, after pursuing a post-graduate course in mathematics, he became tutor and acting professor, and in 1855 professor of mathematics at Yale. There he remained for more than forty years, doing a monumental work as a geometrician and astronomer. His studies of meteors and their movements were of incalculable value to science. From his collation and analysis of data of the "November Showers" he demonstrated that the period of revolution of those clouds of meteors must have one of five ascertained values. He proceeded to establish the secular movement of the node of their mean orbit, and thus enabled others to connect the meteor streams with the comet of 1866. He demonstrated that most of the "shooting stars" move in orbits similar to those of the comets, especially comets of short periods. The results of his studies in these subjects were published in the *Memoirs of the National Academy* and in the *Journal of Science*, and he also contributed im-

portant articles thereon to several encyclopedias. In pure mathematics he wrote treatises on *Investigations on the Construction of Certain Curves by Points*, and *Certain Transcendent Curves*. He was instrumental in getting the metric system generally represented in American arithmetics. For some years he was an editor of the *Journal of Science*. He was a charter member of the National Academy of Sciences, and was president of the American Association for the Advancement of Science in 1885. He was a member of several learned societies in England. He died at New Haven, Conn., on August 12, 1896.

W.F.J.

NEWTON, JOHN, an American soldier; born in Norfolk, Virginia, August 24, 1823. In 1842 he was graduated from the United States Military Academy, second in his class, and commissioned a second lieutenant in the engineer corps. He served for three years as assistant professor of engineering at the United States Military Academy, and was then occupied with the construction of fortifications and river and harbor improvements on the Atlantic coast. He was promoted captain in 1856, and major in 1861. In the Civil War he received the rank of brigadier-general of volunteers. After the war various engineering duties, principally in connection with the harbor of New York, occupied his attention until his retirement on August 27, 1886. His greatest achievement was the removal of obstructions in Hell Gate Channel, an important waterway between Long Island Sound and East River. These, known as Hallett's Reef and Flood Rock, were duly mined and exploded on September 24, 1876, and October 10, 1885. He died in New York city, May 2, 1895. W.M.C.

GEN. JOHN NEWTON.

NEWTOWN, Connecticut, a town and borough of Fairfield County, in the southwestern part of the state. It has manufactories of vehicles and other articles, on the New York and New England and Housatonic railroads, and had in 1900 a population of 3,276. W.F.J.

NEWTOWN, Pennsylvania, a borough of Bucks County, in the southeast part of the state, on the Neshaminy River, eighteen miles north of Philadelphia and nine miles west of Trenton, N. J. It is in a farming and suburban residence region, is reached by the Philadelphia, Newtown and New York railroad, and had in 1900 a population of 1,463. W.F.J.

NEW ULM, a city and the capital of Brown County, central southern Minnesota, 28 miles W.N.W. of Mankato, on the Minnesota River, and on the Chicago and North-Western railroad; was destroyed in a raid and massacre by the Indians in 1862, and in 1881 was almost entirely destroyed by a cyclone; has iron, flour, sash and door, and other manufactures; is a trade center for a farming region. Population 1890, 3,741; 1900, 5,403.

NEW WESTMINSTER, a city of British Columbia, Canada, on the Fraser River, one of the termini of the Canadian Pacific railroad, 1,473 miles by rail W. of Winnipeg; has 12 feet of water in its harbor at ordinary high tide. Population 1891, 6,678; 1901, 6,499.

NEW YORK had a population, in 1890, of 5,997,853. That of 1880 was 5,082,871, the increase constituting a gain of 18 per cent. The rank among the states was first,—a position held since 1820. In 1900 the 12th census was taken which gave the population at 7,268,012. The density of population in 1900 was 152.61 to the square mile; that of 1890 was 126.74. The census reports of 1900 give 47 cities in the state with a population of 8,000 or more in which resided 4,980,042 persons, constituting 68.5 per cent of the entire number of inhabitants. In 1890 the number of cities of the population stated above was 46 in which resided 3,599,877 persons, 60.0 per cent of the residents of the state. The relative number of males and females in 1900 was 3,614,780 of the former and 3,654,114 of the latter. The native-born population at the time of the taking of the last decennial census was 73.9 per cent; the number of negroes 99,232,—an increase from 1890 of 29,140; the foreign-born citizens numbered 1,900,425. Of this latter class there were representatives of almost all nations of the earth. The Germans numbered 498,602, the Irish 483,375, the English 144,060, the Canadians 93,193, the Italians 64,141, the Russians 58,466, the Scotch 35,332, the Austrians 33,145, the Swedes 28,430, the Poles 22,718, the French 20,443, the Hungarians 15,598, the Bohemians 9,129, the Norwegians 8,602, the Dutch 8,366, the Welsh 8,108, the Danes 6,238, the Chinese 3,135.

New York has a total land area of 47,620 square miles, or 30,476,800 acres, of which 22,648,109 acres, or 74.3 per cent, are included in farms. The total acreage under cereals in 1899 was 3,125,079, or 10.63 per cent of the total land surface of the state, and the production in bushels 80,413,710. Of the whole area, 21.1 per cent was under corn, 17.8 under wheat, 42.5 under oats, 9.3 under barley, 5.7 under rye, and 9.3 under buckwheat. The acreage and product of the above-named crops is given below:

	ACRES.	BUSHELS.
Indian corn	658,652	20,024,865
Wheat	557,736	10,412,675
Oats	1,329,753	40,785,900
Barley	111,658	2,943,250
Rye	177,416	2,431,670
Buckwheat	289,862	3,815,350

During the period 1880 to 1890 the number of acres of meadow-land mown for hay was increased in New York by 598,558 acres; 48,954 horses were foaled; the average weight of fleeces sheared from sheep increased from 5.15 to 5.66 pounds; the num-

ber of milch cows was increased by 2,375, giving the state more milch cows than any other three states in the North Atlantic division; the number of neat cattle on farms was decreased by 208,364, —the largest loss of any state in the Union during the time, but leaving almost fifty cattle to each square mile of land surface; the average milk-production per cow during the period was 460.98 gallons,—the second highest production in the United States. New York stood high in the production of both flaxseed and fiber, ranking second in the average value per acre of all flax products. In 1880 the state produced considerably more than one half of the total fiber raised in the United States. The highest average production of hemp to the acre in 1889, 1,192 pounds, was in New York, which stood second in the average value per acre, seventh in acreage, and fifth in production. In the area devoted to tobacco in the same year, New York stood eleventh, with 8,629 acres, and in production stood tenth, with 9,316,135 pounds raised. In the production of hops, New York led all the other states by far in the census reports of 1900, its hop acreage being more than seven times, its hop-production more than two and two fifths times, and the value of its hop crop more than two and three fifths times that of any other state. Below are given the relative statistics of farms, acreage, values and products for 1890 and 1900:

STATE SEAL OF NEW YORK.

	1890.	1900.
Total number of farms	226,223	226,720
Average size of farms, acres	97	99
Total acres in farms	21,961,562	22,648,109
Total acres in farms, improved	16,389,380	15,599,986
Total acres in farms, unimproved	5,572,182	7,048,123
Total value of farms, fences, buildings, implements, machinery and live-stock	$1,139,310,716	$1,069,723,895
Total value of farm products	$161,593,009	$245,270,600
Number of horses	664,430	628,438
Number of mules and asses	4,636	3,651
Number of neat cattle	2,131,392	2,596,389
Number of swine	843,342	676,639
Number of sheep, excluding lambs	1,528,979	984,516
Pounds of wool shorn	6,715,686	6,674,165
Acres of meadow mown	5,243,010	5,154,965
Tons of hay harvested	6,675,658	6,389,496
Acres under Irish potatoes	357,464	395,640
Bushels produced	24,616,736	38,060,471
Acres devoted to hops	36,670	27,533
Pounds of hops produced	20,063,029	17,332,340
Pounds of broom corn produced	450,380	201,060
Bushels of pulse (peas and beans)	1,340,236	1,612,334

New York has stood first among the states since 1850 in the gross and net value of manufactured products, the average number of employees and the total wages paid. The total number of specified industries in 1900 was 78,658, the aggregate capital employed amounted to $1,651,210,220, the number of employees averaged 923,536, to whom annual wages amounting to $490,931,300 were paid, and the value of all products footed $2,175,726,900. Among the leading industries were clothing in all branches, which approximated $234,000,000; all lines of boots and shoes, $26,000,000; furniture, all branches, $24,000,000; hosiery, $36,000,000; malt liquors, $56,000,000; petroleum-refining, $27,000,000; slaughtering and meat-packing, all branches, $57,431,000; tobacco and cigars, all branches, $53,660,000; all kinds of printing and publishing, $95,232,000; lumber in all forms, $45,500,000; leather in all forms, $23,000,000; foundry and machine-shop products, $97,000,000; flouring and grist-mill products, $42,796,340; chemical products, $40,663,363; patent medicines $17,075,937.

In the total value of the mineral products of 1899, New York stood sixth among the states, the output amounting to $24,165,206. The iron ore amounted in value to $3,100,216; all stone, to $4,418,143, which included granite, marble, slate, limestone, sandstone, bluestone, millstones, mica, and graphite. The petroleum product in 1900 in N. Y. was $27,184,524; with that of New Jersey and Pennsylvania, the value of the combined output of the three states was $91,811,690. In the production of salt, New York is second only to Michigan, the report for 1900 giving the number of establishments at 38, which is one-fourth of the whole number in the United States; the capital invested, $17,231,864, is more than one-half of the total amount invested in the entire country; the number of employees was 1,932, their total annual wages, $637,274; the value of the products for the year was $2,698,691, that of the United States being $7,966,897. Natural gas is largely used as a fuel for manufacturing purposes, and capital to the amount of almost one and one-half million dollars is invested in its production. Fully one-half of the cement made in the United States is manufactured in New York, the value of the annual product (lime and cement) amounting in 1900 to $6,188,342.

The timber-lands of the state were formerly very valuable, but great loss has resulted from waste and forest fires until the timber area is almost exclusively confined to the Adirondack region. The state forestry commission is doing much to preserve this district to the state, and legal protection has been thrown around the remaining forests of New York to a greater extent than in any other of the states.

The fishery interests of the state are of considerable magnitude, New York ranking fourth among the states in the census reports of 1890, the value of the catch of the preceding year being given at $3,798,815. The number of persons engaged in boat or coast fishing was reported at

1,626, the value of the catch approximating $1,000,000. The oyster-fisheries engaged 4,124 persons, and the value of the product was $1,765,088. The menhaden-fisheries gave employment to more than 1,000 persons, and the value of the products exceeded $600,000; in the shad and alewife fishery 1,190 persons were employed and $597,059 represented the value of the products; in the inland fisheries 587 persons were employed, and $82,412 was returned as the value of the products; the Great Lakes fisheries had 634 persons engaged, and yielded a return of $165,116, while many persons were engaged in and large returns came from cod and ground fishery, lobster-fishery and whale-fishery. Much attention is given to the fisheries of the state, and the legislature makes liberal appropriation for the distribution of fish and their protection. In 1894 a total of 134,000,000 fry were placed in the different waters of the state, and during the year ending Sept. 30, 1895, 196,247,840 fish of various kinds and ages were planted by the state. The kinds of fish distributed are many, including the brook, brown and rainbow trout, landlocked and sea salmon, maskalonge, black-bass, whitefish, pike, perch, tomcod, smelts, ciscoes, shads, bullheads, frost-fish and pike-perch.

Game is also protected by vigorously enforced laws, and has multiplied very rapidly within the period 1890–96. In the Adirondack region over 5,000 deer were reported killed in the open season of 1895.

The state taxes for 1895 were levied on a basis of a total valuation of $4,292,082,167. The total amount of property in the state was greater than the above sum by $111,693,960, corporate personal property not subject to taxation locally for state purposes. The total wealth of the state was divided as follows: Real estate, $3,841,582,748; personal property, $592,193,379.

The comptroller of the treasury reported on Oct. 1, 1900, that there was in the treasury the sum of $7,289,800; the receipts during the year from all sources amounted to $36,530,121, and the expenditures of the year amounted to $29,221,646. The balance on hand at the beginning of the fiscal year was $1,548,286, which, with the receipts of the year, sufficed to meet the expenditures and leave the balance in the treasury above mentioned,—the smallest balance remaining at the close of a fiscal year since 1890. The different corporations doing business within the state paid in during the year the sum of $1,855,975, which, with the organization taxes received, amounted to a total of $2,115,807. During the fiscal year 1,423 new corporations were formed, which paid in, as taxes, the total amount of $492,495.

The state charitable, reformatory and penal institutions of the state are many and well sustained. The asylums for the insane number eight, and are located at Utica, Poughkeepsie, Middletown, Buffalo, Willard, Binghamton, Ogdensburg and Rochester. The original cost of the buildings alone was $8,509,271. In 1895 the legislative appropriation for the care of the insane amounted to $4,292,082. At Syracuse is maintained an institution for the care of feeble-minded children, and at Newark one for feeble-minded women. The blind of the state are educated at institutions located in New York City and Batavia, and for the deaf and dumb there are six institutions, located at New York City, Buffalo, Rochester, Malone, Albany and Fordham. State prisons are maintained at Sing Sing, Auburn and Clinton; the average total number of convicts being about 4,000. At Auburn separate buildings are provided for women convicts, and reformatories are provided for women at Hudson and Albion. For men there are reformatories at Elmira, Canaan Four Corners, Randall's Island and Rochester. At Matteawan is located a hospital for insane criminals, at Bath is a soldiers' and sailors' home, and at Rome is located a state custodial asylum.

In 1895 the biennial school census of all the villages and cities of the state exceeding 10,000 in population showed a considerable increase over the preceding census. In 1900 there were 11,931 schoolhouses, and during the year following more than $4,000,000 was expended in building and repairs. The total number of persons of school age within the state was 1,932,295, of whom 1,208,855 belonged in the cities and 723,440 in the country. This was an increase of about 40,000 over the number in 1894. The total enrollment in 1900 was 1,569,653; average daily attendance 857,488. The total number of teachers in 1900 was 34,848, of whom 5,096 were males and 27,833 were females. In the cities of the state the teachers received, as salaries, $7,264,613, and in the country $4,788,404,—an increase over 1894 of $169,922. The estimated value of all school property (buildings, sites, apparatus and furniture) was approximately $81,768,895, divided among cities and country in the proportion of seven tenths to the former and three tenths to the latter. The expenditures for teachers' salaries (1900) amounted to $19,218,892; for buildings, sites, repairs, etc., $8,854,633; for school libraries $142,158. The total cost of secondary education in 1900 was $6,096,371 ($4,077,420 for high schools, and $2,018,953 for academies).

Teachers' institutes are held annually to the number of more than one hundred in various portions of the state, which are attended by an average of about 20,000 teachers. Normal schools are maintained at Buffalo, Courtland, Fredonia, Albany, Brockport, Geneseo, New Paltz, Oneonta, Oswego, Plattsburg and Potsdam, the aggregate attendance in 1895 being in excess of 8,000. The total value of the different properties is nearly $2,000,000, and the annual expenditures approximate $400,000.

The superintendent of public instruction, elected by the state legislature, is at the head of the common-school system of New York, under whose guidance work the superintendents in cities and commissioners over groups of towns. The regents of the University of the State of New York, elected by both houses of the legislature

on joint ballot, have supervision of education throughout the state. They supervise and control examinations, and have under their management the State Library and State Museum.

The following is a table of the denominational institutions of education conducted in New York, their location, and the religious organization under whose auspices they are operated:

Location.	Institution.	Religious Denomination.
Alfred.	Alfred University.	Seventh-Day Bapt.
Allegany.	St. Bonaventure's Col.	Roman Catholic.
Annandale.	St. Stephen's College.	Protes. Episcopal.
Brooklyn.	St. Francis College.	Roman Catholic.
Brooklyn.	St. John's College.	Roman Catholic.
Buffalo.	Canisius College.	Roman Catholic.
Canton.	St. Lawrence University.	Universalist.
Geneva.	Hobart College.	Protes. Episcopal.
Hamilton.	Colgate University	Baptist.
Keuka College	Keuka College.	Free Baptist.
New York.	Col. of St. Francis Xavier	Roman Catholic.
New York.	Manhattan College.	Roman Catholic.
New York.	St. John's College.	Roman Catholic.
Niagara Univ.	Niagara University.	Roman Catholic.
Rochester.	University of Rochester.	Baptist.
Syracuse.	Syracuse University.	Meth. Episcopal.

The following is a list of the non-sectarian institutions of the state:

Location.	Institution.
Brooklyn.	Polytechnic Institute of Brooklyn.
Clinton.	Hamilton College.
Ithaca.	Cornell University.
New York.	College of the City of New York.
New York.	Columbia University.*
New York.	University of the City of New York.
Schenectady	Union College.

The following are institutions for women only:

Location.	Institution.
Aurora.	Wells College.
Brooklyn.	Parker Collegiate Institute.
Elmira.	Elmira College.
New York.	Barnard College.
Poughkeepsie.	Vassar College.

In 1890 there were, in New York, 8,237 church organizations, 7,942 edifices, a membership of 2,171,822, which was 36.21 per cent of the population, and church property of the value of $140,123,008. In both membership and the value of church property the state ranks first, in number of edifices third, and in number of organizations fourth. The number of different denominations was 48, and there were 26 independent congregations. Leading among the denominations were the Baptists, all bodies, with 1,071 organizations; the Roman Catholics, 959; the Congregationalists, 301; the Jewish congregations, 179; the Lutherans, all bodies, 317; the Methodists, all bodies, 2,563; the Presbyterians, all bodies, 903; the Protestant Episcopals, 735; the Reformed, 323; and the Universalists, 168.

In 1896, and for many years previous, New York stood first among the states in the strength and organization of its National Guard. Reports made in 1896 showed the actually organized force to consist of 730 commissioned officers, 12,159 infantry, 134 cavalry and 416 artillery. Additional troops of cavalry were formed in Brooklyn and Buffalo during the year. There was also a battalion of naval militia, numbering 344 officers and men, and 2 separate divisions of an aggregate strength of 100. The military force of the state is divided into four brigades, which include, in addition to the forces mentioned, signal and hospital corps. The state appropriations, including a permanent one for ordinary expenses of $400,000, average close to half a million dollars annually. The Federal appropriation varies with the needs of the guard, amounting in 1894 to $31,000, and having reached $50,000.

At the time of the taking of the Federal census of 1850 there were but 1,361 miles of railway in the state of New York. In 1860 there were 2,682 miles; in 1870, 3,928 miles; in 1880, 5,991 miles; in 1890, 7,745 miles. Later reports have not been regularly made, but the mileage in 1900 was not far from 8,230. The time from 1890 to 1895 was not favorable for railway-construction, the greatest amount in any year being 99 miles of main line in the fiscal period ending June 30, 1894. The total number of passengers carried on the steam roads in 1900 was 73,846,114, and on the street surface and elevated roads, 1,986,138,207. In 1900, 671 persons were killed, and 1,374 injured by the steam roads; while the accidents on the street and elevated railways aggregated 152 killed and 665 injured. The funded debts of the various roads was decreased within the year mentioned by $1,264,021, and the non-funded debt increased $13,941,656. The average percentage of dividends declared during the year was 2.63, as against 2.69 in 1894.

The canals of New York began to receive legislative attention in 1893–94, and in 1895 a proposition was submitted to the voters of the state to issue bonds to the amount of $9,000,000 for the purpose of improving the canals of the state by deepening and in other ways fitting them for greater traffic. This act was approved by a large majority of the voters of the state, and a tax, amounting to $\frac{1.3}{100}$ of a mill on each dollar of valuation of real and personal property in the state, is to be annually imposed for the purpose of meeting the maturity of the bonds and the annual interest thereon. The use of electricity as a motor for boats on the canals will, it is estimated, increase the traffic at least thirty per cent, and with the waterways deepened a revival of shipping interests is expected.

The report of the Commissioner of Insurance for 1900 shows that the total receipts of 182 fire and marine insurance companies for the year were $167,371,063. The assets of N. Y. joint-stock companies doing business in the state were for 1900 $91,851,548; the assets of N. Y. life insurance companies for the same year were $1,042,317,839.

In 1895 there were nearly 600 libraries in New York of 1,000 volumes and over each, containing an aggregate of nearly 4,500,000 bound volumes

* Name changed from Columbia College, 1896.

and 500,000 pamphlets. Of these, about 250 were school libraries, 30 college, 100 public, and the remainder divided among legal, theological, college society, medical, government, state, social, scientific, Y.M.C.A., public institution, garrison, mercantile and miscellaneous. The traveling library system originated in New York in 1893, when the Albany State Library officials resolved to loan boxes of from fifty to one hundred volumes each to such public libraries as needed them, and to communities where no libraries existed. The library remains in one place but six months, and is then returned to headquarters, to be followed, if desired, by another selection, while it is forwarded elsewhere. A small fee is paid by the borrowing library or town, sufficient to cover transportation charges and the wear of the books. Iowa, Michigan and Montana have followed the example set by New York, and the traveling library is now established by law in all of the states named.

The principal cities and towns of New York, with their populations according to the Federal census of 1890, and a Federal census taken in 1900, are given in the following table:

Cities.	1890.	1900.
New York	1,515,301	3,437,202
Brooklyn	806,343	1,166,582
Buffalo	255,664	352,287
Rochester	133,896	162,608
Albany	94,923	94,151
Syracuse	88,143	108,374
Troy	60,956	60,651
Utica	44,007	56,383
Binghamton	35,005	39,647
Yonkers	32,033	47,930
Elmira	30,893	35,672
Auburn	25,858	30,345
Newburg	23,087	24,943
Cohoes	22,509	23,910
Poughkeepsie	22,206	24,029
Oswego	21,842	22,199
Kingston	21,261	24,535
Schenectady	19,902	31,682
Amsterdam	17,336	20,929
Jamestown	16,038	22,892
Lockport	16,038	16,581
Rome	14,991	15,343
Watertown	14,725	21,696
Gloversville	13,864	18,349
Middletown	11,997	14,522
Ogdensburg	11,662	12,633
Ithaca	11,079	13,136
Mt. Vernon	10,830	20,346
Niagara Falls	.....	19,457
Lansingburg	10,550	12,595
New Rochelle	9,057	14,720
Saratoga Springs	11,975	12,409

At the close of 1900 there were 200 state banks in New York, which reported, together with four private banks, assets and liabilities of $271,448,300. Items of the liabilities were $11,136,005 undivided profits, $178,331,859 due depositors on demand, and $16,148,856 surplus fund. The number of national banks was about 337, their combined capital nearly $97,336,000, their circulation and reserve $316,827,788, and individual deposits about $924,600,000. There were, also, about 59 loan and trust companies, whose capital would average almost $1,000,000 each, and whose deposits would aggregate about $640,000,000.

March 30, 1905, the newspapers and all other periodicals published in New York numbered, 1,975, of which 210 were daily, 6 triweekly, 44 semiweekly, 1,025 weekly, 11 fortnightly, 41 semimonthly, 572 monthly, 15 bimonthly, 50 quarterly, and 1 semiannually. Papers were published in all of the 61 counties, and in 488 of the cities, towns, and villages, of which 63 were county seats.

The following is a list of the governors of New York from 1777, with their respective terms of office:

George Clinton	1777-95
John Jay	1795-1801
George Clinton	1801-04
Morgan Lewis	1804-07
Daniel D. Tompkins	1807-17
John Taylor	1817
De Witt Clinton	1817-22
Joseph C. Yates	1822-24
De Witt Clinton	1824-26
Nathaniel Pitcher	1826-28
Martin Van Buren	1828-29
Enos T. Throop	1829-32
William L. Marcy	1832-38
William H. Seward	1838-42
William C. Bouck	1842-44
Silas Wright	1844-46
John Young	1846-48
Hamilton Fish	1848-50
Washington Hunt	1850-52
Horatio Seymour	1852-54
Myron H. Clark	1854-56
John A. King	1856-58
Edwin D. Morgan	1858-62
Horatio Seymour	1862-64
Reuben E. Fenton	1864-68
John T. Hoffman	1868-72
John A. Dix	1872-74
Samuel J. Tilden	1874-76
Lucius Robinson	1876-79
Alonzo B. Cornell	1879-82
Grover Cleveland	1882-84
David B. Hill	1884-91
Roswell P. Flower	1891-94
Levi P. Morton	1894-97
Frank S. Black	1897-99
Theodore Roosevelt	1899-1901
Benjamin B. Odell, Jr.	1901-05
Frank W. Higgins	1905-07
Chas. E. Hughes	1907-09

See also New York, Vol. XVII, pp. 462–469.

*NEW YORK CITY.—The early history of the American metropolis, its development and progress, up to the year 1884, may be found in Vol. XVII, pp. 469–479 of this Encyclopædia. The greater city expanding and enlarging every year, spreading and reaching far beyond the confines of Manhattan Island, had in 1905, included a part of Westchester County to the north, Queens County to the east, and all of Kings County and Richmond County to the south. The greater city under the charter of 1902 is divided into five boroughs: Manhattan, consisting of Manhattan Island, Governor's Island, Bedloe's Island, Ellis Island, Blackwell's Island, Randall's Island, Ward's Island, and Oyster Island; Bronx, consisting of all that portion of the city lying north or east of the Harlem River between the Hudson and the East rivers, and Long Island Sound, including City, Traver's, Hart's and Riker's Islands; Brooklyn, consisting of the former city of Brooklyn, and all of Kings County; Queens, including the present county of that name; and Richmond, consisting of Staten Island. The business center of the city proper since 1895 has been gradually moving northward, while since 1884, the shopping, hotel and amusement centers haved changed from 14th street to 23rd street, and thence to 33rd street, to 42nd street and Columbus Circle at the entrance to Central Park. The trend is still further northward, and 125th street, in Harlem, promises eventually to be the great throbbing heart of activity on Manhattan Island.

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ARCHITECTURE. — In the latter-day construction of buildings in New York, architecture becomes a matter of style rather than of beauty. The sky-line changes each year owing to the ever increasing number of "sky-scrapers" which in late years are reared quickly in most unexpected portions of the city. The styles are various, Greek, Roman, Gothic, Italian, Tudor, Renaissance and modern French. Office buildings of astonishing height predominate. Among the more prominent of these are the Park Row Building, 385 feet in height; Pulitzer Building, containing the offices of the New York *World;* the New York Life Insurance Building; Bowling Green Building; American Surety Building; American Tract Society; Broad Exchange Building; St. Paul Building; Manhattan Life Building; Commercial Cable Building; Empire Building; Standard Oil Building, and Washington Insurance Company, all over 250 feet in height. The Fuller, or "Flat-Iron" Building at 23rd street, Fifth avenue and Broadway, towers skyward 286 feet. The new *Times* building, at 42nd street, and Broadway, is 25 stories above the curb and is 358 feet high. The Produce Exchange Building, near Bowling Green, covers an area of 300 by 150 feet. The cornice is 116 feet above the street, and the top of the campanile, or tower, reaches 225 feet. It is built of brick and terra-cotta, in the modern Renaissance style. Madison Square Garden, at Madison avenue and 26th street, is built of buff brick with terra-cotta trimmings, and has an Italian tower rising to a height of three hundred feet, bearing aloft, at the peak of a minaret, a gilded statue of Diana. This building contains an amphitheater of thirty thousand square feet, available for fairs, conventions, and exhibitions. There is also a theater, concert-hall and roof-garden. The amphitheater will seat 15,000 people. The New York hotels in number, size and magnificence rival those of any city in Europe. The Waldorf-Astoria, Fifth avenue, 33rd and 34th street, is the largest and best equipped hotel in the world. It is constructed of red brick with terra-cotta trimmings. The Hotel Astor, Knickerbocker and St. Regis are recent additions to the list of leading hotels, which include the better known Astor House, Fifth avenue, Hoffman House, Majestic, Netherland, Park Avenue, Plaza, St. Denis, Savoy, Vendome, and Murray Hill. The St. George and Marguerite, in Brooklyn, are also of attractive architecture, as is Hotel Castleton on Staten Island. Gothic architecture in New York is best represented by the Roman Catholic Cathedral in Fifth avenue. See also PUBLIC BUILDINGS; MONUMENTS.

MADISON SQUARE GARDEN BUILDING, NEW YORK.

PARKS AND DRIVEWAYS. — The public parks are managed by a board of three commissioners appointed by the mayor. In addition to the two largest parks, Central Park, Manhattan, and Prospect Park, Brooklyn, there are 51 parks in Manhattan, 17 in the Bronx, 38 in Brooklyn, and 5 in Queens, the total acreage being 6,982. The new Bronx Park, is in the central northern section of the Bronx borough. The northwestern section of 250 acres has been assigned to the Botanical Society, whose gardens are free to the public. The southeastern section of the park comprising 261 acres, is in charge of the Zoölogical Society, and its buildings are free to the public except on Mondays and Thursdays. Riverside Park and Riverside Drive are on the upper west side along the banks of the Hudson River. Van Cortlandt Park, adjoining the Yonkers boundary, contains 1,069 acres. Pelham Bay Park, in the eastern corner of the Westchester annexed district, fronts upon Long Isand Sound and and contains an area of 1,700 acres. Plans are making for parkways connecting Van Cortlandt Park with Bronx Park, Bronx Park with Pelham Bay Park, and Crotona Park with Bronx Park. In Brooklyn there are the Ocean Parkway, running from the southern end of Prospect Park to Coney Island; Eastern Parkway, from the northern end eastward 2½ miles, with an extension 2½ miles farther; Fort Hamilton avenue, from the southeastern side to Fort Hamilton, about four miles; Bay Parkway, branching off from Ocean Parkway and running to Bensonhurst; 75th street; and Bay Ridge Shore Drive. The Speedway, a public road for fast driving, 100 feet wide, extends for a distance of two miles along the foot of the bluff on the west bank of the Harlem River.

MONUMENTS. — There are sixty monuments and statues, allegorical and personal, to be found in the public parks and squares of New York city. Among those erected since 1884 is the white marble statue of Columbus in Central Park, unveiled in 1892. It consists of a lofty column surmounted by a colossal figure of Columbus. Allegorical figures are at the pedestal and base of the column. The colossal effigy of Liberty Enlightening the World, on Bedloe's Island (see BARTHOLDI and BEDLOE'S ISLAND, in these Supplements) was dedicated in 1886. Other monuments include a bronze bust of Beethoven, Central Park, (1884); equestrian statue of Simon Bolivar, Central Park; bronze statue of Roscoe Conkling, at Madison Square (1893); the letter-carriers' commemorative statue, in bronze of S. S. Cox, in Astor Place; a

statue of William E. Dodge, a New York philanthropist and merchant, at 36th street and Broadway (1885); Garibaldi, in Washington Square (1888); two statues of Horace Greeley; a bronze of Nathan Hale, the Revolutionary martyr-spy, in City Hall Park (1893); an equestrian statue of General Winfield S. Hancock, near the northern end of Central Park; a bronze of Dr. James Marion Sims, in Bryant Park; one of Thorwaldsen in Central Park, and one of John Ericsson, commemorating, on a panel, the fight of the *Monitor* and *Merrimac*, at the Battery (1893). The Grant Tomb, on Riverside Park, overlooking the Hudson River, was brought to completion in 1896. The main structure is square, with a projecting Greek porch, intended to supply a background for equestrian statues of Grant and his generals. It is surmounted by a circular tower, of which one member is a Greek arcade. Among other public works of art is the Washington Arch at the

WASHINGTON ARCH, NEW YORK.

north entrance to Washington Square. It is of pure white marble, in the Roman triumphant style, and consists of a single arch, with pedestals at the base for the reception of statuary. The arch, above its piers, which are plain, is highly enriched with emblematic and decorative carving in relief. In the Bronx, at Mott avenue and 161st street, a fountain commemorative of the German poet, Heine, was erected in 1899. In Brooklyn a bronze equestrian statue of General Grant was erected in 1896 in Bedford avenue. There were also erected in Brooklyn, a bronze statue of Major-General G. K. Warren in Prospect Park (1896); a bust of Mozart in Prospect Park (1897); and a Maryland Soldiers' Monumental shaft in Prospect Park (1895).

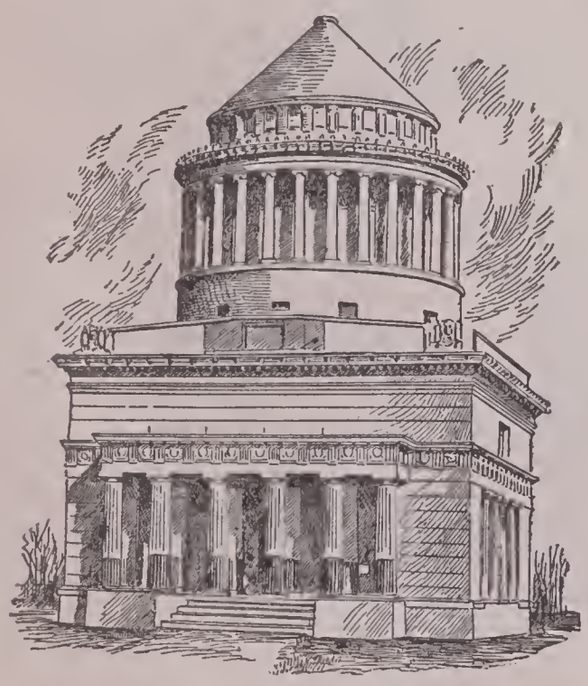
CEMETERIES.— In 1904 there were 44 cemeteries in and about the city, including Calvary, Cypress Hills, Greenwood, Kensico, Evergreen, Lutheran, Maple Grove, Marble, Mount Hope, Mount Olivet, Rockland, Rosedale, Trinity, Union, Washington and Woodlawn. The borough of Queens contains more cemeteries than any other section. The number of interments in that borough is 2,500,000, of which 2,000,000 are in the town of Newtown, which has a cemetery area of 1,800 acres. The largest average burial per acre has been reached by Calvary Cemetery — 600,000 in 214 acres, or an average of 2,800 burials to the acre. A crematory was established at Fresh Pond, on Long Island, in 1885. The building is in the style of a Grecian temple. To January 1, 1905, over 2,400 bodies had been incinerated here.

NEW PUBLIC BUILDINGS.— Within the past two decades few public buildings have been erected in New York. In 1903 the New York Stock Exchange building was opened at the head of Broad street, near Wall. The new Customs House, under course of construction in 1905, at the foot of Broadway on the original site of Fort Amsterdam, is to cost $10,000,000. The Tombs Prison, being rebuilt in 1905, and the Hall of Records, nearing completion at Chambers and Center streets, are notable among new municipal buildings. A new Post-Office building is in contemplation, the site to be in the vicinity of 42nd street.

BRIDGES.— The new Williamsburg Bridge over the East River, opened in 1904, gave to the metropolis a structure greater and more imposing than the famous Brooklyn Bridge. (See NEW YORK, Vol. XVII, pp. 477, 478.) The tower foundations of the bridge in Manhattan are at the foot of Delancey Slip, and in Brooklyn at a point between South Fifth and South Sixth streets. The bridge ends at Clinton street in Manhattan, and at Havemeyer street in Brooklyn. The dimensions of the bridge are as follows: — Main span, 1,600 feet; entire bridge, between terminals, 7,275 feet; width of bridge, 118 feet; minimum height of bridge above mean high water, 135 feet; height of center of cables at top of towers above mean high water, 332 feet, 8½ inches; width of carriage ways, each, 20 feet; width of two foot walks, each, 10½ feet; width of two bicycle paths, each, 7 feet; width of four trolley car tracks, center to center, 9¾ feet; width of two elevated railroad tracks, center to center, 11 feet; New York side — north caisson, 55 feet below low water mark; south caisson, 66 feet. Brooklyn side — north caisson, 107.5 feet below low water mark; south caisson, 91.9 feet. The tower foundations are 23 feet above high water mark, and the towers that are placed on top of them are made of steel. The estimated cost is about $11,000,000, exclusive of real estate. Two other bridges over the East River are under construction: The Manhattan Bridge, on which the work of construction of tower foundation in Brooklyn commenced August 29, 1901; title to land vested in the city, September 14, 1901. Plans for the new Blackwell's Island Bridge were approved by the War Department February 23, 1901. Ordinance providing for the issue of stock to the extent of $550,000, signed by the mayor, May 21, 1901; title to land vested in the city, December 22, 1901. Work of constructing the piers commenced July 19, 1901. The date set for its completion being

in 1908. A new bridge over the Harlem River, completed in 1895, at a cost of about $2,000,000, leads from Eighth avenue to Central avenue. It is 66½ feet wide, is the largest drawbridge in the country, and the bridge proper has a length of 1,920 feet. On the south side it is connected with Washington Heights at One Hundred and Fifty-fifth street, by a viaduct built of iron and steel, with asphalt sidewalks and road ways. (See also TRANSPORTATION.)

DEFENCES.—Since 1884 the Federal government has expended millions of dollars in constructing military defences for New York harbor, including the improvement and enlargement of old fortifications and the construction of new works. The fortifications surrounding the city are those protecting the eastern approaches by way of the Sound, and those protecting the southern approaches, by way of Sandy Hook. Those of the first division are Fort Schuyler, on Throgg's Neck, fifteen miles from the City Hall, and opposite to it, Fort Totten, on Willet's Point. Five miles east of Fort Schuyler is Fort Slocum. The forts



GENERAL GRANT'S TOMB.

of the second division are Fort Hamilton, on Long Island, and at the Narrows, and opposite to it, Forts Wadsworth, Tompkins, and Newton, on Staten Island. At Sandy Hook are the Government Proving Grounds and a series of detached works or heavy batteries known as Fort Hancock. Opposite, on Plumb Island, and just east of Coney Island, a new work is now being erected. Two hundred yards from shore, opposite Fort Hamilton, is Fort Lafayette, used as a powder storehouse by the navy. Governor's Island, opposite the Battery Park in New York, is the headquarters of the Department of the East and saluting station of the harbor.

GREATER NEW YORK.—Under a state commission appointed in 1890, by the legislature, a project was brought forward to consolidate Brooklyn and adjoining districts with New York city under one municipal government, known as Greater New York. In 1894, a bill was passed defining the limits of the proposed consolidation, and submitting the unification to the popular vote of the districts involved. Under this act, Greater New York embraced an area of 327 square miles. The consolidation was approved by a small majority of the people, when submitted to them, but their action was not confirmed until 1896 when the legislature gave effect to the popular will, and directed a commission to draw up a charter for the common government. The charter was revised by the legislature in 1901, was signed by Governor Odell and became a law on January 1, 1902.

GOVERNMENT.—Under the charter of 1902 the executive power is vested in the mayor, elected for two years; a comptroller, elected for two years; and a board of aldermen, consisting of 73 members, elected for two years; and a president elected at large for the same term. For local administration, the city is divided into five boroughs, Manhattan, Brooklyn, Bronx, Queens and Richmond. The president of each borough is elected for two years. The mayor appoints the heads of departments and commissioners, except those over which the presidents of the boroughs have jurisdiction, and except also the comptroller or head of the department of finance who is elected by popular vote. He can, with few exceptions, remove any official appointed by him, and can himself be removed by the governor after a hearing upon charges. The mayor has the power of veto over all ordinances and resolutions of the Board of Aldermen, but an ordinance or resolution can be passed over his veto by a vote of two-thirds of the members of that body. The president of each borough presides over each local board in his borough, with the right to vote on and of veto over its actions, and is an ex-officio member of the board of estimate and apportionment. He is also a member of the Board of Aldermen and has the same right to vote as any member elected to that body.

CIVIL SERVICE.—Under the laws of 1899 there is a Municipal Civil Service Commission. The rules apply to all positions in the service of the city of New York except officers elected by the people, all legislative officers and employees, heads of any department, or superintendents, principals, or teachers in a public school, academy or college. This requires "examinations, wherever practicable, to ascertain the fitness of applicants for appointment to the civil service of the city." The law requires that these examinations shall be competitive.

FINANCES.—The income of New York city for 1904, excluding bonds, was $111,608,194. The interest on bonds for 1904 was $15,188,951. The assessed valuation of property within the city for 1903 was $3,857,047,718, five-sixths of it being real estate. The net bonded debt of the city is $437,796,661. The city tax rate is 1.41 per cent. The city owns property valued at $354,000,000. The annual income from taxation is estimated and apportioned by a Board of Estimation and Apportionment, which also allows for municipal improvements and the expenses of municipal government. The budget for 1905 to pay the charges and expenses of Greater New York amounted to $110,525,259.

THE FIRST NATIONAL BANK BUILDING, CHICAGO, ILL.

LARGEST OFFICE BUILDING IN THE WORLD

GENERAL GRANT'S TOMB, NEW YORK CITY

COURTS AND POLICE.—The courts of New York in 1905 included the Supreme Court (5 judges); the Special Sessions (6 judges); eight Magistrate's Courts (14 magistrates); a Juvenile Court (1 judge); City Court (7 judges); Surrogate's Court (2 judges); the Court of Arbitration, and various state and United States Courts. The Police Department is in charge of a Police Commissioner, four deputy commissioners, a chief inspector, and 16 deputy inspectors. There were 8,352 policemen employed in 1904. The appropriation for the maintenance of the police department in 1904 was $12,030,500. There are 36 police stations in Manhattan Borough. A body of harbor police patrol the rivers in rowboats, with headquarters on the police steamer, *Patrol*. In summer a steamboat squad is detailed to accompany all pleasure-boats plying to suburban and seaside resorts. In 1904

COLUMBUS MONUMENT, NEW YORK.

a mounted squad was established to control and regulate street traffic. A bicycle squad patrols Fifth avenue and the leading driveways. The prisons within the city limits are designed only for those prisoners awaiting trial. These include the Tombs, Ludlow street jail and the various police court prisons. On Blackwell's Island in the East River, are the Penitentiary, Almshouse, Workhouse and numerous city asylums and hospitals.

CHARITIES.—In New York there are 28 hospitals, refuges and asylums receiving municipal aid and 89 hospitals and dispensaries supported by endowment and voluntary contributions. The leading charitable institution is the Charity Organization Society, which is supported by voluntary contributions and legacies. The Children's Aid Society has provided 75,000 boys and girls with homes and places of employment, and in its industrial schools given aid and instruction to over 115,000 children. Two other well-known organizations are the New York Foundling Hospital, controlled by the Sisters of Charity and the Society for the Prevention of Cruelty to Children. Other institutions are the Catholic Protectory, the House of Refuge, the Grace Institute, endowed by William R. Grace in 1897, the Legal Aid Society, the Prison Association, the Provident Loan Society; the Baron de Hirsch Fund for the benefit of Hebrew emigrants; various Church and College Settlement Houses and the Sailors' Snug Harbor, on Staten Island. There is a City Department of Charity managed by a commissioner appointed by the mayor. The yearly appropriation for this department averages $2,000,000.

FIRE DEPARTMENT.—The amount appropriated for fire protection in New York in 1904 was $5,968,300. There were 3,753 firemen employed during the same year. The department is controlled by a commissioner appointed by the mayor. In 1904 the apparatus consisted of three fireboats, 158 steam fire-engines, 6 water towers, 45 hook and ladder trucks, and 685 horses. During the year there were 5,839 fires, with a total estimated loss of $4,510,982, on which the insurance was $164,506,440.

BUILDING DEPARTMENT.—There is a Bureau of Buildings in each of the New York boroughs, in charge of a superintendent. No building can be erected unless the plans are approved by this Bureau. There is also a Tenement House Department, in charge of a commissioner. The Department is divided into the New Building Bureau, the Inspection Bureau and the Bureau of Records. The New Building Bureau examines plans for light and ventilation of tenement houses; the Inspection Bureau inspects completed tenement houses, and the Bureau of Records keeps a record of all tenement houses in the city. The estimated cost of the new buildings in New York for 1904 was $96,000,000, and the cost of alterations, $11,500,000.

PUBLIC WORKS.—The streets and avenues of New York are in charge of a commissioner appointed by the mayor. The appropriation made in 1904 for cleaning the streets was $6,437,020, and for maintaining and repairing highways, $2,375,454. The streets of New York in 1904 had a total length of 2,534½ miles, of which 1,765 miles were paved. The total length of the city's sewers is 1,557 miles. The annual cost of removing the garbage and ashes is $2,511,780. The street-cleaning department expended $750,000 during 1904 removing snow and ice from the streets during the winter months. The streets are lighted by 46,835 gas lamps and 16,316 electric lights. There are 26,853 fire hydrants in Manhattan and the Bronx. The city owns its own water works, including 2,000 miles of mains, which cost $122,590,000. The water supply is in charge of a commission consisting of the mayor, comptroller and four special commissioners. A second conduit of the Croton system was completed in 1890 at a cost of $25,000,000. The present work of the commission is concerned with the extension of the

storage system. Titicus dam, near Purdy's Station, in the northeast of Westchester County, was completed at a cost of nearly $1,000,000, and 4,000,000,000 gallons of water were stored in the adjacent reservoir. The Cornell dams, with a storage capacity of 30,000,000,000 gallons, were finished at a cost of $4,150,000, and the Croton dam, completed in 1904, will have a storage capacity of 32,000,000,000 gallons, making a total capacity for New York of nearly 70,000,000,000 gallons. The Jerome Park reservoir, begun in 1895, is estimated to require twelve years for its completion. It will cost $5,473,060 and its capacity will be 1,500,000,000. The daily consumption of water in the city in 1904 was 463,103,000 gallons.

Docks.—The Department of Docks and Ferries is conducted by a commissioner appointed by the mayor. There were 61 piers on the East River front and 72 on the North River in 1904. In the same year there were 4 new piers constructed and over 500 feet of bulkhead.

Excise.—The Excise Department was formerly under the control of three commissioners, but in 1896 the passage of the Raines Law put an end to the old system of licenses, and transferred the control of the liquor traffic to the state. (See Liquor Laws, in these Supplements.)

Education.—The city in 1904 had 502 free school buildings with 16,569 teachers; the educational system being maintained at a cost of $21,431,379. The school system is under the control of 21 commissioners, appointed by the mayor, and there are subordinate district boards in charge of local interests. The Normal School at 69th street and Park avenue, and the College of the City of New York at 138th street and Amsterdam avenue, are the highest schools of the public system. The schools were attended by 535,000 pupils in 1904. The new schools established by the University of New York in late years include the Graduate School (1886); the University Law; the School of Pedagogy (1890); the New York-American Veterinary College (1899) and the School of Commerce, Accounts and Finance (1900). Among the new buildings of the University is the Library building, the open colonnade of which is known as the Hall of Fame. The arrangement of the library is on the plan of semi-circular rooms, of which there are eighteen. In 1904 there were 67,364 volumes in the library. The students in 1904 numbered 2,177, the professors 93, and lecturers and instructors 95. Other educational institutions in New York are: the College of St. Francis Xavier, Columbia University, Manhattan College, St. John's College, Teachers' College, Brooklyn Polytechnic Institute, Adelphi College, St. Francis College, St. John's College in Brooklyn, Packer Collegiate Institute, and Barnard College. The medical schools are the College of Physicians and Surgeons of Columbia University, Bellevue Hospital Medical College, New York University Medical School, Cornell University Medical School, and the Post-Graduate Medical School. There are also the New York Dental College, New York College of Pharmacy, American Veterinary College, and the New York College of Veterinary Surgeons. The art schools include the Art Students' League, the Academy of Design, and the art schools of the Metropolitan Museum of Art, Cooper Union, and Gotham Art Institute. The principal schools of music are, the National Conservatory of Music, New York College of Music, the Grand Conservatory of Music, and the Metropolitan College of Music.

Libraries.—The New York Public Library was established in 1895 by the consolidation of the Astor and Lenox libraries and the Tilden Trust. The Tilden Trust was created in 1884 by the will of Samuel J. Tilden, and at the end of a legal contest, became possessed of $1,000,000. The consolidated library has an invested endowment of $4,500,000, contains 750,000 bound volumes and 220,000 pamphlets. The new Public Library building now under construction at 42nd street and Fifth avenue, will be completed in 1907 and will cost $2,800,000. The Carnegie Library endowment of 1901, provides for 50 branch library buildings which will cost over $3,000,000. Throughout the city there are many institutional, private and special libraries, that of Columbia University including 350,000 volumes; the library of the New York Historical Society, 100,000 volumes; the Society Library, 100,000 volumes; the Mercantile Library, 233,000 volumes; the City Hall Library, 20,000 volumes; the Museum of Natural History Library, 75,000 volumes; New York Law Library, 55,000 volumes, and the New York Academy of Medicine Library, 80,000 volumes.

Churches and Religion.—Exclusive of Brooklyn, there were 687 churches and chapels in New York on January 1, 1905. These include 151 Roman Catholic, 138 Protestant Episcopal, 86 Presbyterian, 103 Methodist Episcopal, 69 Baptist, 52 Reformed, 68 Lutheran, 18 Congregational, 7 Christian Science, 4 Disciples of Christ, 2 Friends, 7 Moravian, 4 Unitarian, 3 Universalist, 2 Evangelical, and 43 miscellaneous churches and chapels, and 110 Jewish synagogues. The new Cathedral of St. John the Divine, at 110th street and Morningside avenue, when completed will be one of the finest buildings in the United States. Plans for the cathedral were completed in 1892, the corner stone was laid on December 27, 1892. The external length of the structure will be 520 feet. The width across the front will be 192 feet; the width across the transepts, 296 feet; the height of the central spire will be 445 feet, from the floor of the cathedral. The width of the front towers will be 57 feet, while their height will be 240 feet. The width of the four flanking towers will be each 43 feet, and their height will be 160 feet. The exterior diameter of the central tower will be 116 feet. The nave will be 180 feet long. The chancel vaults will be 115 feet high. In Brooklyn there are over 550 churches of all denominations, and in Greater New York there is a total of over 1,300 churches. The total value of church property in the city is estimated at $185,026,000. Of this amount Manhattan church property is valued at $95,076,000.

Newspapers and Periodicals.—In 1905 there were regularly published in New York city over 600 periodicals, of which 38 were daily newspapers, 224 weekly periodicals and 275 monthly magazines. One-third of all the cloth bound, and two-thirds of all the

paper bound books published in the United States bear a New York imprint.

CLUBS.—In 1905 there were 74 well-known clubs in the metropolis, 49 of them occupying specially built club-houses. Some of the more recent organizations include the Aldine (1895); American Yacht (1883); Army and Navy (1889); Automobile (1899); Barnard (1894); City (1892); Engineers (1888); Grolier (1884); Jockey (1894); Lawyers (1887); Masonic (1894); Players (1888); Strollers (1886); Transportation (1895); Underwriters (1898), and the Wool Club (1894). (See also NEW YORK, Vol. XVII, p. 473.)

PLACES OF AMUSEMENT.—New York in 1905 had 47 theaters and 6 music halls of the first class. It is the greatest theatrical center in the world, and 150,000 people attend the theater nightly. The largest theaters in Manhattan are the Academy of Music, American, Grand Opera House, New Star, New York, Metropolitan Opera House, Proctor's, the West End, and the Windsor. The New York Hippodrome at 6th avenue and 43rd street has an auditorium seating 5,200 persons. The public museums include the Metropolitan Museum of Art in Central Park; the Museum of Natural History at 8th avenue and 77th street; the Aquarium, in Battery Park; the Zoölogical Garden in Central and Bronx Parks, and the Botanical Garden in Bronx Park.

COMMERCE.—New York is the leading seaport of the world. The total import trade is over $600,000,000 a year, or 55 per cent. of the imports of the United States. The total export trade is $560,000,000, or three-fifths of the exports from all the ports of the United States. There are owned in New York 4,000 vessels with a total tonnage of 1,247,828. Over 150 steamship and steamboat lines run from New York to other ports. The total tonnage of the over-sea vessels entering and leaving the port of New York in 1904 was 17,308,058. There are numerous exchanges in the city, the largest being the Produce Exchange. It has a limited membership of 3,000. Other exchanges are the Stock Exchange, Maritime Exchange, Consolidated, Cotton, Metal and Mercantile Exchanges. The New York Chamber of Commerce has a membership of about 800.

BANKS AND BANKING.—In New York in 1904 there were 422 banks of discount (53 national), 59 savings banks, 49 trust companies and 133 building and loan associations. The total stock of the 37 national and 17 state banks which are members of the Clearing House Association is $109,822,700, and their undivided profits $129,257,100—a total of $239,079,800 capital invested in these 54 institutions. The trust companies in 1904 owned $193,044,837 of stocks and bonds; the state banks in 1904 owned $9,720,400, and the national banks (exclusive of bonds held to secure circulation and United States deposits) owned in 1904, $106,412,100, a total of more than $300,000,000 in securities owned by the banks and trust companies of the city. The New York Clearing House transactions for the year ending September 30, 1904, were as follows: Exchanges, $59,672,796,804.41; balances, $3,105,858,575.60; total transactions, $62,778,655,380.01. The average daily transactions: Exchanges, $195,648,514.11; balances, $10,183,142.87; total, $205,831,656.98. Total transactions since organization of the Clearing House (51 years): Exchanges, $1,565,668,321,737.75; balances, $74,684,703,792.63; total, $1,640,353,025,530.38. The average daily receipts of the 53 national banks in New York are $130,976,963; the percentage of cheques received being 92.36. The largest New York Savings bank is the Bowery Savings Bank, which in 1904 had upward of 135,000 accounts open with a total amount deposited of $75,696,854. There are 36 fire and marine and 5 life insurance companies in the city. The securities listed at the New York Stock Exchange in 1904, aggregated $13,550,000,000 in value, divided as follows: railroad stocks, $4,500,000,000; miscellaneous stocks, $3,500,000,000; railroad bonds, $5,000,000,000; miscellaneous bonds, $500,000,000.

MANUFACTURES.—It was estimated in 1904 that there were 43,000 manufacturing establishments in New York city, giving employment to 650,000 people. The official government census for 1900 reported 39,776 manufacturing establishments, employing $921,876,081 capital and 510,774 persons; paying $245,021,881 for wages and $709,109,412 for materials; and having a combined output valued at $1,371,358,468. The principal articles manufactured according to value of output were, men's clothing, in factories ($103,220,201); women's clothing, in factories ($102,711,604); sugar and molasses ($88,598,113); newspapers and periodicals ($51,397,304); foundry and machine shop products ($41,089,475); malt liquors ($39,105,837); cigars and cigarettes ($37,998,261); meat, wholesale, excluding packed meat ($34,923,412); bakery products ($32,239,307); men's clothing, custom work ($22,077,030); coffee and spices ($21,346,195); and millinery and lace goods ($20,983,956). These figures were based on New York city before the Greater New York charter of 1902 and to these totals must be added the figures for Brooklyn, Long Island city and the other surrounding towns now included in Greater New York.

TRANSPORTATION.—The city has nearly 100 street railway lines, all but ten of which are equipped with electricity. There are 1,232 miles of track and the construction and equipment represented an outlay of $250,000,000. The elevated railways in Manhattan and the Bronx are united under one management, the Interurban Railway Company, with four lines running north and south. There are five elevated lines in Brooklyn, all under control of the Brooklyn Heights Railroad Company. Ten large railroad lines have terminal facilities on the New Jersey side of the Hudson River, connected by ferry with New York. The New York Central railroad is the only line directly entering the city. In 1903 the Central planned terminal improvements which will cost $25,000,000, while the Pennsylvania railroad has commenced a tunnel under the Hudson and East rivers and the boroughs of Manhattan and Queens, giving a continuous track between the Pennsylvania and Long Island railroads, with a central station in the borough of Manhattan, and a terminal emergence of the tunnel

system at a point near Thompson avenue, Long Island city. The Pennsylvania project will be completed in 1906 and the estimated cost is $50,000,000. There are ferry lines connecting Manhattan with Brooklyn, Jersey City, Weehawken, Staten Island, Hoboken, Long Island City, and other cities. There are steamship lines connecting with over 140 points on the Hudson River, the Atlantic coast and Long Island Sound.

RAPID TRANSIT.—The first subway or underground electric railway in New York was opened on October 27, 1904. The work was commenced in March, 1900, the total cost being $40,000,000. The building of the subway was first planned officially in 1890, but the first commission was not appointed until 1891. The road in January, 1905, was 20 miles in length, with 64 miles of track, 5½ miles of viaduct, 4 miles of tunnel and 11¼ miles of subway proper. The subway was built by the city, but was leased to an operating company for a long term of years. The cost of the road's equipment was $18,000,000. The line in operation in January, 1905, extended from the Battery, northward to 169th street, with a branch line from 103rd street to 145th street. (See also UNDERGROUND RAILROADS, in these Supplements.)

SHIP CANAL.—The Harlem ship canal connecting the Harlem River with the Hudson River, was built under the authority and with the appropriations of Congress, and was opened on June 17, 1895. The canal, which is a mile in length, was several years in construction and cost $2,700,000. It is 400 feet wide and 15 feet deep.

IMMIGRATION.—The greater portion of the immigration into the United States passes through the port of New York. In 1904, of 812,870 immigrants, 606,019 landed in the port of New York. Under the old system the State Board of Immigration had charge of the arrivals, and Castle Garden was used for the reception of the immigrants. In 1891, however, the United States assumed control, abandoned Castle Garden, and established a new depot on Ellis Island, just north of the Liberty Statue. Hither all steerage passengers are transferred from the steamers in which they arrive, and here they are detained until examined and recorded. A ferryboat runs between the Battery and the island, and visitors are admitted to the galleries overlooking the rooms in which the immigrants await registration. A commissioner and assistant commissioner of immigration are stationed in New York.

VITAL STATISTICS.—The Board of Health consists of the president of the Board of Police, the health officer of the port and two other commissioners, one of whom must have at least five years' standing as a practicing physician. The death rate for 1904 was 18.15 per 1,000. The Board of Health is also charged with the regulation of food-inspection and offensive trades and employs a special force of sanitary policemen and inspectors. The municipality supports free floating baths on the East and North rivers during the summer months, and there are six interior permanent baths, free to the public.

HISTORY.—In 1883 the Brooklyn Bridge was opened to the public with fitting ceremony, and with this event began the latter-day history of the metropolis. (See NEW YORK, Vol. XVII, pp. 469-479.) On August 8, 1885, the remains of General U. S. Grant were escorted to the Grant Mausoleum in Riverside Park by an imposing civic, military and naval procession. In 1886 the Bartholdi Statue was unveiled. A three days' celebration of the inauguration of George Washington as first President of the United States occurred April 29 to May 1, 1889. On May 5, 1891, occurred the dedication of Carnegie Hall, founded by Andrew Carnegie. In 1892 occurred the burning of the Metropolitan Opera House. In the same year occurred the ceremonies of laying the corner stone of the Cathedral of St. John the Divine. On April 26, 1893, a grand pageant began in commemoration of the discovery of America by Columbus, the ceremonies continuing for two days. In 1894 occurred the investigation by the Lexow Legislative Committee of the police and other departments, disclosing the corruption of the municipal government. (See LAW AND ORDER SOCIETIES, in these Supplements.) The exposure led, in the following autumn, to a combination of men of all parties to redeem the city from the malign influence of Tammany Hall. The elections resulted in a sweeping victory for all the men named on the ticket of the reforming Committee of Seventy, of whom William L. Strong was candidate for mayor. On Mayor Strong's accession, the legislature strengthened his hands by conferring large power to remove from office; the police department was reorganized under a new board of commissioners, and the Raines Liquor Law broke the hold of political organizations upon the saloons. In the Presidential elections of 1896 the city of New York failed, for the first time in fifty years, to give a Democratic majority, and McKinley received a plurality of 20,000 as President. In 1897 Robert A. Van Wyck of Tammany Hall was elected the first mayor of Greater New York. In 1902 Seth Low was elected mayor of the city, under a reform ballot, by a combination of the Republican and the Citizens' Union. Three disasters, wherein forty persons were killed and nearly two hundred injured, occurred in 1902 in Park avenue, within two months. On January 8, a Harlem local on the New York Central railroad telescoped the rear car of a New Haven accommodation, which had been stopped in the Park avenue tunnel by a danger signal. Fifteen persons were killed and thirty-six seriously injured. An explosion in the subway at Park avenue and 41st street, on January 27, killed six persons and injured nearly one hundred. The Murray Hill Hotel, the Grand Central Station, the Grand Union Hotel and the Manhattan Eye and Ear Infirmary sustained damage. The Seventy-first Regiment Armory, at Park avenue and 34th street, was burned on February 22. The Park Avenue Hotel, opposite, caught fire, and seventeen were killed, and fifty were burned and injured. On October 24, 1903, an explosion in the subway at 195th street killed ten persons and injured many others. On November 3, 1903, George B. McClellan, Tammany Hall candidate, was elected mayor by 60,000 plurality over Seth Low the Republican Reform candidate. In 1904, on June 15, the

steamer *General Slocum* burned in the East River, and over 1,000 persons, mainly women and children, perished. In August the Williamsburg bridge over the East River was completed and on October 27, 1904, the New York subway was opened to the public. Early in 1905 the engineers of the Department of Bridges made public the declaration that the Brooklyn hridge would have to be rebuilt at a cost of $5,000,000. On February 9, 1905, fifty persons were injured in a collision on the Third Avenue Elevated railroad, and on February 11, occurred the burning of the Casino Theatre. The New York Rapid Transit Commission announced on February 28, plans for more than 100 miles of new subways to cost $125,000,000. On March 7, 1905, a strike of 5,000 employees of the subway and elevated railroads occasioned a temporary closing of both systems for a period of three days. Plans were perfected during March, 1905, for the building of a municipal gas plant to be owned and operated by the city, and a bill was introduced in the state senate providing for a reduction in the price of gas to 70 cents per 1,000 feet. A citizen's committee of nine on Police Reform investigated crime conditions in New York during March, 1905, and early in April recommended a uniformed head or superintendent for the metropolitan police department, and advised the abolition of the existing force of detective sergeants. An epidemic of cerebro-spinal meningitis prevailed in the city during the spring months of 1905, and during three months the health department reported 1,800 cases and 681 deaths.

POPULATION.—In 1905 the estimated population of New York was 4,112,000. In 1904, the estimated population was 3,732,903. At the last official census in 1900 the population was 3,437,202. The following table gives the census for the five boroughs of Greater New York for 1900 and the approximate population for the same areas in 1880 and 1890:

POPULATION OF NEW YORK CITY BY BOROUGHS 1880 TO 1900.	POPULATION.		
	1900.	1890.	1880.
New York City	3,437,202	2,507,414	1,911,698
Manhattan Borough	1,850,093	1,530,124	1,216,653
Bronx Borough	200,507		
Brooklyn Borough	1,166,582	838,547	599,495
Richmond Borough	67,021	51,693	38,991
Queens Borough	152,999	87,050	56,560

The alien population of New York is given by the census of 1900 as follows: Germany, 736,435; Ireland, 725,511; Russia, 245,525; Italy, 218,918; England, 155,180; Austria, 113,237; Poland, 53,469; Hungary, 52,430; Scotland, 48,929; Sweden, 44,798; Bohemia, 28,849; Canada (English), 30,550; Canada (French), 5,305; Norway, 18,087; Switzerland, 15,474; Denmark, 9,369; Wales, 4,370, other countries, 58,080, making a total of 2,643,957. In 1900 there were 60,666 persons of African descent residing in New York. There were 29,000 more females than males in the Greater city, and of the qualified voters 460,445 were native born and 547,225 foreign born. The census also showed that there were 735,621 families housed in 249,991 tenements or dwellings. New York is the largest Irish city in the world, and the third largest German city in the world.

BIBLIOGRAPHY.—King's *Handbook of New York City* (1885); Barcus's *New York Public Service* (1898); Clew's *Twenty-eight Years in Wall Street* (1888); Hemstreet's *When New York Was Young* (1890); Brown's *History of New York* (1903); *Almanacs* of the New York *World*, *Tribune*, and Brooklyn *Eagle* (1905); New York *City Record* and various publications of the different municipal departments and of the New York Historical Society.

WILL M. CLEMENS.

NEW YORK UNIVERSITY, an institution for the education of men, chartered in 1831, located in New York city. It has been governed since 1883 by a board of private trustees. Previous to that time five members of the board were elected by the city. The university consists of three departments: The Faculty of Arts and Sciences, which includes the undergraduate and graduate collegiate courses; the Department of Medicine, commonly known as the University Medical College; and the Department of Law. The original building was erected in 1832, on Washington square. A new structure was erected in 1894, in which are placed the School of Law and the graduate and pedagogical departments. The undergraduate work is carried on at Two Hundredth street, where, in 1892, new buildings were erected near the Harlem River. The medical department is situated on Twenty-sixth street, near Bellevue Hospital. There were, in 1907, in all the departments, 3,200 students and 215 instructors. The university possesses a library of 84,000 volumes. From the organization until 1904, there were graduated 18,368. In 1904, the university had productive funds to the amount of $1,040,097, and an income of $360,000.

NEW YORK, UNIVERSITY OF THE STATE OF, a very remarkable institution, and the only body of the kind in the United States. It is the term applied to the governing body which controls all schools of higher education, libraries, and museums in the state of New York. The elementary schools and high schools are under the supervision of the state superintendent of public instruction, whose duties are similar to those of the like officer in all states of the Union. The governing body of the University of the State of New York consists of a board of regents, who are elected by a joint ballot of the legislature. All higher schools, including technical colleges, theological, law, and pedagogical schools, are controlled by this board, and are obliged to secure their charters through it. The power of the board is absolute, and includes in its scope the financial management of the institutions. Regular examinations are held under the authority of the board, and University Extension work is controlled by it. The University of the State of New York is an outgrowth of the opposition of the country districts to the control of the state educational interests by New York city. This opposition was engendered by the feeling of the patriot farmers, that the colleges of the city were under the control of Tory sympathizers.

NEW ZEALAND. (For the general article, see NEW ZEALAND, Vol. XVII, pp. 479–84.) The report of 1901 made the area 104,471 square miles.

The North Island is estimated to embrace an area of 44,468 square miles, the Middle Island 58,525, while Stewart's Island has an area of 665 square miles. The total acreage of the colony is 66,861,440, and up to the end of March, 1900, 23,382,972 acres had been alienated from the crown.

The total population, exclusive of aborigines, in 1901, the date of the census returns, was 815,820, an increase since 1858 of 667,245, and an increase during the previous five years of 148,176. In 1896 the population was 743,214, including 39,854 Maoris and 3,711 Chinese

The population of the North Island in 1901 was 390,571; of the Middle Island, 382,148; Stewart, and other islands, 493, exclusive of Maoris and Chinese.

Of the Maoris, 23,100 were males, and 20,001 females. The total number includes, 3,123 half-castes, living as members of Maori tribes, and 196 Maori wives of European husbands.

At the census of 1901 there were five towns with over 10,000 inhabitants in New Zealand; namely, Auckland, 34,213, or with suburbs, 67,226; Wellington (the seat of government), 37,441, or with suburbs, 44,791; Christchurch, 16,964, or with suburbs, 56,330; Dunedin, 24,879, or with suburbs, 52,390; and Lydenham, 11,404. All the towns showed an increase in population between the enumerations of 1891 and 1901.

GOVERNMENT. The system of government remains the same as described in Vol. XVII, p. 483.

The Legislative Council consisted, in 1901, of 45 members, nominated by the crown for seven years. By an act passed in 1887, the number of members to be elected to the House of Representatives was reduced to 74, including four Maoris, elected by the people for three years. The qualifications of electors are as follows: For Europeans of both sexes, 21 years of age and upward, a residence in the colony for one year and in the electoral district for three months immediately preceding registration. The property qualification was abolished in 1896. No person may be registered on more than one electoral roll. Women cannot be members of either branch of the legislature. For Maori representation, every adult Maori resident in any Maori electoral district can vote, provided he (or she) be not registered on any European roll. At the elections in 1896 there were 196,925 men and 142,305 women electors on the rolls for the 70 European members; and 13,008 votes of natives were recorded for the four Maori members.

The general administration rests with a responsible ministry of seven members. The governor, appointed by Great Britain, receives a salary of $25,000. The debt, in 1900, was $240,000,000.

New Zealand, during the last decade of the nineteenth century, became the experimental battle ground for formulating and working out theoretical solutions of social problems. A tendency towards the extension of the functions of the state to settle and prevent strikes and lockouts had been growing for some time previously, but began to take definite shape, in 1890, when the labor element exercised a dominant influence in the legislative election. The movement for the amelioration of labor conditions was not confined to a class, but able and philanthropic minds from all walks of life were enlisted in the cause. Some of the schemes proposed and tried were declared to be failures, but after they had had time to adjust old conditions to the new order of things in the transition period, they were admitted to be decided improvements. Of those in full and successful operation in 1905 were resumption of landed estates by the crown, old age pensions, advances of cheap money to farmers, graduated land and income tax, conciliation and arbitration in industrial affairs, compensation to workmen for accidents; government insurance for life, accident and fire; state coal mines and state railways, telegraphs and telephones.

In the course of progressive legislation by the New Zealanders, the first great step taken, in a purely economic sense, was to relieve the farmers of a defective land tenure and an unjust system of taxation. The few early settlers had in many instances acquired large estates for nominal sums and, as population increased and railroads were built, they became valuable and made the owners anxious to hold them for speculative purposes. In addition to this, a system of taxation existed which was based on actual values, so that the more a man improved his property the more he was taxed. This system bore especially hard upon the small farmer whose buildings and stock constituted the bulk of his possessions, and who was obliged to improve his land up to the highest point of fertility in order to make a living. Every successful effort in improving his holdings increased the burden of his taxes. Reform in this respect was instituted by abolishing the property tax and establishing a land and income tax. Land was taxed minus improvements and with exemption for all below $2,500 in value. Added to this was a graduated tax (rising from one penny in the pound to two pence) and commencing at farms valued at $25,000, such a farm would pay $10 annually for this tax, while an estate worth $1,050,000 or over would pay $8,756. An extra twenty per cent. is charged for land held by absentees from the colony. The annual income of the land tax from 1900 up to 1905 was $1,500,000. The total number of land owners in 1904 was 115,000, but some of their holdings were mere town sections and those who paid the tax numbered 18,500. With the repeal of tax on improvements, industry and enterprise were stimulated, and to aid the struggling small farmer still further the government loaned money to settlers at cost, thus enabling them to pay off mortgages or take up land for use, as the case might be. This assistance caused a new era of prosperity to dawn in the rural dis-

tricts. To prevent the land of the colony from falling into private hands the government became inbued with the idea of gradually leasing its land instead of selling outright, thus preventing its monopolization by the wealthy classes and limiting the lease owner to the area he could profitably use. The effect of the land tax was the government's resumption of some of the large fertile estates. Any landlord king objecting to the government assessor's valuation for taxation purposes is asked to state his own valuation and then the government can take the land at that price with ten per cent. added. It was stated by the secretary of Labor for the Commonwealth of New Zealand, Edward Tregar, in the *Arena* for December, 1904, that "this not only prevents evasion of the land tax and much moral injury to the proprietor through temptation to under-value his own property for such tax purposes, but has enabled the government to break up large estates and divide them among willing hands." As an illustration of its actual workings, he further stated that "on one estate so acquired (the Cheviot estate) the land which a few years ago only supported a dozen shepherds is now covered with homesteads giving occupation and nourishment to about two thousand people."

The legislation having a most salutary effect on the densely settled centers of industry in New Zealand, that known as the "Compulsory Arbitration Act" had a prominent place. Experience has demonstrated the act's feasibility, and while at first many difficulties were encountered from complications arising, the number of disputes calling for adjustment under its provisions decreased in number from year to year, the Arbitration Court in 1903 having only twenty-five cases of that kind to settle. The fact that in about four decisions out of five the awards favored the laborers the cry that the operation of the law would "drive capital out of the country" was a plausible theory, but facts proved that from 1895 to 1904, inclusive, the number of persons employed in manufactures doubled and the value of exports increased in a like ratio. That an award requiring an employer to pay increased wages to his work people might not place such an employer at the mercy of a similar firm in another industrial district, the act empowered the court to extend its award outside one industrial district to another where goods are used in inter-district competition.

A number of smaller acts were passed for the encouragement of industries, the settlement of land and the protection of the working-classes. The provision was made that workers must be paid in cash, not in goods or by a "set off," and that payment of such wages must not be made in any place where intoxicants were sold. A further provision was that wages must be paid within twenty-four hours of demand, and were made first charge on all moneys owing a contractor. The property on which the work is done can be placed under lien until wages are paid, therefore, an owner must see that his contractor liquidates his wage-bill before paying any other expenses. Up to $10 a week, the wages of a worker can not be attached or alienated in advance for debt. A man is not allowed to will away his property, unless his will makes due provision for his wife and family. The railways being public property are run on the principal that any profit accruing above maintenance and the interest on the cost of construction should be distributed generally by reduction of fares and freights. The telegraph and telephone systems are also state property, and financiers cannot manipulate them in the interests of individuals or corporations. "The prosperity of the colony," says Secretary Tregar, "is not to be attributed to the labor-laws, nor to the land-laws, nor to commercial enterprise, but to all three directed in unison for the public good. It is 'the government by the people for the people.'"

RELIGION. No state aid is given any religion. The principal churches in the colony are Church of England, Presbyterian, Roman Catholic, Methodist, Baptist, and Congregational. In 1896 there were but 3,391 pagans in the colony.

EDUCATION. The University of New Zealand is solely an examining body, granting degrees, awarding scholarships, and exercising a general supervision over the colleges of the colony. There are four colleges under its jurisdiction, which had, in 1900, 805 students. In 1900 there were 26 secondary schools, with 195 teachers and 2,665 pupils. The primary schools are in charge of the Education Department. Of these there were, in 1900, 1,674, with 3,856 teachers and 130,724 pupils. School age is from 5 to 15; and between the ages of 7 and 13 education is compulsory in districts in which the compulsory act is enforced. There were 85 native schools, with 3,109 pupils. In addition, there were 304 private schools; also medical, mining, agricultural, engineering, normal, and art schools, a school for deaf mutes, and one for the blind. There were, in 1896, 304 public libraries, with 409,604 volumes. In 1900 there were 54 daily papers, 43 tri-weeklies, 32 semi-weeklies, 66 weeklies, and 26 monthlies.

JUDICIARY. The administration of justice is in the hands of 5 supreme-court judges, 3 district-court judges, and 29 stipendiary magistrates.

INDUSTRIES. It is estimated that two-thirds of the surface is suitable for agriculture and grazing. Twenty million acres were, in 1898, under forest. The total acreage under crop in 1900 was 12,474,511 acres (including sown grasses, and 60,792 just broken). There were, in 1896, 83,300 persons engaged in agriculture. The principal crops are wheat, oats and barley. There were, in 1900, 261,834 horses, 1,210,439 cattle, 19,348,506 sheep, 249,027 pigs, and 1,790,070 poultry. There were, in 1895, 2,459 factories, with an estimated capital of $28,980,085, and giving employment to 27,389 persons. These industries include packing establishments, tanneries, mills, saw-mills, and iron-works. Gold, silver, antimony, manganese, and coal are mined, and there are precious deposits of tungsten. In 1900 there was mined $7,198,010 worth of gold, and, in the same year, $194,395 worth of silver.

FINANCE AND COMMERCE. In 1900 the imports amounted to $53,230,000, and the exports to $66,030,000. The total revenue for 1900–01 was $29,530,000, and expenditure $27,400,000. The registered vessels of the colony in 1897 numbered 506. On March 31, 1900, there were 824 miles of government railways in the North Island, and 1,280 in the South Island. The surplus earnings of the railways in the year 1900 were $2,856,000. There are also 167 miles of private railways. The telegraph system is entirely in the hands of the government. The colony had, in 1900, 6,910 miles of line. The telephone is included in the telegraph department.

DEFENSE. The principal ports of the colony are defended by submarine mines, torpedo-boats, and heavy shore batteries. All males from 17 to 55 years of age are liable to serve in the militia. The volunteer force in 1900 had a strength of 9,835, while the available force in 1898 was 118,000.

NEZ PERCÉ INDIANS OR SAHAPTINS. See INDIANS, Vol. XII, pp. 866, 871.

NIAGARA, FORT, a United States military post, in the Department of the East, an inclosed work in Niagara County, western New York, commanding the entrance from Lake Ontario to the Niagara River, about 14 miles below the Falls. It has its own telegraph station, its railroad station at Lewiston, seven miles distant, and post-office at Youngstown. The reservation covers 228½ acres; and had, in 1895, 3 companies of infantry, with accommodations for 4 companies of infantry and 13 officers; has good water-supply from the Niagara River. During the War of 1812 Fort Niagara was a post of great importance, and was the scene of many stirring events. It was, in 1813, surprised and captured and most of its garrison slain.

NIAGARA FALLS, a village of New York, the principal settlement in the neighborhood of the falls, has several flour-mills, and sash and blind factories. The suspension-bridge connects it with the Canadian side, and there is also a bridge to Goat Island. Population 1900, 19,457.

NIAGARA FALLS RESERVATION. For some years prior to 1885, efforts were made by public-spirited persons to have the approaches to Niagara Falls, on the American side, made the property of the state, and free of access to all. Private interests of various kinds stood in the way of this project, and numberless petty extortions were practiced on the public. The legislature of 1884 passed a measure constituting a state commission for the appraisal and condemnation of the structures obstructing the bank of the river, which commission was also empowered to police the reservation when control should be obtained. July 15, 1885, was the day set for the final abolishment of the fee system and of the various hotels and shanties, and on that date the Niagara Falls Reservation, sometimes called the Niagara State Park, measuring 107 acres, at a cost to the state of $1,433,430, passed into the keeping of the representatives of the people forever. A similar reservation, known as the Queen Victoria Niagara Falls Park, on the Canadian side, and embracing about 150 acres, was authorized by the legislature of Ontario, and was opened to the public June 22, 1887.

NIAGARA FORMATION. See *Upper Silurian*, under GEOLOGY, Vol. X, p. 301.

NIAGARA POWER–PLANT. The water-power of Niagara Falls has long claimed the attention of engineers and capitalists. In 1873 a canal was constructed which gave 6,000 horse-power to several mills. The large amount of power going to waste, estimated by some at 7,000,000 horse-power, caused a number of residents of cities near the Falls to organize the Niagara Falls Power Company, chartered in 1886 by the legislature of New York. The first problem to be solved was the proper construction of the turbines and dynamos, as it was proposed to furnish electrical power. A commission was sent to Europe to study power-utilization. A conference of noted civil and mechanical engineers was held in London to discuss the problem. This conference was called the International Niagara Commission, and its method of procedure was to call for plans and ideas from any engineer. The best of these were adopted, and in 1890 the work was begun by the Cataract Construction Company. A tunnel 7,000 feet long, 21 feet high and 19 feet wide was dug, its construction occupying three years. At the same time a canal was constructed, 1,400 feet long, 110 feet wide at the upper end and 180 feet at the mouth. The water is carried from the river to the power-house by means of the canal, and carried away, after passing over the turbines, through the tunnel. There are 14 turbine-wheels, each supplied by a mill-race, and each capable of developing 5,000 horse-power. These turbines are located in a pit 178 feet deep, 140 feet long and 18 feet wide. In connection with each wheel is a dynamo of 5,000 horse-power. The power company obtained possession of two and one half square miles of land, on which have been erected various factories operated by the water-power. The electric current is carried to Buffalo, 18 miles distant, for supplying light to the city and running the machinery of the water-works system. Many private establishments in that city are also furnished with power. It is purposed to supply all adjoining manufacturing centers.

NIAGARA UNIVERSITY, a Roman Catholic institution for the education of men, located in Niagara County, New York, two miles N. of Niagara Falls. This institution was founded in 1856 as a seminary for the training of priests. It was changed to a general educational institution and received its charter from the state of New York in 1883. It includes, in its courses, full preparatory work, theological and general collegiate instruction and a course in medicine. In 1907 there were 275 students in attendance and 26 instructors. The library, in 1907, consisted of 20,000 volumes; and the total income was $60,000.

NIAS ISLAND. See SUMATRA, Vol. XXII, pp. 638–40.

NICARAGUA, REPUBLIC OF. (For geography, history and general description, see NICARAGUA, Vol. XVII, pp. 490–493.) The area, according to the reports of 1900, is about 49,200 square miles, with a population of about 480,000, the great mass of which consists of aboriginal Indians, mulattoes, negroes and mixed races, and a number of Europeans, who are on the increase, numbering, in 1900, about 1,200. There are 28 towns, with from 2,000 to 30,000 inhabitants. The seat of government is the town of Managua, situated on the southern border of the lake of the same name, with about 30,000 inhabitants.

A new constitution was proclaimed July 4, 1894.[1] It vests the legislative power in a congress of one House, the members being elected for a term of two years by universal suffrage, and numbering 40. The executive power resides in a president, whose term of office is four years. He is assisted by a council of four responsible ministers, who have charge of the departments of Finance, Foreign Affairs and Public Instruction, Public Works, and Interior, Justice, War and Marine. June 20, 1895, a treaty was signed by the ministers of Nicaragua, Honduras and Salvador, providing for a union of the three republics under the name "Greater Republic of Central America." This treaty went into effect when it was ratified by all the legislatures, the last to do so being Salvador, May 6, 1896. This federation was intended as a step toward the reorganization of Central American states, and the confederation to be known as the "Republic of Central America." Each government was represented in a Diet, a body composed of two representatives from each republic. The federation lasted till 1898. In 1898 and 1902 Zelaya was re-elected president. See HONDURAS in these Supplements.

The chief occupations of the inhabitants are cattle-raising and coffee-culture. There were about 400,000 head of cattle, and 98,000 acres were devoted to coffee culture, in 1899. Gold, silver and copper are mined. The chief export is coffee. The total imports in 1900 were $3,517,450, and the exports $3,961,015. Trade is increasing, and, with the deepening of the principal harbors and the construction of railways, it is expected that the volume of trade will be doubled. The Nicaragua canal (q. v., in these Supplements) will, when finished, make Nicaragua the great highway between the Atlantic and Pacific oceans. There were, in 1900, 1,245 miles of telegraph lines and 140 miles of railway. The railways are the property of the government. In 1901 the total revenue of the republic was $2,400,375, and the expenditure $2,399,050. The public debt amounted in 1901 to $4,730,000. There were, in 1900, 323 elementary schools, with 17,000 pupils. The active army consists of 2,000 men, the militia of 5,000.

After the interference of Great Britain with the native government of the Mosquito Reserve, and the consequent objection of Nicaragua, the Mosquito Indians, by voluntary action, were incorporated as the thirteenth province of Nicaragua, Nov. 20, 1894. In these troubles the Nicaraguan forces had expelled from the Mosquito territory the British pro-consul. For this act Great Britain presented, Feb. 26, 1895, a formal demand for an indemnity payment of $375,000. Other demands were made for private redress, in favor of British subjects expelled and British vessels seized. Nicaragua demanded arbitration, but Great Britain presented an ultimatum demanding immediate settlement, with a threat of the seizure of the Pacific port of Corinto, in case of non-compliance. Nicaragua expected United States interference, but that was refused, on the ground that in the expulsion of its pro-consul Great Britain had just cause for complaint. April 22d a British fleet entered Corinto harbor, and April 27th the British took possession of the port. May 4th the troops were withdrawn, Nicaragua, persuaded by the United States and Salvador, agreeing to pay the indemnity.

NICARAGUA CANAL. Early in the present century the possibilities of a canal from the Pacific Ocean to the Atlantic side of Central America, through the state of Nicaragua, were realized. The first charter granted to a company formed to construct such a canal was in 1849, and is known as the "Vanderbilt concession." This company failed to carry out its plan, and the project, with intermittent agitation, was not revived until April, 1887, when the government of Nicaragua granted a charter to the New York Nicaragua Canal Association, and on Feb. 20, 1889, the United States Congress chartered the Maritime Canal Company. A Nicaragua Canal Construction Company undertook to do the actual labor of the undertaking. From Oct. 8, 1890, until September, 1891, $2,000,000 were expended, and during the next year $2,000,000 more. The company, in 1891, realizing the great burden of the undertaking, caused a bill to be introduced in Congress providing for government supervision and the appropriation of $100,000,000. This bill failed to pass. In 1892 the Senate passed a bill with almost the same provisions, but the House of Representatives refused to act. In the mean time various private companies, both American and foreign, were organized, but no further expenditures were made. Congressional legislation being again agitated, in 1895 the President appointed a commission of three engineers to examine the work already done and to report upon the feasibility of the undertaking. This commission reported in November, 1895, and gave as the result of its investigations, that a final judgment could not be given without a complete survey of the district being made; that the Nicaragua route is the best for an interoceanic canal in Central America, but that the plans and surveys made are poor, and new ones should be made. It recommended that a government survey be made and a year and a half be allowed the survey to complete its work. This report was submitted to Congress, Feb. 7, 1896. The party platform adopted by the Republican convention in 1896 urged the completion of the

[1] Amended Dec. 10, 1896.

canal by the government. With this end in view, the United States government, in June, 1897, appointed a commission of inquiry into the most practical route to be followed in constructing the canal. Its report was in favor of what is known as the Childs route, from the Pacific to Lake Nicaragua, and the Lull route from the lake to the Caribbean Sea. The estimated cost of construction of this route varied between $118,000,000 and $135,000,000. Congress, in March, 1899, authorized the creating of a new commission to report further anent the Nicaragua route as well as the abandoned Panama route, and in accordance with this President McKinley named nine members, under the chairmanship of Rear-Adm. J. G. Walker, the head of the previous commission. For the expenses of this new inquiry a million dollars were appropriated by Congress, and the new commission procee .ed to investigate according to instructions. After receiving the committee's report and a lengthy discussion on the respective merits of the Nicaragua and Panama routes, the 57th Congress passed an act, which was approved June 28th, 1902, signifying a preference for the latter, or Isthmian route, and authorizing President Roosevelt to arrange for the construction of the canal as provided by said act. But, if negotiations could not be concluded satisfactorily with the parties interested in the Panama route, it was further provided that the President proceed to arrange for opening the Nicaragua waterway. The negotiations, however, with the New Panama Canal Company of France and the Republic of Panama being successful, it was decided Nov. 18, 1903, to construct the Isthmian Canal and abandon the Nicaraguan route. See CANAL, Vol. IV, p. 701; and CANAL, in these Supplements.

NICENE COUNCIL. See COUNCIL, Vol. VI, pp. 452–455; also CREEDS, Vol. VI, pp. 495, 496.

NICHOL, JOHN, a British littérateur; born in Montrose, Scotland, Sept. 8, 1833. He was professor of English literature at Glasgow University (1861–89), and contributed to the leading British reviews and to this ENCYCLOPÆDIA. His article on AMERICAN LITERATURE, in Vol. I, pp. 630–644, has been published separately. He also published *Hannibal*, a drama (1872); *Byron*, in the English Men of Letters Series (1880); *Robert Burns* (1882); *Bacon*, in English Philosophers (1888); and *Lord Bacon's Life and Philosophy* (1889). He died in London, Oct. 11, 1894.

NICHOLAS II, Czar of Russia; born in St. Petersburg, May 18, 1868. He succeeded to the throne Nov. 1, 1894, and was crowned formally May 26, 1896. His father was Czar Alexander III, and his mother a daughter of the King of Denmark. He was president of the Committee of Succor during the Russian famine of 1891. He was married, Nov. 26, 1894, to Princess Alix of Hesse-Darmstadt. The coronation ceremonies were attended by representatives of almost every government on the globe. The young Czar immediately evidenced a tendency to deal liberally with all classes of his subjects. In September, 1896, the Czar and Czarina started upon a journey which included the principal courts and nations of Europe. Everywhere they were greeted with enthusiastic cordiality, but especially in France.

NICHOLAS NICOLAIEVITCH, Grand Duke of Russia, brother of Tsar Alexander II, was born in Tsarskoië Selo, Aug. 8, 1831. He entered into active service at the age of 16. Nominated a general and inspector-general of engineers, he was commander-in-chief of the army, having General Todleben as his assistant. In the war against Turkey he received the chief command of the army of the Danube, which invaded Roumania, April 24, 1877. In April, 1878, he resigned the chief command of the Russian army before Constantinople, and was succeeded by General Todleben. He was afterward field-marshal and aide-de-camp to the Czar. He became insane in October, 1890, and remained in that condition until his death, in St. Petersburg, April 25, 1891.

NICHOLASVILLE, a city and the county seat of Jessamine County, Kentucky, in the central part of the state. It lies in a fertile farming and stock-raising region, a few miles north and east of the Kentucky River and twenty-eight miles southeast of Frankfort, and is reached by the Cincinnati, New Orleans and Texas Pacific and the Richmond, Nicholasville, Irvine and Beattyville railroads. Its population in 1900 was 2,393. W.F.J.

NICHOLS, EDWARD LEAMINGTON, an American educator; born of American parentage at Leamington, England, September 14, 1854. He was graduated from Cornell in 1875 and studied at Leipsic, Berlin and Göttingen until 1879. In 1880 he was an assistant to Thomas A. Edison at Menlo Park, N. J., and in the following year was professor of physics and chemistry at the Central University of Kentucky. From 1883 to 1887 he was professor of physics and chemistry at the University of Kansas. For some years he was editor of the *Physical Review*. He has written *The Galvanometer; Manual of Physics and Applied Electricity; The Elements of Physics; Outlines of Physics*, and other works on chemistry; and has contributed to various scientific journals. W.M.C.

NICHOLSON, MRS. ELIZA JANE, pseudonym "Pearl Rivers," an American journalist; born near Pearl River, Mississippi; the daughter of J. W. Poitevent. She contributed verses to *Lippincott's* and other periodicals under her pseudonym. A volume of her poems was published in 1873. She was given a position on the New Orleans *Picayune* by A. M. Holbrook, the proprietor of the paper, whom she afterward married. Upon his death she became sole owner of the *Picayune*, and afterward married George Nicholson, the business manager. She died in New Orleans, Feb. 15, 1896.

NICHOLSON, HENRY ALLEYNE, a British scientist; born in Penrith, Cumberland, Sept. 11, 1844, and educated at the Universities of Göttingen and Edinburgh. He was appointed professor of natural history and botany in the University of Toronto in 1871; professor of natural history in the University of St. Andrew's in 1875, and in 1882 regius professor of natural history in t

University of Aberdeen. He published scientific works, chiefly geological and palæontological, including *Geology of Cumberland and Westmoreland* (1866); *Palæontology of Ontario* (1875); and *Textbook of Zoölogy*. Died in Aberdeen, Jan. 19, 1899.

NICHOLSON, James William Augustus, naval commander, was born at Dedham, Mass., on March 10, 1821, and entered the navy in 1838. He was a member of Perry's expedition to Japan. In the Civil War he was sent to the relief of Fort Sumter, was in the attack on Port Royal, served on the Potomac River, helped capture Fernandina, St. Augustine and Jacksonville, commanded the monitor *Manhattan* at Mobile Bay and helped to cripple the ram *Tennessee*, and was the captor of Fort Morgan. With his ship *Lancaster* he gave protection to many refugees at the bombardment of Alexandria, Egypt, in 1882. He was made rear-admiral in 1881, and died on October 28, 1887. W.F.J.

NICHOLSON, John, a British soldier; born in Dublin, Dec. 11, 1822. In 1838 he joined the East Indian Company's service, and in 1840 was ordered to Ghazni, in Afghanistan. On the breaking-out of the Sikh war he served in the campaign on the Sutlej, and was present at the battle of Ferozeshah. During the Sikh rebellion he greatly distinguished himself by his daring and promptitude. The Punjab having finally become a British province, Captain Nicholson was appointed a deputy-commissioner under the Lahore board. In the mutiny in 1857 Nicholson did more than any other man to hold firm the British grasp of the Punjab. He suggested the formation of the famous "flying column," and supervised over its organization. As brigadier-general he led the first column of attack at the siege of Delhi, and after the troops had forced their way into the city he still exposed himself in the most fearless manner, and fell, shot through the body, Sept. 23, 1857.

NICKEL CARBONYL. See Chemistry, in these Supplements.

NICKEL-STEEL. See Iron and Steel, in these Supplements.

NICKERSON, a city of Reno County, central Kansas, 10 miles N.W. of Hutchinson, on the Atchison, Topeka and Santa Fé railroad; is in a grain and stock-raising district, and has the railroad round-house and repair-shops. Population 1890, 1,662; 1900, 1,038.

NICOL, Erskine, painter; was born in Leith, Scotland, on July 3, 1825; lived in Dublin in 1843–46, and in London after 1862. He excelled in painting homely scenes of Irish and Scotch life. He was a member of the Royal Society of Artists, and from 1866 to 1885 an associate of the Royal Academy. A number of his works are in well-known American galleries. He died on March 8, 1904. W.F.J.

NICOLAY, John George, an American author and public man; born in Essingen, Bavaria, Feb. 26, 1832. He learned the printer's trade in Pittsfield, Ill., and later became the editor and proprietor of the Pittsfield *Free Press*, on which he had acquired his experience. He was private secretary to Abraham Lincoln from 1860 to 1865; United States consul at Paris from 1865 to 1869; and marshal of the United States Supreme Court from 1872 to 1887. His principal literary works are: *Abraham Lincoln: a History* (10 vols., 1890); and *Abraham Lincoln's Complete Works* (2 vols., 1894) (both with Col. John Hay). He has also written many magazine articles. He died in Washington, D. C., Sept. 26, 1901. E.E.T.

NICOLINI, Signora. See Patti, Adelina M. C., in these Supplements.

NICOLLET, Jean Nicolas, a French scientist; born in Savoy about 1786. He was the friend and pupil of Laplace, who makes frequent mention of him in his *Mécanique Céleste*. He came to the United States in 1833 for scientific study and exploration of the country, especially of the Red, Arkansas, Mississippi, and Missouri river basins. He collected many ethnological, historical, linguistic, and physiographical data concerning America and its products. He was employed by the War Department to make further researches in the far West, and on this expedition he was accompanied by Frémont. He made several geological reports, and a map which was published by order of Congress. He died in Washington, D. C., Sept. 11, 1843. E.E.T.

NICOLLS, Sir Richard, a British colonial governor of New York; born in 1624, in Amptill, England. He served in the British army until 1664, attaining the rank of captain. He was sent to America in 1664 as the representative of Charles II, to take possession of the New Netherlands and to act as arbitrator between the other colonies. He landed on Long Island, Aug. 25, 1664, and immediately took formal possession, compelling the Dutch under Stuyvesant to take the English oath of allegiance. He governed the colony until Aug. 25, 1668, when he engaged in the naval war with Holland and was killed in battle with Admiral De Ruyter, May 28, 1672. While governor of New York he changed the name of the colony from New Netherlands to New York, and gave the names to the lower counties and Hudson River cities. He was popular both among the English and Dutch settlers.

NICOSIA or LEFKOSIA, the capital city of Cyprus, and situated in the north central part of the island, on the right bank of the river Pedias, 23 miles N.W. of the port of Larnaka. It has manufactures of carpets and leather goods, and a trade in cottons and wines. Population 1901, 16,000. For extended article, see Nicosia, Vol. XVII, p. 504.

NICOTIANA. See Tobacco, Vol. XXIII, pp. 451–455.

NICTHEROY, Brazil, the capital of the state of Rio de Janeiro, a town on Praia Grande Bay, an inlet at the mouth of the Bay of Rio de Janeiro, opposite the seaport town of that name. It is a residential and suburban bathing resort with manufactures of war materials. Pop., 20,000. C.L.S.

NIEL, Adolphe, a French marshal: born in

Muret, Oct. 4, 1802. He entered the army as an engineer officer; took part in the storming of Constantine in Algeria, the siege of Rome, the bombardment of Bomarsund in Finland, the fall of Sebastopol, and in the battles of Magenta and Solferino. His share in these battles won him the marshal's baton. He was made Minister of War in 1867, and was employed in reorganizing the French army when he died, Aug. 14, 1869. It was in honor of him that the Marechal Niel rose received its name.

NIEMEN OR MEMEL RIVER. See RUSSIA, Vol. XXI, p. 80.

NIEMEYER, JOHN HENRY, an American artist; born in Bremen, Germany, 1839. He was taken when a child by his parents to the United States. He studied in Paris, and in 1871 became professor of drawing in the Yale School of Fine Arts. He exhibited portraits and genre pictures in New York. Perhaps his best-known work is *Guttenberg Inventing Movable Type* (1869).

NIERSTEIN, a village of the Grand Duchy of Hesse, in Germany, on the Rhine, 10 miles S.E. of Mainz; famous for its wines. Population, 4,000.

NIETZSCHE, FRIEDRICH, a German author; born in 1844, in the village of Röcken, on the historic battle-field of Lützen. His ancestry, probably of Slavonic origin, a proud, pretentious race, settled in Saxony during the eighteenth century. Friedrich, being left an orphan at an early age, was fortunate in receiving a superior education, concluding his studies at Bonn and Leipsic. Although intended for the ministry, Nietzsche's rebellious spirit soon led him to renounce all faith in Christianity, on the ground that it impeded the free expansion of life. Turning his attention to Oriental studies, he became noted as an acute and comprehensive philologist, receiving the offer of a professorship in the University of Basel, Switzerland, a position he filled with great credit, although his heterodox, not to say revolutionary, opinions occasioned no little dismay among his staid and pedantic colleagues. He was at this period of his career strongly influenced by Schopenhauer and Richard Wagner, the latter being for a while his intimate personal friend. His radical doctrines found early expression in *The Old Faith and the New* and *The Value of History for Life*, written at this time. In 1876 incessant labor, together with extreme nervousness engendered by an uncongenial environment, induced brain and eye affections, compelling Nietzsche to relinquish his duties as instructor. Being retired on a pension, he was reduced to the condition of an invalid, spending his summers in Switzerland and in winter visiting the shores of the Mediterranean. His physical sufferings may be inferred from his own confession that the year contained for him two hundred days of pure and unadulterated pain. Yet it was during this interval of excruciating headaches, when the shadow of final eclipse was creeping upon his intellectual faculties, that he produced the works destined to rivet the attention of philosophical minds, recalling the perfectionist theories of all ages, mingled with the pessimism of Schopenhauer, and fired with an iconoclastic ardor surpassing the wildest dreams of contemporary free thought. His doctrines, however, as embodied in the *über-mensch* ("the over-man)," are inspired with human interest and lofty aspirations, while in brilliancy of thought and diction and in epigrammatic force the writings of Nietzsche command admiration. In rapid succession he poured forth his works, amid the most distressed circumstances. *Human, all too Human*, appeared in 1879, quickly followed by *Dawn of Day; The Joyous Science* (1882); *So Spake Zarathrustra* (1883–85), perhaps the most remarkable of his works; *Beyond Good and Evil* (1886); *The Genealogy of Morality* (1887); *The Case of Wagner* (1888), from whom he had unaccountably become estranged; *Twilight of the Idols* (1888); etc. But the tension induced by this surprising fertility of brain had been too great; the cord snapped suddenly, and Nietzsche became hopelessly insane. Yet, notwithstanding the pathetic close of his literary life and the evident traces in his works of an intellect already clouded by approaching doom, the germs of Nietzsche's philosophy have awakened in Germany a profound interest, even among his most pronounced antagonists, the constructive element in his writings, as well as their fearless iconoclasm, marking the author as the chief apostle of modern rationalism in its extreme, possibly aberrant, phase. He died at Weimar, Aug. 25, 1900.

NIGER DISTRICT PROTECTORATE. See AFRICA, in these Supplements.

NIGHT-HAWK, a popular name for North American birds of the genus *Chordeiles*, belonging to the family of goatsuckers. They are often seen during twilight flying to a great height and then making a sudden downward rush, at the same time giving a sharp, rasping cry. They are valuable insectivorous birds.

NIGHTINGALE, FLORENCE, a British army nurse, the daughter of William Edward Nightingale, of Embley Park, England; born in Florence, in May, 1829. She early exhibited an intense devotion to the alleviation of suffering, which, in 1844, led her to give attention to the condition of hospitals. She visited and inspected civil and military hospitals all over Europe; and in 1851 went into training as a nurse. In 1854 war was declared with Russia, and the hospitals on the Bosphorus soon were crowded with sick and wounded. In this crisis Miss Nightingale offered to go out and organize a nursing-department at Scutari. Lord Herbert accepted her services, and she departed with thirty-four nurses.

FLORENCE NIGHTINGALE.

She arrived at Constantinople November 4th, on the eve of Inkermann, in time to receive the wounded into wards already filled with 2,300 patients, and a few months after her arrival she had 10,000 sick men under her care. In 1855, while in the Crimea, she was prostrated with fever, but refused to leave her post, and on her recovery remained at Scutari till Turkey was evacuated by the British, July 28, 1856. At the close of the Crimean War a fund of $250,000 was subscribed for the purpose of enabling her to form an institution for the training of nurses; this is spent in connection with St. Thomas's (the Nightingale Home) and at King's College Hospital. In 1858 she published valuable *Notes on Nursing*. The *Notes on Hospitals* (1859), from the clearness of arrangement and minuteness of detail, are valuable to the architect, the engineer and the medical officer. In 1873 appeared *Life or Death in India* and *A "Note" of Interrogation*, the latter making a great impression because of her mode of handling matters relating to religious belief and life. Longfellow lauded her in *Santa Filomena*.

Revised by R.C.A.

NIHILISTS, Nihilism. See Socialism, Vol. XXII, pp. 228, 229.

NIKON, a Russian patriarch and primate; born in 1605 and died in 1681. He became patriarch of Moscow in 1652, and so changed the church services as to cause a secession of part of the members. See Russia, Vol. XXI, pp. 90, 113.

NILES, a city of Berrien County, southwestern Michigan, 21 miles S.S.E. of St. Joseph and 90 miles E. of Chicago, on the Cleveland, Cincinnati, Chicago and St. Louis and the Michigan Central railroads; has excellent water-power and important manufactures; flour and feed, straw paper, wood-pulp and furniture are extensively produced. It is in an agricultural district, and ships fruit and live-stock. Population 1890, 4,197; 1900, 4,287.

NILES, a city of Trumbull County, northeastern Ohio, on the Mahoning River, and on the Youngstown and Pittsburg and the Lake Erie railroads; one of the largest iron-manufacturing towns in the state, having blast-furnaces, nail-works, machine and boiler shops and rolling-mills. The vicinity abounds in coal, and the city is situated in the center of a rich dairying country. Population 1890, 4,289; 1900, 7,468.

NILES, Hezekiah, editor and author; was born in Chester County, Pennsylvania, on October 10, 1777. He became a printer, wrote humorous essays under the title of *Quill-Driving*, published the *Evening Post* in Baltimore, and in 1811 founded a uniquely valuable periodical called *Niles's Register*, which he continued to edit and publish until 1836. It became well known throughout the world, and to this day is one of the richest mines of historical data in existence for the period which it covers. In 1836 he turned the paper over to his son, William Niles. Mr. Niles wrote *Principles and Acts of Revolution in America*. He died on April 2, 1839.

W.F.J.

NILOMETER, an arrangement for measuring the height of the Nile in Egypt. On the Island of Rhoda, opposite Cairo, is a square well, connected with the river by a canal and containing a graduated marble pillar, divided into 24 cubits, each measuring 21.386 inches. See Egypt, Vol. VII, p. 612.

NILSSON, Christine. See Miranda, Countess of, in these Supplements.

NILSSON, Sven, a Swedish naturalist and archæologist; born near Landscrona, Sweden, March 8, 1787. In 1812 he became instructor in natural history, and afterward overseer of the Zoölogical Museum. From 1831 to 1856 he was professor of zoölogy at Lund. His chief scientific publications are *Ornithologia Suecica* (2 vols.), and *Skandinavisk Faunä* (4 vols.). His most important archæological work is *Skandinaviska Nordens Urinnevanare* (4 vols., 1838–43). He died in Lund, Nov. 30, 1883.

NIMRUD, an ancient city. See Nineveh, Vol. XVII, pp. 525, 526.

NIOBRARA FORT, a United States military post (Department of the Platte) in Cherry County, northern Nebraska, on the Niobrara River; post-office and telegraph station at the post; railroad station at Valentine, 4½ miles W. on the Fremont, Elkhorn and Missouri Valley railroad. The post is situated in a reservation covering 540 square miles; has accommodations for 25 officers, six troops of calvary and three companies of infantry, and in 1895 was garrisoned by seven companies of infantry. Fort Niobrara has played an important part in several Indian outbreaks, owing to its nearness to the reservations in South Dakota.

NIOBRARA RIVER. See Nebraska, Vol. XVII, p. 317.

NIPIGON or NEPIGON. See St. Lawrence, Vol. XXI, pp. 186, 187; and Nepigon, in these Supplements.

NIPISSING, a lake in the province of Ontario, Canada, near the northeast side of Lake Huron, nearly midway between it and the Ottawa River. It contains many islands, upon one of which a summer hotel has been constructed. It discharges its waters into Georgian Bay by French River. Length, 50 miles; breadth, 14 miles; altitude, 599 feet.

NIPPON or DAI-NIPPON, the Japanese name for Japan. See Japan, Vol. XIII, p. 578.

NIPPUR, an ancient Babylonian city discovered by the expedition sent out by the University of Pennsylvania, which began excavations in the old mound of Nippur (located by Sir Austen Layard about 1850), about 50 miles S.E. of Babylon, in Feb., 1889. The work was begun under the direction of Dr. John P. Peters, and in 1894–96 was carried on under himself, Mr. J. H. Haynes, and Professor Hilprecht. In 1895–96 the work had resulted in discoveries which, it has been alleged, supply the world with history antedating any ever before received. Prior to this, the earliest Babylonian kings of whom we have possessed accounts were Sargon I and his son, Naram-Sin, 3800–3750 B.C. Beneath the walls and pavements constructed by

these monarchs, excavations have revealed the walls and foundations of an older city. Pottery and inscribed tablets have been found, upon which the cuneiform inscriptions indicate, according to Professors Peters and Hilprecht, that the world, at 7000 B.C., had a civilization; that Babylonia was old and wise when the shepherd kings or pyramids of Egypt were young and new. Their computation rests upon the time taken in the accumulation of strata and in developing a system of cuneiform writing. A large collection of relics was brought to the University of Pennsylvania.

NIRVANA, THE BUDDHIST DOCTRINE OF. See BUDDHISM, Vol. IV, p. 388.

NITOCRIS, a queen of ancient Egypt. See EGYPT, Vol. VII, pp. 636, 670.

NITRATE COMPOUNDS. See GUN-POWDERS, in these Supplements.

NITRATE OF AMYL, a powerful drug used as an anti-spasmodic in affections of the chest. It is formed by the action of nitric acid or fusel oil, and its chemical representation is $C^5A^{11}NO^2$. In 1865 Sir Benjamin W. Richardson discovered its control over tetanus and other spasmodic affections. It is a volatile, yellowish liquid, having a fragrance like bananas, and on inhalation it produces violent arterial action in the head and neck, which quickly passes away. It is useful in some forms of asthma, in *agina pectoris* and other spasmodic symptoms arising in the vaso-motor system.

NITRIC ACID. See CHEMISTRY, Vol. V, pp. 442–444.

NITRIFICATION, a process carried on by certain peculiar bacteria of the soil, known as nitrobacteria, by which they oxidize ammonia compounds to nitrites and these to nitrates, the form in which nitrogen material is usually absorbed by plants. The nitrobacteria are peculiar among plants, in that they have the power of producing organic substance without the aid of chlorophyll and light. It is by the oxidative process known as nitrification that they obtain the necessary supply of kinetic energy.

NITRIFICATION, the changing of nitrogenous organic matter or ammonia compounds into nitrates. Under certain conditions, nitrification goes on in every fertile soil, the atmospheric nitrogen, nitrogenous organic matter, or ammonia compounds being converted, in the presence of lime or potash, into the corresponding *nitrates* of lime or potash; and from these compounds plants derive the most or all of their nitrogen, although some observers maintain that many plants obtain part at least of their nitrogen from ammonia. The oxidation of the nitrogen takes place through the agency of certain organisms called "nitrifying ferments."

NITROBENZOL, a chemical compound. See ANILINE, Vol. II, pp. 43, 44.

NITRO-HYDROCHLORIC ACID. Same as AQUA REGIA, q.v., in these Supplements.

NITROMETER. A chemical apparatus for determining the quantity of niter, nitric acid or some other combination of nitrogen in a mixture. The preferred form is a tube bearing two bulbs; one is placed immediately below a filtering-funnel and is connected with an absorption-tube. The other bulb is connected and surmounted by a graduated absorption-tube. C. H. COCHRANE.

NITROUS ANHYDRIDE. See CHEMISTRY, in these Supplements.

NITROUS ETHER OR NITRITE OF ETHYL, a very volatile ether, with an agreeable apple odor and highly inflammable. In itself it is of little importance, but on account of its relation to the *sweet spirits of niter* or *spirit of nitrous ether*, is one of the most important drugs. The sweet spirits of niter contains in addition aldehyde and paraldehyde, and it is believed that to these we must ascribe much of its virtue. It is used, in conjunction with other medicines, as a diuretic, especially in the dropsy which follows scarlatina; and it is employed, in combination with acetate of ammonia and tartarized antimony, in febrile affections.

NITROUS OXIDE OR LAUGHING-GAS. See CHEMISTRY, Vol. V, pp. 443, 445.

NIZA OR NIZZA, MARCOS DE, an Italian-American explorer and missionary; born in the fifteenth century, probably in the last quarter. He became a Franciscan monk, went to the West Indies in 1531, and took part in the conquest of Peru. He afterward, with two companions, explored the Northwest into New Mexico, and went with Coronado on his famous expedition. His account of the discoveries of his first trip were so far from true that when Coronado's men learned the truth, and that the country was not rich in gold, it was with difficulty that Coronado protected Niza. Niza went back to Mexico alone, and died there in 1542.

NIZHAN. See NYEZHIN, Vol. XXVIII, p. 268.

NO OR NO-AMON, a city of ancient EGYPT. See Vol. VII, p. 673.

NOBLESVILLE, a city, the capital of Hamilton Co., Ind., 20 miles N.N.E. of Indianapolis, on the White River, and on the Chicago and Southeastern and the Lake Erie and Western railroads; the trade-center of a farming region; has iron-works, lumber-mills, strawboard, novelty, and carbon works. Population 1890, 3,054; 1900, 4,792.

NOCTILIONES, a family of bats. See MAMMALIA, Vol. XV, pp. 417, 418.

NODES, LINE OF. See ASTRONOMY, Vol. II, p. 674.

NOGENT-LE-ROTROU, a town in the department of Eure-et-Loir, France, prettily situated on the Huisne, 32 miles W. by S. of Chartres and 93 miles S.W. of Paris. It is a well-built place, with the ruined château of the great Sully, his violated sepulcher, and a statue of General Saint-Pol, who fell before Sebastopol. The Germans here won two fights, in 1870 and 1871. Population, 6,571.

NOISSEVILLE, a village of France, in the department of Meurthe-et-Moselle, about five miles from Metz; an important place during the Franco-Prussian War, several large battles having taken place here, principal among them the engaga-

ment in which Manteuffel defeated the army of General Bazaine, Sept. 1, 1870.

NÖLDEKE, THEODORE, a German Orientalist; born in Harburg, March 2, 1836. He studied at Vienna, Leyden, Berlin and Göttingen, where he graduated in 1861. In 1864 he was made professor extraordinary at Kiel, and in 1868 professor ordinary. In 1872 he accepted the professorship of Semitic languages at the newly established University of Strasburg. He published *Geschichte des Korans* (1860); *Grammatik der Neusyrischen Sprache* (1868); *Untersuchungen zur Kritik des Alten Testaments* (1869); *Mandäische Grammatik* (1875); *Geschichte des Perserreiches zur Zeit der Sassaniden* (1879); *Syrische Grammatik* (1880); *Aufsätze sur Persischen Geschichte* (1887); *Beiträge zur Geschichte des Alexandersromans* (1890); *Orientalische Skizzen* (1892). He also wrote numerous articles for this ENCYCLOPÆDIA, including those on KORAN (Vol. XVI, pp. 619–628); PAHLAVI (Vol. XVIII, pp. 139–140); PERSIA (*Anc. History*, Vol. XVIII, pp. 573–627); and SEMITIC LANGUAGES (Vol. XXI, pp. 673–688).

NOLHAC, PIERRE DE, a French writer; born in Ambert, Puy-de-Dôme, Dec. 12, 1859; in 1882 was admitted to the French school at Rome, where he remained three years. Upon his return to France he took the degree of doctor of letters, and was attached to the Bibliothèque Nationale at Paris, and was appointed in 1886 a professor at the École des Hautes-Études. After occupying the position of assistant curator of the Versailles Museum, he succeeded to the curatorship in 1892. He devoted his studies chiefly to the history of Italian and French renaissance, a list of his works including *Lettres de Joachim du Bellay* (1883); *La Bibliothèque d'un Humaniste* (1883); *Les Collections d'Antiquités de Fulvio Orsini* (1884); *Le Canzoniere Autographe de Pétrarque* (1886); *Petites Notes sur l'Art Italien* (1887); *La Bibliothèque de Fulvio Orsini* (1887); *Érasme en Italie* (1888); *Les Correspondants d'Alde Manuce, Matériaux Nouveaux d'Histoire Littéraire, 1483–1514* (1889); *Pétrarque et l'Humanisme* (1892); *Études sur la Cour de France: La Reine Marie-Antoinette* (1892).

NOME, CAPE, GOLD FIELDS OF. See under ALASKA, and CAPE NOME.

NOMENCLATURE, GEOGRAPHICAL. See GEOGRAPHIC NAMES, BUREAU OF, in these Supplements.

NOMINALISM. See SCHOLASTICISM, Vol. XXI, pp. 436, 437, 447, 448, 449.

NONIUS, MARCELLUS, a Latin grammarian, the dates of whose birth and death are unknown, the nearest that can be said being that he must have lived some time during the period from the second to the sixth centuries. He was the author of an important treatise entitled, *De Compendiosa Doctrina per Litteras ad Filium.* This work is divided into eighteen chapters, the first twelve being in reality separate treatises on different grammatical subjects, while each of the last six contains a list of technical terms referring to some one department. One feature of the work, and one which makes it valuable, consists of the numerous quotations from Latin writers of an earlier date. Three editions have been published by Gerlach and Roth, Basil (1842); L. Quicher, at Paris (1871); and L. Müller, Leipsic (1888).

NORDAU, MAX SIMON, a Hungarian physician and author; born in Budapest, July 29, 1849, of Jewish parentage. He studied medicine in his native town and received his doctorate in 1873, and engaged himself in writing for the *Pester Lloyd*, the *Frankfurter Zeitung* and the *Vossische Zeitung*. After traveling in Europe he visited Paris in 1878, and settled there, resuming his medical studies and obtaining a doctor's degree in 1882. He continued his journalistic and literary labors, publishing political and social criticism. He then wrote some works which received wide attention and were translated into the English language. These are known by their English titles as *Paris Pictures* (1880); *Conventional Lies* (1883), dealing with religion, politics, economics, matrimony, etc., which was suppressed in Austria; and *Paradoxes* (1885), a philosophical study. In 1887 he published *The Malady of the Century*, a novel. Then appeared *Entartung* (1893), the work which brought him into greater prominence, translated and known to English readers as *Degeneration* (1895), in which he endeavored to prove that the intellectual activity and excitement of the last half-century have resulted in the degeneration of a once healthy mental condition into maudlin and emotional sentimentality and salacious impurity. Others of his works are *The Comedy of Sentiment* (1892); *The Right to Love* (a drama, 1894); *The Ball* (a drama, 1895); and *The Battle of the Drones* (1896).

MAX NORDAU.

NORDENSKJOLD, BARON ADOLF ERIK, a Swedish, naturalist and explorer; born in Helsingfors, Finland, Nov. 18, 1832. He first went to the gymnasium at Borgo, and on entering the University of Helsingfors in 1849 devoted himself almost entirely to scientific studies, spending his vacations in excursions to the rich mineral localities of Finland. He soon became eminent in this particular branch of science. He settled in Sweden, and in 1851 first entered on his Arctic travels by accompanying Torell to Spitzbergen. (For descriptions of three subsequent expeditions, see POLAR REGIONS, Vol. XIX, pp. 335–338.) In recognition of his services he was created a baron in April, 1880, and named a commander of the Legion of Honor and a foreign knight of the Prussian Ordre pour le Mérite for Arts and Sciences. Died Aug. 12, 1901.

NORDHAUSEN, a town of Prussia. Population 1905, 29,883. See NORDHAUSEN, Vol. XVII, p. 548.

NORDHOFF, CHARLES, journalist, was born in Germany on August 31, 1830, was brought to

America at the age of four years, and was apprenticed in a printing office. He spent several years at sea, and in 1853–57 was employed in various newspaper offices. In 1857–61 he was connected with *Harper's Weekly* and *Harper's Magazine*, in 1861–72 with the New York *Evening Post*, and in 1874–90 with the New York *Herald* as its Washington correspondent. In 1890 he retired from active work on a pension granted by the *Herald*. He was the author of a number of books which were widely read, including *Man-of-War Life*, *The Merchant Vessel, Whaling and Fishing*, *Stories of the Island World*, *Secession Is Rebellion*, *The Freedmen of the South Carolina Sea Islands*, *Slavery Injurious to Free Laborers*, *Cape Cod and All Along Shore*, *California for Health, Pleasure and Residence; Northern California, Oregon and the Sandwich Islands; Communistic Societies of the United States*, *The Cotton States Under Reconstruction*, *Politics for Young Americans*, *Peninsular California*, and *God and the Future Life*. His *Politics for Young Americans* has been translated into Spanish, and is used as a text-book in Mexican schools. He died in California on July 14, 1901. W.F.J.

NORDICA, Madame Lillian. See Dome, Mrs. Z. F., in these Supplements.

NORFOLK, a city of Madison County, northeastern Nebraska, 17 miles N. of Madison, on the Chicago, St. Paul, Minneapolis and Omaha and the Fremont, Elkhorn and Missouri Valley railroads; has a foundry and machine-shop, cannery, creamery and beet-sugar factory, and is an important shipping-point. The surrounding country is devoted to grain and stock raising. The North Nebraska Insane Asylum is here. Population 1890, 3,038; 1900, 3,883.

NORFOLK, a city and port of entry of Virginia, on the right bank of the Elizabeth River, 8 miles from Hampton Roads. Its large harbor is defended by two forts. Norfolk ships considerable quantities of cotton, oysters, and early fruits and vegetables; lines of steamers connect it with New York and other cities. Pop. 1890, 34,871; 1900, 46,624. See Norfolk, Vol. XVII, p. 551.

NORFOLK, Henry Fitzalan Howard, Duke of, premier Duke and Earl of England, and holds besides these titles those of Earl of Arundel, Surrey and Norfolk; and Baron Fitzalan, Clun, Oswaldestre and Maltravers; and is hereditary Earl Marshal and Chief Butler of England. He was born in London, Dec. 27, 1847; and succeeded to the peerage on the death of his father, the fourteenth duke, Nov. 26, 1860. The Duke is a Roman Catholic, and in 1887 was charged with a special mission from Queen Victoria to the Pope on his jubilee. He was elected mayor of Sheffield, and in 1895 was appointed Postmaster-General in Salisbury's cabinet.

NORMAL, a town of McLean County, Illinois, in the central part of the state. It lies just north of Bloomington, of which it is a suburb, at the intersection of the Illinois Central and the Chicago and Alton railroads. It was founded in 1857 as the seat of the Illinois State Normal School, from which institution it takes its name, and is also the seat of a home for soldiers' orphans. Its population in 1900, apart from the normal school, was 3,795. W.F.J.

NORMAL SCHOOLS, institutions in which the students are trained to become teachers. The students are young men or women, generally between 17 and 20 years of age, who have passed through a grammar-school, or even a superior school, and who have passed an examination in reading, writing, grammar, arithmetic, and in the geography of their own country. Most normal schools in the United States were modeled after those of the state of Massachusetts, and most of the European normal schools took those of the kingdom of Prussia as their patterns. According to the returns made to the Bureau of Education in 1899, about half of the students pursuing teachers' training were in public normal schools, the number being 56,279. There were 166 public schools, 2,750 instructors, 11,543 male students, 33,265 female students, and 8,948 graduates. Among the total number of normal students were 1,138 negro students, in normal schools of that race. Sixty-one per cent of the students in the public normal schools were in the teachers' training-courses. Besides these public schools, there were 749 private institutions.

In the American normal schools the studies first attended to are those which the law of the respective state requires to be taught in the district schools, namely: orthography, reading, writing, English grammar, United States geography, and arithmetic. When these are mastered, studies of a higher order are progressively taken up. Those pupils who take the full course of three years are in addition instructed in composition, rhetoric, logic, penmanship and drawing, higher arithmetic, algebra, geometry, book-keeping, surveying, ancient and modern geography, chronology, general history, human physiology and hygiene, mental and natural philosphy, history of the United States, natural history, astronomy, music—and, above all, the science and art of teaching with reference to all the above-named studies.

NORMAN, a town and the county seat of Cleveland County, Oklahoma, in the southern part of the territory. It lies just north of the Canadian River, and is reached by the Gulf, Colorado and Santa Fé railroad, forty-five miles south of Guthrie. It is in an agricultural region, and is the seat of the University of Oklahoma (q. v.). Its population in 1900 was 2,225. W.F.J.

NORMAN, Henry, an English journalist and author; born in Leicester, in 1857; educated in Paris and at Harvard University, where he graduated in 1881, and took a two-years' post-graduate course at Leipsic. He then was engaged on the *Pall Mall Gazette*, London, for four years, and, on account of his proficiency in languages, was sent on several important missions abroad. Having inherited a small fortune, in 1888 he began to travel in the far East, visiting China, Siberia, Korea, Japan, Tonquin and Malaya; he visited the Franco-Chi-

nese frontier, crossed Korea on horseback, exploring a hitherto unknown portion of the Malay peninsula, being the first European to pass through the upper part of the closed native state of Kelantan. He became in 1892 a member of the editorial staff of the *Daily Chronicle* of London; was put in charge of the literary page, and in 1895 became assistant to the editor-in-chief, H. W. Massingham. He was sent to Constantinople to report on the Armenian atrocities; and from there, in 1895, he proceeded to Washington, District of Columbia, to ascertain the facts as to the Monroe doctrine. He made an exhaustive investigation of the matter, and was able to throw much light upon the subject. On his return to London from his Eastern travels he married Menie Muriel Dowie, who had traveled alone in masculine attire through the wildest parts of Europe, and who published an account of her experiences in a work entitled *A Girl in the Carpathian Mountains.* Mr. Norman published several works, his first appearing the year of his graduation at Harvard. Its title was *The Performance of Œdipus Tyrannus at Harvard*, which was followed later, as the result of his traveling, with *The Real Japan* (1891); *The Peoples and Politics of the Far East* (1894); and *Round the Near East* (1895).

NORMAN, Sir Henry Wylie, a British general; born in London, in 1826; achieved distinction as a soldier in India and afterward in the British civil service. He entered the Bengal army as an ensign in 1844, and served through the Punjab campaign in 1848. He was at the battles of Chillianwallah and Goojerat, and commanded a detachment in the Sonthal campaign. Throughout the Indian Mutiny he was a conspicuous figure. He was appointed assistant military secretary at the Horse Guards in 1860, and from 1862 to 1870 he was military secretary to the government of India, and afterward for seven years military member of the Viceroy's council. From 1878 to 1883 he was at the India office as military member in the council of the Secretary of State, and then he began his later civil career as governor of Jamaica. In 1889 he assumed the governorship of Queensland, and in 1893 he was appointed, as the successor of Lord Lansdowne, Viceroy of India, whose term of office expired in December. This post he at first accepted, but afterward declined. Died October 26, 1904.

NORMAN-NERUDA, Madame. See Hallé, Lady, in these Supplements.

NORNS, a Scandinavian myth. See Aesir, Vol. I, p. 190.

NORONHA, Fernando de, a group of small islands belonging to Brazil. See Fernando de Noronha, Vol. IX, pp. 87, 88.

NORRIS, William Edward, an English novelist; born Nov. 18, 1847, the son of Sir W. Norris, formerly chief Justice of Ceylon. He was educated at Eton, and called to the bar at the Inner Temple in 1874, but did not practice, preferring the profession of literature, and contributing his first serials to *Cornhill, Temple Bar* and other magazines. His first novel, *Heaps of Money*, was published in 1877, and there followed *Mademoiselle de Mersac* (1880); *Matrimony* (1881); *No New Thing* (1883); *His Grace; The Countess Radna* (1893); and several other books and serials. His novels are noticeable for their excellence of dialogue, and are generally descriptive of aristocratic society. His series of novels include *Thirlby Hall* (1884); *A Man of His Word* (1885); *My Friend Jim* (1886); *A Bachelor's Blunder* (1886); *Major and Minor* (1887); *The Rogue* (1888); *Miss Shafto; Mrs. Fenton* (1889); *The Baffled Conspirators; Marcia; Mrs. Wentworth's Idea* (1891); *Mysterious Mrs. Wilkinson* (1892); *A Deplorable Affair* (1894); *Mathew Austin; A Victim of Good Luck* (1894); *St. Ann's; A Despotic Lady* (1895); *Clarissa Furiosa* (1897); *The Fight for the Crown* (1898); *The Widower* (1898).

NORRISTOWN, a borough, the capital of Montgomery Co., Pa. See Norristown, Vol. XVII, p. 566. Pop. 1890, 19,791; 1900, 22,265.

NORTH, John Thomas, a British millionaire, familiarly known as "the Nitrate King"; was born in Leeds, England, Jan. 30, 1842, his father being a coal-merchant. From his fifteenth to his twenty-third year he was an apprentice millwright, after which he was a foreman in the Fowler Locomotive Works, Leeds. Upon the death of his father he and his wife emigrated to Chile, where he obtained an appointment as an engineer on a railway at Carrizal. At that time speculation in nitrate was rife in Peru, and he proceeded thither, where he secured certain privileges for supplying the place with drinkable water. These privileges laid the foundation of his vast fortune. He acquired rich deposits of guano and nitrate of soda in the province of Tarapaca, built railroads and ships to transport these products to the Peruvian coast and British ports. He took an active financial part in connection with public works in South America, and after an absence of twenty years returned to England with a fortune estimated at $100,000,000. In January, 1889, he presented Kirkstall Abbey and grounds to his native city, Leeds, and received the freedom of that place January 25th of the same year. He purchased a fine old estate at Eltham, near London where he entertained lavishly; made handsome gifts to the Leeds Infirmary and to the Yorkshire College of Science. In 1889 he registered his racing-colors, his most fortunate horse being *Nunthorpe*, which in 1891 won the City and Suburban stakes, and followed this up by winning the Jubilee stakes. He was perhaps even better known in the coursing world as the owner of the famous *Fullerton*, winner of the Waterloo cup four times in succession. In 1895 he contested West Leeds as a Conservative against Herbert Gladstone, his canvass being such a farce that the Conservative journals, after his defeat, congratulated the party thereon. He was colonel of the Tower Hamlets Engineer Volunteers. His last speculation was the creating of a vast pleasure-resort at Ostend. He was popular with the Prince of Wales and in society, notwithstanding his many native eccentricities. He died suddenly while presiding over

a meeting of one of his companies in London, May 5, 1896.

NORTH ADAMS, a village of Massachusetts. It has a library, founded in 1884, which has over 15,000 volumes. In 1896 a building valued at $125,000 was presented to the town by A. C. Houghton as a memorial to A. J. Houghton of Boston. Population 1890, 16,074; 1900, 24,200. See NORTH ADAMS, Vol. XVII, p. 568.

NORTHAMPTON, a city and the capital of Hampshire County, Massachusetts, on the Boston and Maine and the New York, New Haven and Hartford railroads. Population 1900, 18,643. See NORTHAMPTON, Vol. XVII, p. 571.

NORTH ATTLEBORO, a manufacturing town of Bristol County, Massachusetts, in the southeastern part of the state, is a center of the jewelry trade. It is reached by the New York, New Haven and Hartford railroad, and had in 1900 a population of 7,253. W.F.J.

NORTH BALTIMORE, a village of Wood County, northern Ohio, 13 miles south of Bowling Green, on the Baltimore and Ohio railroad. It has natural gas, and glass and brick works. Population 1890, 2,857; 1900, 3,561.

NORTH BAY, a town of Nipissing District, northern Ontario, on the Canadian Pacific railroad, 364 miles W. of Montreal. Population 1891, 1,848; 1901, 2,530.

NORTH BROOKFIELD, a town of Worcester County, central Massachusetts, 15 miles W. of Worcester, on the Boston and Albany railroad; has boot and shoe industries; is in a farming and dairy district, and has a library which in 1896 contained 5,128 volumes. Population 1890, 3,871; 1900, 4,587.

NORTH CAPE is the northern extremity of the small island Magerö, Norway, noted as the most northerly land of Europe. It lies in lat. 71° 10′ N. W.F.J.

NORTH CAROLINA has, according to the latest corrected surveys, a gross area of 52,250 square miles, of which 3,670 square miles are water surface and 48,580 square miles, or 31,091,200 acres, are land surface.

The comparisons given below are taken from the twelfth decennial census:

	1890.	1900.
Population	1,617,947	1,893,810
Percentage of increase over preceding census	15.59	17.1
Relative rank in population	16	15
Density of population to the sq. mile.	33.30	39.0
Urban population (cities of 8,000 or over)	62,544	96,537
Percentage of urban population of the whole	3.87	5.1
Number of cities 8,000 or over	5	7
Number of male inhabitants	799,149	938,677
Number of female inhabitants	818,798	955,133
Percentage of native-born population.	99.77	99.8
Number of negroes	561,018	624,469
Increase of negroes since the preceding census	29,741	63,451
Number of civilized Indians	1,514	5,687

In 1899 North Carolina had 3,771,783 acres devoted to the culture of the cereals, the total production being 41,806,518 bushels. Of the total area, 72.1 per cent was under corn; 19.8 per cent under wheat; 7.2 under oats; 0.9 under barley, under rye, and under buckwheat. The acreage and product of each of the cereals is given below:

PRODUCT.	ACREAGE.	BUSHELS.
Corn	2,720,206	34,818,860
Wheat	746,984	4,342,351
Oats	270,876	2,454,768
Barley	475	4,237
Rye	28,074	133,730
Buckwheat	5,168	52,572

The census reports show that in 1899 North Carolina had in cotton 1,007,020 acres, which produced 216,506,930 pounds, or 459,707 bales of 477 pounds each. The area devoted to cotton was greater than that of 1879 by 253,983 acres an increase of 28.44 per cent; but while this gain in acreage was made, the production was decreased by 16,091,397 pounds, equal to 9.12 per cent. Of the 96 counties of the state, 80 produced more or less cotton, three having over 50,000 acres, 15 less than 1,000 acres; 49 ranged from 1,000 to 25,000 acres, and 13 from 25,000 to 50,000 acres. In the raising of flax the state stood 21 in acreage, 23 in production of seed, 13 in production of fiber, 23 in total value of product, 28 in the average yield of seed per acre, and 24 in the average value of products per acre. In tobacco North Carolina stood 3 in the area devoted and 4 in production, the acreage having been 203,023 and the yield 127,503,400 pounds, an increase of 9,389,045 pounds over the crop of 1889. In the area devoted to rice the position was 4, the acreage 22,279, and increase over 1889 of 10,000 acres. The total production was 7,838,580 pounds, an average of 478 pounds to the acre. The following comparative farm statistics are taken from the reports of the twelfth (1900) decennial census:

	1890.	1900.
Total number of farms	178,359	224,637
Average size of farms, acres	127	101
Total area of farms, acres	22,651,896	22,749,356
Total area of farms, improved.	7,828,569	8,327,106
Total area of farms, unimprov'd	14,823,327	14,422,250
Value of lands, fences and buildings	$183,977,010	$194,655,920
Value of implements and machinery	$7,183,210	$9,072,600
Value of live-stock, June 1	$25,547,280	$30,106,173
Value of three items above, total	$216,707,500	$233,834,693
Number of horses	131,451	158,000
Number of mules and asses	100,011	136,000
Number of neat cattle	630,903	587,000
Number of swine	1,251,006	1,300,469
Number of sheep, not including lambs	402,247	208,812
Pounds of wool shorn	733,765	797,176
Pounds of butter	13,129,374	16,913,802
Acres of meadow-land mown	190,754	.....
Tons of hay harvested	191,262	429,824
Bushels of Irish potatoes	1,199,416	1,636,445
Bushels of sweet potatoes	5,665,391	5,781,587

All agricultural interests were rapidly advanced from 1890. The corn crop of 1893 approximated 30,000,000 bushels, and that of 1900, 34,818,860 bushels. The report of the labor commissioner for 1895 gives the number of cotton-mills in the state at 156, which had been increased at the opening of 1896 to 167. The number of looms was near 25,000, the number of spindles approximately 1,000,000. In the mills 4,900 men, 6,150 women and 4,700

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children were employed, making a total of 15,750 employees. The capital invested was fully $15,500,000 at the beginning of 1896, and during the preceding year near 125,000,000 pounds of cotton was used.

Much attention has been given since 1890 to truck-farming, and as much as $750,000 worth of produce has been shipped from a single town in one season. Peanuts are extensively grown, North Carolina having been at one time almost the only source of supply of the article in the United States. The culture of the silk-worm has gained a firm hold among the industries of the state, one mill turning out about eighteen thousand pounds of finished product annually. Since 1870 much attention has been given to grape-culture, both for the manufacture of wine and the supply of Northern markets with grapes. The climate is specially adapted to grapes, as is the soil, and vineyards are found in almost all sections. No state in the union has within its boundaries so large a number of the plants used in *materia medica*, the Atlantic slope of the Blue Ridge furnishing near two thousand five hundred varieties. One firm annually ships over two million pounds, the dried herbs, roots and barks going to all parts of the world. In 1900 North Carolina had 7,226 specified manufacturing industries, in which $76,503,894 were invested as capital, 70,570 persons were engaged whose wages annually reached the sum of $13,868,430 and finished products of the value of $94,919,663 were turned out. Prominent among the various industries were cotton goods, yielding $28,372,798; flouring and grist-mill products, $8,867,462; lumber in different forms, valued $17,754,651; fertilizers, $1,497,625; and tobacco in all forms amounting to $13,620,816. Other industries of importance were oil, cotton-seed and cake, carriages and wagons, and foundry and machine-shop products.

The fisheries of North Carolina yielded a return in 1899 of $1,351,944. In 1895 the number of men employed approximated 6,000, the boats and vessels about 2,500. The value of the products is nearly equally divided between sea and river products. The shad and herring fisheries are the most important of any state, and the greater portion of the catch is made in and about the Albemarle Sound. Oysters are abundant, the area of the public grounds exceeding 20,000 acres and the natural beds nearly 5,000 acres. Legislative protection has been thrown around the oyster and fishery interests, and the laws are rigidly enforced.

Reports made in 1900 regarding the public schools of the state give the school population of the preceding year at 490,000 whites and 130,000 colored, the former having 4,603 schools and the latter 2,376. The receipts for school purposes for the year 1901 amounted to $1,119,746. The average monthly salary of white male teachers was $26.33, for colored male teachers, $24.69; for white female teachers, $22.72, and for colored female teachers, $20.14. In 1895 was celebrated the centennial commencement of the State University (q.v., in these Supplements). Normal schools are maintained at several points in the state, that at Greensboro, for girls, having at the commencement of 1899 about 400 students in attendance. At the same time the State College of Agriculture and Mechanic Arts, established in 1889, had about 330 students. At Cullowhee is a normal school under state control, and colored institutions of the same class are in operation at Fayetteville, Salisbury, Goldsboro, Franklinton, Plymouth and Elizabeth City. A summer school for teachers and those preparing to teach is held annually at the University of Chapel Hill.

Of the denominational educational institutions in North Carolina, the Methodist Episcopal Church

CAPITOL BUILDING, RALEIGH, NORTH CAROLINA.

has Trinity College, at Durham, and Livingston College, at Salisbury; the Presbyterian Church, Biddle University, and Charlotte and Davidson Colleges, at Davidson; the Lutheran Church, Lenoir College, at Hickory, and North Carolina College, at Mount Pleasant; the Baptist Church, Wake Forest College, at Wake Forest, and Shaw University, at Raleigh; the Methodist Episcopal South Church, Weaverville College, at Weaverville; the Reformed Church, Catawba College, at Newton; and the Friends Church, Guilford College, at Guilford College.

In 1890 there were in North Carolina 6,824

church organizations, 6,512 edifices and a membership of 685,194, which constituted 42.35 per cent of the population. The value of all church property within the state was $7,077,440. Thirty different denominations were represented, the principal ones being the Baptists, all bodies, with 3,144 organizations; Christians, 158; Disciples of Christ, 186; all Lutheran bodies, 131; all Methodist bodies, 2,413; all Presbyterians, 411; Protestant Episcopal, 178.

The legislature appropriated in 1895 for state institutions, for the two years following, the amounts herewith given: Raleigh Asylum, $141,880, of which $11,390 was a special appropriation; Morgantown Asylum, $200,000, of which $20,000 was special; Eastern Hospital (colored) $95,000, of which $20,000 was special; Deaf and Dumb Institute, at Morgantown, $91,500, of which $21,500 was special; Blind Institute, $80,000; Soldiers' Home, $17,000; Penitentiary, $49,000; State University, $20,000; Normal and Industrial School, $37,500, of which $10,000 was special; Agricultural and Mechanical College, $50,000, of which $30,000 was special; Agricultural and Mechanical College (colored), $10,000; Colored Normal Schools, $13,250; Orphan Asylum, $20,000, and Colored Orphan Asylum, $6,000. In July, 1895, the orphan asylum located at Oxford had 104 inmates, almost evenly divided between boys and girls. The institution is under the control of the Masonic order, and about one half of the expenditures, which average about $10,000 annually, come from the different lodges of the state, from churches and earnings of the asylum. The Raleigh Asylum for the Insane has an average of about 300 inmates, the one at Morgantown about 550, and the Eastern Hospital about the same as the one at Raleigh. The Colored Orphans' Asylum, at Oxford, has about 75 inmates, the state contributing $1,500 annually, which is about one half the expenditures, the remainder coming from churches and charitable institutions.

The receipts from all sources, according to the report of the state treasurer in 1901, were $1,602,676; the disbursements for the same period, $1,685,556. The taxable property of the state was valued at $287,339,288. The per capita state and county taxes amounted to $1.44. Estimates of the total public indebtedness, state and county, place the aggregate (1900) at $6,527,770, or about 25 per cent of the taxable property of the state.

In 1900 the total railroad mileage was reported at 3,696, with a valuation of $24,501,899. The number of persons employed on the different lines aggregated 9,439. The gross earnings amounted to $9,008,054, and the net income to $2,974,475.

North Carolina had in 1895 a National Guard consisting of 32 commissioned officers, 1,462 infantry, 45 cavalry and 175 naval artillery. The entire force formed a brigade, consisting of 28 infantry companies equally divided among four regiments, one troop of mounted riflemen and a battalion of naval artillery. There was also one company of infantry (colored) unattached. The appropriation for the maintenance of the Guard for the year mentioned was $16,000 from the state and $9,500 from the Federal government.

March 30, 1905, there were 256 newspapers published in North Carolina, of which 29 were daily, 14 semiweekly, 195 weekly, 3 fortnightly, 3 semimonthly, 10 monthly, and 2 quarterly. Papers were published in 85 of the 97 counties of the state, and in 134 of the cities, towns, and villages.

The following is a list of the principal cities and towns of North Carolina, with their populations as given in the census of 1900: Wilmington, 20,976; Raleigh, 13,643; Charlotte, 18,091; Asheville, 14,694; Winston, 10,008; Newbern, 9,090; Durham, 6,679; Salisbury, 6,277; Concord, 7,910; Fayetteville, 4,670; Greensboro, 10,035; Elizabeth City, 6,348.

The following is a list of the governors of North Carolina from 1776, together with their respective terms of office:

Richard Saswell	1776–79
Abner Nash	1779–81
Thomas Burke	1781–82
Alexander Martin	1782–84
Richard Caswell	1784–87
Samuel Johnston	1787–89
Alexander Martin	1789–92
Richard Dobbs Spaight	1792–95
Samuel Ashe	1795–98
William R. Davie	1798–99
Benjamin Williams	1799–1802
James Turner	1802–05
Nathaniel Alexander	1805–07
Benjamin Williams	1807–08
David Stone	1808–10
Benjamin Smith	1810–11
William Hawkins	1811–14
William Miller	1814–17
John Branch	1817–20
Jesse Franklin	1820–21
Gabriel Holmes	1821–24
Hutchings G. Burton	1824–27
James Iredell	1827–28
John Owen	1828–30
Montford Stokes	1830–32
David L. Swain	1832–35
Richard D. Spaight	1835–37
Edward B. Dudley	1837–41
John M. Morehead	1841–45
William A. Graham	1845–49
Charles Manley	1849–51
David S. Reid	1851–55
Thomas Bragg	1855–59
John W. Ellis	1859–61
Henry T. Clarke	1861–62
Zebulon B. Vauce	1862–65
William W. Holden	1865
Jonathan Worth	1865–68
William W. Holden	1868–72
Tod R. Caldwell	1872–74
Curtis H. Brogden	1874–77
Zebulon B. Vance	1877–81
Thomas J. Jarvis	1881–85
Alfred M. Scales	1885–89
Daniel G. Fowle	1889–91
Thomas M. Holt	1891–93
Elias Carr	1893–96
D. L. Russell	1897–1901
C. B. Aycock	1901–05
Robert B. Glenn	1905–08

See NORTH CAROLINA, Vol. XVII, pp. 572–576.

NORTH CAROLINA, UNIVERSITY OF, located at Chapel Hill, in Orange County. The university was

"THE OLD WEST" UNIVERSITY OF NORTH CAROLINA.

founded in 1793, under a charter secured in 1789, its first endowment being Governor Benjamin Smith's gift of 20,000 acres of land in Tennessee.

The campus consists of 50 acres; the buildings are nine in number. A fine tract of 500 acres of woodland adjoins the campus. The university has departments of arts, literature, philosophy, and law, and courses in agriculture, arts, etc. There is also a post-graduate course. In 1907 it had 80 professors and instructors and 775 students. It is nonsectarian, and provides special facilities for poor but deserving students; has a library of 50,000 volumes; the value of the grounds and buildings is about $250,000, and its productive funds amount to $127,000. Its total income in 1902 was $78,000, $20,000 from the state.

NORTHCOTE, Sir Stafford. See Iddesleigh, Lord, in these Supplements.

NORTH DAKOTA, one of the north central group of states, and the thirty-ninth to be admitted

STATE SEAL OF NORTH DAKOTA.

to the Union. The first settlement made within the territory of Dakota, which now constitutes the states of North and South Dakota, was in 1780, by a French trader, who located at Pembina. The United States government expedition under Lewis and Clarke passed through the country, in 1804 going to and in 1806 returning from the Columbia River. A Scottish colony under a grant from the Hudson Bay Company settled at Pembina in 1812, remaining in possession until Aug. 8, 1823, when Maj. S. H. Long, in charge of a United States expedition, reached that point and raised the flag over the settlement. The first attempt at navigation of the waters of Dakota was in 1832, when the *Yellowstone*, a side-wheel steamboat, ascended the Missouri River to Fort Union, near the mouth of the Yellowstone River, in the interests of the American Fur Company of Pittsburg, which also sent the *Assiniboine* up the same river, but it was burned on its return trip with a cargo of furs, near the mouth of Heart River. Nebraska territory was organized May 30, 1854, and May 11, 1858, Minnesota became a state, leaving the country which now comprises North and South Dakota and Wyoming without legal organization. On March 2, 1861, the territory of Dakota was organized, and the year following its capital was located at Yankton. At this time Indian troubles were frequent, the Sioux being almost constant aggressors. In September, 1862, they made two unsuccessful assaults on Fort Abercrombie. In 1868 almost 90,000 square miles was taken from the territory of Dakota to form Wyoming territory. The Northern Pacific railroad broke ground for its line at Grand Forks, Jan. 2, 1872, which event began an era of rapid development, the settlement at Bismarck, the present capital of North Dakota, having been made in that year. A detachment of government troops under General Custer headed a scientific expedition to the Black Hills in 1874, from which the first authentic reports of that part of the country were obtained. In 1883 the seat of government was removed to Bismarck, and September 4th of the same year a convention met at Sioux Falls and framed a state constitution for Dakota, with the 46th parallel (the present southern boundary of North Dakota) as the northern boundary of the proposed new state. Eight days later a convention of citizens of the northern part of the territory assembled at Fargo to protest against this constitution. In 1884 and 1885 many new territorial institutions were opened, among the number being the North Dakota University, at Grand Forks, in the former year, and the Jamestown Insane Hospital, April 30th, in the latter year. On a vote as to the separation of South Dakota, in November, 1887, a majority was recorded in favor of the measure, North Dakota voting against it and South Dakota favoring it. The opposing factions gradually came together, and a convention held at Watertown, Dec. 5, 1888, reported in favor of the division of the territory, the northern portion to form the state of North Dakota and the southern portion the state of South Dakota. Having passed both houses of the Congress, the bill providing for the admission of the two new states was signed by President Cleveland, Feb. 22, 1889. The act relating to North Dakota provided for the assembling of a convention at Bismarck, July 4th, to prepare a constitution for submission to the people at an election to be held on the first Tuesday of the following October; and also for a division of the institutions, debts, records, etc., of the territory between the two proposed states. Upon receiving notice of the adoption of the constitution, the President was to issue his proclamation, admitting the state to the Union. The bill provided for the following grants of public domain:

	Acres.
For university purposes	46,080
For public buildings at the capital	32,000
For public buildings at the capital (additional)	50,000
For agricultural colleges	130,000
For a school of mines	40,000
For a reform school	40,000
For a deaf and dumb asylum	40,000
For the university	40,000
For normal schools	80,000
For general educational and charitable purposes	170,000

The state also became entitled to the customary land grant for public schools. Thirty thousand dollars was granted to erect a state penitentiary, the territorial prison having been set off to South Dakota. The state was to form one United States judicial district and be entitled to one representative in Congress, until otherwise provided.

The constitution framed at the Bismarck convention of 1889 provided for a senate and house of representatives, the former to consist of not less than 30 nor more than 50 members, to hold office for the term of four years; and the latter to consist of not less than 60 nor more than 140 members, their term of service to be two years. The sessions of the legislature are biennial, and after the first must not exceed 60 days; the passage of local and special

laws was forbidden, and all acts, except in the event of an emergency, were to take effect on July 1st, next after the close of the session at which passed.

The governor holds office for two years, or until his successor becomes duly qualified. He has the power to veto any separate item of an appropriation bill. The lieutenant-governor presides over the senate, not voting except in a case of equal division of the senators. In the event of the disability of the governor, he acts as such, the next in line of succession being the secretary of state.

The government also comprises a secretary of state, auditor, treasurer, superintendent of public instruction, commissioner of insurance, three commissioners of railroads, an attorney-general, and a commissioner of agriculture and labor—each to hold office for two years. The treasurer is not to hold office for more than two consecutive terms.

The supreme court has appellate jurisdiction only; consists of three judges elected by the people at large, to hold office for six years. When the population of the state exceeds 600,000, the number of judges may be increased to five. The people also elect district and county judges and justices of the peace.

All elections are conducted with secret ballots. Women are declared eligible to any school office, and are given the right to vote for school officers.

Other provisions are as follows:

The public schools are open to all children of the state, and free from sectarian control; the funds arising from the sale or lease of lands granted for educational or charitable purposes by the United States must never be diminished; the total annual tax for state purposes is limited to four mills on the dollar; railroads are taxed on their gross earnings; no state debt can be incurred in excess of $200,000 over and above the amount of indebtedness at the time of the adoption of the constitution; county and municipal indebtedness is also limited; the labor of children under 12 years of age is prohibited in mines, factories and workshops; the "black-listing" of employees is a misdemeanor; flowing streams and natural water-courses are to remain forever the property of the state for mining, irrigating and manufacturing purposes. Amendments to the constitution must be passed by a majority vote in two succeeding legislatures and be approved by a majority of the electors at a general election.

At the election, October 1st, the constitution was ratified by a heavy vote; the proposed article prohibiting the manufacture and sale of intoxicating liquors received a majority of 1,159 votes. On November 3d the proclamation admitting North Dakota to the Union was promulgated.

Up to 1895 North Dakota had many severe financial situations to battle with. The collection of taxes levied was difficult on account of the monetary depression, felt most severely among the farmers, the largest class of tax-payers. The unpaid taxes up to 1895 were as follows:

1889 and prior years	$117,893.93	1892	$ 25,816.86
1890	26,053.69	1893	52,090.61
1891	22,570.36	1894	320,353.85

Making a total of $564,779.30.

North Dakota lies between lat. 46° and 49° N. and long. 96° 25′ and 104° 5′ W. of Greenwich. It is bounded on the north by the Canadian provinces of Assiniboia and Manitoba; on the east by Minnesota; on the south by South Dakota, and on the west by Montana. The winters are cold, but the dryness of the atmosphere renders the low temperature endurable. At Bismarck the mean annual temperature is 39.4; at Fargo, 37; at Pembina, 34. The mean annual rainfall varies in different localities, that of Bismarck being 20.10 inches; Fargo, 27.17; Pembina, 21.91; and Fort Buford, 13.91.

The population of North Dakota in 1900 was 319,146. In 1880 the population of that part of Dakota territory which now constitutes North Dakota was 36,909, the gain during the decade constituting an increase of 395.05 per cent. The gross area of North Dakota is 70,795 square miles, of which 600 square miles is water surface. The density of population in 1900 was 4.5 to the square mile. The percentage of native-born population was 64.6, that of foreign-born was 35.4. The relative proportion of females to males is 79,808 to each 100,000. The number of negroes in North Dakota in 1900 was 286, the number in South Dakota being 465; a total in the two states of 751. The number of Chinese was given at 32, the number of Japanese at 148 and the number of civilized Indians at 2,276.

Essentially an agricultural region, North Dakota early came into prominence as a highly productive portion of the United States. The following facts are taken from the census reports of 1900:

Total acreage devoted to the cereals	5,610,349
Production of the cereals in bushels	89,939,074
Percentage of the whole area under corn	0.37
Percentage of the whole area under wheat	83.74
Percentage of the whole area under oats	12.45
Percentage of the whole area under barley	3.38
Percentage of the whole area under rye	0.05
Percentage of the whole area under buckwheat,	0.01
Total number of acres under corn	62,373
Total number of bushels of corn produced	1,284,870
Total number of acres under wheat	4,451,251
Total number of bushels of wheat produced	59,888,817
Total number of acres under oats	780,517
Total number of bushels of oats produced	22,125,331
Total number of acres under barley	287,092
Total number of bushels of barley produced	6,752,060
Total number of acres under rye	27,995
Total number of bushels of rye produced	368,240

Considering North and South Dakota together, the acreage of meadow-land to be mown for hay was increased from 1879 to 1889 more than tenfold, or 1,924,813 acres were added; the number of horses on farms was increased by 339,566, the per cent of increase being 814.89, the greatest in the country; the number of swine was increased from 63,394 in 1880 to 682,678 in 1890; the number of sheep was increased by 289,687, and the clip of wool 1,427,301 pounds; the number of working oxen was greater by 49,938; the number of milch cows was more than seven times greater in 1890 than in 1880, the increase being 257,957, and notwithstanding the total number of cattle of all kinds averaged less than ten to the square mile, the annual production of milk in both North and South Dakota amounted to more than 100 gallons per capita of

population. Both of the Dakotas were included in the states reporting an increase in the product of butter on farms, and were noted as being among the very few states not experiencing a large decrease in the amount of cheese made on farms. In the twelfth census the state of North Dakota stood

CAPITOL BUILDING, BISMARCK, NORTH DAKOTA.

seventh in area devoted to flax, seventh in the production of seed, and eighth in the total value of all flax products. The acreage in 1899 was 773,999, and the amount produced 7,766,610 bushels. In 1890, 3,163,742 bushels of Irish potatoes were raised; in 1900 the yield was 2,257,350 bushels, a decrease of 906,392 bushels.

In the census returns of 1900 the two states of North and South Dakota are compared with the territory of Dakota, in tables of agricultural statistics. It therefore becomes necessary to give the combined returns from both states, in order to make intelligent comparisons between 1890 and 1900:

Total number of farms in Dakota territory in 1880	17,435
Total number of farms in North Dakota in 1900	45,332
Total number of farms in South Dakota in 1900	52,622
Total number of farms in North and South Dakota in 1900	97,954
Increase in the number of farms, 1890 to 1900	20,185
Total acreage in farms in Dakota territory in 1880	3,800,656
Total acreage in farms in North Dakota in 1900	15,542,640
Total acreage in farms in South Dakota in 1900	19,070,616
Total acreage in farms in North and South Dakota in 1900	34,613,256
Increase in the acreage in farms, 1890 to 1900	15,556,463
Acres of improved land in farms in Dakota territory, 1880	1,150,413
Acres of improved land in farms in North Dakota in 1900	9,644,520
Acres of improved land in farms in South Dakota in 1900	11,285,983
Acres of improved land in farms in North and South Dakota in 1900	20,930,503
Increase in acres of improved land in farms, 1890 to 1900	9,313,195
Value of land, fences and buildings, Dakota territory, 1880	$ 22,401,084
Value of land, fences and buildings, North Dakota, 1900	$198,780,700
Value of land, fences and buildings, South Dakota, 1900	$220,133,190
Value of land, fences and buildings in North and South Dakota, 1900	$418,913,890
Increase in value of land, fences and buildings, 1890 to 1900	$236,137,250
Value of farm-implements and machinery, Dakota territory, 1880	$ 2,390,091
Value of farm-implements and machinery, North Dakota, 1900	$ 14,055,560
Value of farm-implements and machinery, South Dakota, 1900	$ 12,218,680
Value of farm-implements and machinery, North and South Dakota, 1900	$ 26,274,240
Increase in value of farm-implements and machinery, 1890 to 1900	$ 11,254,348
Value of live-stock, Dakota territory, June 1, 1880	$ 6,463,274
Value of live-stock, North Dakota, June 1, 1900	$ 42,430,491
Value of live-stock, South Dakota, June 1, 1900	$ 65,173,432
Value of live-stock, North and South Dakota, June 1, 1900	$107,512,910
Increase in value of live-stock, 1890 to 1900	$ 59,494,107
Increase in value of three above items	$306,885,705

The 45,332 farms of North Dakota were divided according to size as follows: 407 were under 10 acres; 384 were over 10 and under 20 acres; 555 were over 20 and under 50 acres; 716 were over 50 and under 100 acres; 36,810 were over 100 and under 500 acres; 5,114 were over 500 and under 1,000 acres, and 1,346 were over 1,000 acres, the average size being 342.9 acres. Of the whole number of farms, 33,866 were cultivated by the owners, 591 were rented for a fixed money value, and 3,274 were rented for a share of the products.

In 1894 the state commissioner of agriculture reported as follows: The tendency of the farmers of the state is toward diversification of crops. The acreage of wheat, once considered the great staple of the two Dakotas, has increased since the census year but 16 per cent, while the acreage of oats, barley, flax, rye, corn and potatoes, considered as a whole, has increased about 47 per cent. During the four years oats increased about 24 per cent, barley 150 per cent, rye more than 500 per cent, potatoes about 23 per cent. Flax and corn have been less steady, increasing one year to decrease the next. In 1890 the greatest flax acreage in the history of the state was recorded, 114,000 acres. This dropped to about one-fourth that acreage in 1892, but since has recovered, the crop of 1899 rising to the high yield of over 7,766,000 bushels. The following report was gathered by the county assessors in 1899:

Crop.	1899.	
	Acres Sown.	Amount harvested (Bushels).
Wheat	4,451,251	59,888,817
Oats	780,517	22,125,331
Barley	287,082	6,752,060
Flax Seed	773,999	7,766,610
Rye	27,995	368,240
Corn	62,373	1,284,870
Potatoes	21,936	2,257,350
Hay and forage	1,410,534	1,748,213 (tons)

The number of sheep sheared in 1899 was 451,437, the clip 3,030,478 pounds. In 1900 the number of farms in the state had increased to 45,332, the number of acres under cultivation was 9,644,520 and the total acreage of farms 15,542,640. The total number of acres in crops, including tame grasses, amounted to 13,726,973, and in cultivated timber of more than one year's growth there were 36,792 acres.

In 1900 North Dakota had 1,130 specified manufacturing industries, in which the capital employed amounted to $5,396,490; the number of persons engaged numbered 2,398, whose annual wages amounted to $1,222,472, and the finished products aggregated $9,183,114. Flouring and grist-mill products led in importance, the amount of the output being $4,134,023. Other industries of importance were printing and publishing, saddlery and harness, foundry and machine-shop products, and tobacco and cigars.

For the fiscal year ending June 30, 1900, the superintendent of public instruction of North Dakota reported 1,179 organized districts of all kinds, 88 graded schools, 1,878 ungraded schools; total seating-capacity of all schoolhouses, 94,445; total value of school property, $1,910,638; enumeration for apportionment in 1899 showed 93,567 pupils; average monthly wages of male teachers $44.75, of female teachers $35.03. At the time of this report there were 9,501 trees growing on school-grounds, mainly planted by the pupils on Arbor day. State normal schools are maintained at Mayville, on an appropriation in 1893, for the two years following, of $30,000; and at Valley City, on an appropriation for the two years, 1893 and 1894, amounting to $14,000. A normal department is maintained in the University of North Dakota. The North Dakota Agricultural College is also under state control, and receives aid both from the state and the Federal government.

North Dakota in 1898 had 868 church organizations, 335 edifices, a membership of 59,496, which was 32.56 per cent of the entire population, and church property of the value of $780,775. The number of denominations was 22, the principal ones being the Baptists, with 54 organizations; the Roman Catholics, with 115; the Congregationalists, with 65; the Lutherans, with 298; the Methodists, with 140; the Presbyterians, with 100; and the Protestant Episcopal, 39.

For 1899 the state treasurer reported the receipts from county taxes, $334,165; from railroads, $97,223; from insurance, $18,760; from sale of warrants, $210,000; receipts from all sources, including a balance of $61,568 carried over from 1894, were $1,160,225. The total amount of expenditures was $1,103,676, leaving a balance of $56,549 at the opening of 1900. The appraisement for the purposes of assessing the taxes for 1900 resulted in values being equalized as follows: Real property $77,739,637, personal property $27,849,290, etc., a total of $117,204,485. The state indebtedness in 1899 amounted to $800,000, the maximum indebtedness allowed by the constitution.

The railway mileage in North Dakota at the close of 1900, according to the assessment made in each county of the state, was 2,826.72. Three of the five lines of road operating partly within the state reported deficits after comparing the gross receipts with the operating expenses.

The state charitable, reformatory and penal institutions include the School for the Deaf at Devil's Lake, the State Hospital for the Insane at Jamestown, Soldiers' Home at Lisbon, and the State Penitentiary at Bismarck. An institution for the blind was in course of erection at Bathgate, in Pembina County, in 1896.

In 1894 an irrigation plant was established at Bottineau, and the results proved favorable. In addition to the numerous streams, many of them considerable rivers, North Dakota has admirable provisions for irrigation in artesian wells. In 1896 there were 672 flowing wells, besides hundreds from which water is obtained by pumping. Of the former, the most noted is the Minnehaha, at Turtle Mountains, which flows 283 gallons per minute.

March 30, 1905, there were 257 newspapers published in North Dakota, of which 11 were daily, 1 semiweekly, 233 weekly, 1 semimonthly, 9 monthly, 1 bimonthly and 1 quarterly. Papers were published in 39 of the 40 counties, and in 171 of the cities, towns, and villages of the state.

The following is a list of the principal cities and towns of North Dakota, with their populations, as given in the census reports of 1900: Bismarck, 3,319; Dickinson City, 2,076; Fargo City, 9,589; Grafton, 2,378; Grand Forks, 7,652; Jamestown, 2,853; Valley City, 2,446; Wahpeton, 2,228.

State flower, Wild Rose and Golden Rod.

Governors of North Dakota from the admission of the state in 1889, with their respective terms of office:

John Muller.....1889–91	F. E. Briggs.....1897–99
A. H. Burke.....1891–93	F. B. Fancher.....1899–1901
E. Shortridge.....1893–95	Frank White.....1901–05
R. Allin.....1895–97	E. Y. Searles.....1905–07
	John Burke.....1907–

See DAKOTA, Vol. VI.

NORTHFIELD, a town of Franklin County, Massachusetts, in the northwestern part of the state. It was the birthplace of Dwight L. Moody, the evangelist (q. v.), and is the site of the Northfield Seminary for young women and the Mount Hermon School for young men, founded by him and now developed into great religious institutions. It is reached by the Connecticut River and the Central Vermont railroads, and had in 1900 a population of 1,966. W.F.J.

NORTHFIELD, a city of Rice County, southeastern Minnesota, 34 miles S. of St. Paul and 32 miles W.S.W. of Red Wing, on the Minneapolis and St. Louis and the Chicago, Milwaukee and St. Paul railroads; has a foundry and machine-shop, saw and planing mills; is surrounded by a farming country. It contains Carleton College (Congregational), a co-educational institution founded in 1870, having in 1901, 21 instructors, 366 students, and a library containing 15,400 volumes. Also St. Olaf College (Lutheran), a co-educational institution, organized in 1874 and having in 1901, 17 instructors, 306 pupils, and a library containing 3,400 volumes. Population 1890, 2,659; 1900, 3,210.

NORTHFIELD, a town of Washington Coun-

ty, central Vermont, 9 miles S.S.W. of Montpelier, on the Central Vermont railroad; noted for its slate quarries. It has flannel, excelsior and granite works and a corn cannery. Northfield is the seat of a military school, known as Norwich University, established in 1834. Population 1900, 1,508.

NORTH MAGNETIC POLE. See METEOROLOGY, Vol. XVI, p. 168; also MAGNETISM, Vol. XV, p. 222.

NORTH PLATTE, a city and the capital of Lincoln County, central southwestern Nebraska, 50 miles E. of Ogallala, on the Union Pacific railroad and at the north and south forks of the Platte River. It has extensive railroad repair-shops, employing a great number of men, and a large flour-mill, and is surrounded by an extensive cattle-raising and agricultural district. Population 1900, 3,640.

NORTHROP, CYRUS, an American educator; born in Ridgefield, Conn., Sept. 30, 1834. He graduated at Yale Academical Department in 1857, and from the Law School in 1859, and was admitted to the Connecticut bar in 1860. He was clerk of the Connecticut House of Representatives in 1861, and of the State Senate in 1862. He became editor of the New Haven *Palladium* in 1863, and was professor of rhetoric and English literature at Yale from 1863 to 1884. In the latter year he was chosen president of the University of Minnesota, and has held the position since that time. E.E.T.

NORTH SEA AND BALTIC CANAL. See CANALS, in these Supplements.

NORTHUMBERLAND, a borough of Northumberland County, Pennsylvania, in the east-central part of the state. It stands at the great fork of the Susquehanna River, and in the anthracite coal and lumber country. It is reached by the Pennsylvania, the Philadelphia and Reading, the Delaware, Lackawanna and Western and the Northern Central railroads, and had in 1900 a population of 2,748. W.F.J.

NORTHUMBERLAND, ALGERNON GEORGE PERCY, DUKE OF, an English nobleman; born in 1810, and educated at Eton and St. John's College, Cambridge, of which university he was made a doctor of laws in 1842. He first entered Parliament as member for the borough of Beeralston, and represented the northern division of Northumberland in the Conservative interest from 1852 down to 1865. He held office in 1858–59, first as a lord of the admiralty and afterward as vice-president of the Board of Trade. He succeeded to the dukedom in 1867, was appointed Lord Privy Seal in 1878, and in the same year made chairman of the Royal Commission charged with conducting an inquiry into the parochial charities of the city of London. He was president of the Royal Institution, honorary colonel of the Northumberland militia, and lord-lieutenant of Northumberland. Died Jan. 2, 1899.—His eldest son, EARL PERCY (born in 1846), was long Conservative member for North Northumberland, and was called to the House of Lords in his father's barony of Lovaine in 1887.

NORTHUMBRIA. See NORTHUMBERLAND, KINGDOM OF, Vol. XVII, p. 582.

NORTH VERNON, a village of Jennings County, southeastern Indiana, 2 miles N.W. of Vernon, on the Baltimore and Ohio, the Cincinnati, Columbus, Chicago and St. Louis and the Pittsburg, Cincinnati, Chicago and St. Louis railroads; has graded schools; several breweries are here, and it manufactures chairs, flour, furniture and woolen goods. Population 1890, 2,012; 1900, 2,823.

NORTHWESTERN ALLIANCE. See FARMERS' ORGANIZATIONS, in these Supplements.

NORTHWESTERN UNIVERSITY, an institution of learning, for both sexes, maintained at Evanston, Illinois, a suburb of Chicago, by the

LIBRARY, NORTHWESTERN UNIVERSITY.

Methodist Episcopal Church, having been founded in 1851. It is provided in the charter that the institution "shall remain located in or near the city of Chicago." The location of the campus, comprising 45 acres of oak-grove, along the front of Lake Michigan, could scarcely have been better chosen. The schools are divided between Chicago and Evanston. Those at Evanston are the College of Liberal Arts, the Garrett Biblical Institute and the School of Music. The College of Liberal Arts has four courses: classics, philosophy, modern literature, and science. The Garrett Biblical Institute, comprehending Heck Hall and Memorial Hall, though under a separate corporation, serves as the theological department, and includes a Norwegian-Danish and a Swedish theological seminary. The schools of law, medicine, pharmacy, and dentistry, as well as the women's medical school, are located at Chicago. In 1907 there were 203 professors and instructors, and 4,000 students. The total number of graduates up to 1905 was 9,819. The university maintains high standards in all its departments. The medical school was the first in the United States to insist on preliminary entrance examinations; and was one of the first to establish a four years' course. Its law school has a three years' course, and grants the degree of LL.B. The Dearborn Observatory belongs to the university, and its telescope, the largest when made, has an 18½ inch aperture. The library in 1907 contained 107,000 volumes, and is particularly rich in the classics. The income of the university in 1904 was $780,344, and the productive funds were $5,595,343, much of the property being in Chicago. Dr. Edmund J. James, dean of the Univ. of Chicago, succeeded H. W. Rogers, LL.D., as president in 1892. *Revised by* R. W.C.

NORTH-WEST TERRITORIES. The North-West Territories of Canada include the vast region, of 1,293,295 square miles in extent, lying west of Manitoba and the District of Keewatin, formerly owned by the Hudson Bay Company. Out of this

great tract a group of four districts was organized, in 1882, by the Dominion government, with a total area of 555,640 square miles, of which 19,545 square miles are water. The following are the districts, with their separate areas in square miles: Assiniboia (90,340); Saskatchewan (114,000); Alberta (100,000), and Athabasca (251,300). The Canadian Pacific railroad traverses both Assiniboia and Alberta, onward, across the Rocky Mountains to the Pacific Coast. Both districts are bounded on the south by the international boundary line. Assiniboia is flanked by Manitoba on the east and by Alberta, or long. 111° W., on the west. Its northern limit is the southern boundary of Saskatchewan (lat. 52° N.), which has the same western boundary as Assiniboia, and a northern boundary near lat. 55° N. The eastern limit of Saskatchewan is Manitoba and Lake Winnipeg. The western boundary of Alberta is the Rocky Mountains, and its northern is also the line, lat. 55° N. To the north of Alberta is the district of Athabasca, which is bounded on the south by lat. 55° N. and on the north by lat. 60° N.; its eastern boundary is long. 111° 50′ W. and its western long. 120° W. The population of the organized territories was, by the census of 1901, 158,940, of which about 15,000 were Indians, or 20,000 including the nomadic tribes that people the northern watercourses flowing into the Arctic Ocean. The Indians of this region include the half-breeds located along the two branches of the Saskatchewan river, who in 1885 took part in the Riel rebellion against the Dominion government. The capital of the North-West Territories is Regina (pop. 2,645), in Assiniboia, 357 miles W. of Winnipeg. It is the seat of the local government and the headquarters of the North-West Mounted Police, a force 1,000 strong, maintained by the Dominion authorities for the preservation of law and order. Since 1888 the affairs of the North-West Territories have been administered by a lieutenant-governor, an advisory council or executive of three members, and a legislative assembly of 31 members. In 1894, by act of the Federal Parliament, the local assembly, which represents the four organized districts, was given full control of the finances of the Territories, the number of its local representatives, the boundaries of the constituencies; it also increased the period of existence of the assembly to four years. In 1905 these four districts were organized into two provinces called Alberta and Saskatchewan, their dividing line running North and South.

There is no public debt, the government of the Territories not having power to borrow money or pledge the public credit. The federal vote for 1895–96 amounted to $242,879, $115,000 of which was appropriated for the purposes of education and $65,000 for roads, bridges and public works. The first school district in the Territories was organized in 1884. In 1900 there were 492 public schools, 2 Protestant separate schools, 44 Roman Catholic public schools and 11 Roman Catholic separate schools. The average pupil attendance, 9,439. Denominationally, the population is roughly classified as one half Protestant, 15 per cent Roman Catholic and 35 per cent pagan (Indian). The chief towns besides the capital are Edmonton, Prince Albert and Battleford, on the north branch of the Saskatchewan, and Moosomin, Moose Jaw, Medicine Hat and Calgary, on the line of the Canadian Pacific railroad, and Lethbridge, on the Belly River, near Fort McLeod. Lethbridge has of recent years become a center of the rich coal country in the southern portion of the district of Alberta. The coal is bituminous, and in the locality has been estimated to cover an area of 15,000 square miles. Though not of the best quality, for the farmer and colonizer it is an important "find" in a vast treeless region. Near Banff and close to the line of the Canadian Pacific railway a mine of anthracite coal is being developed. This deposit represents the only true anthracite coal which is being worked in America, outside of Pennsylvania. It is said to contain a larger amount of fixed carbon and give greater heat than the Pennsylvania coal, and also to burn more rapidly. Extensive coal-measures have also been tapped along the valleys of the Peace and Bow rivers and the North Saskatchewan. The output of the commodity in the Lethbridge region aggregated, in 1894, 250,000 tons.

It is, however, as a great grain-producing and cattle-ranching area that the North-West Territories are most noted. So rich and extraordinarily fertile is the soil that it needs no laborious tilling, and there are no tree-stumps or rocks to interfere with the operations of the sulky plow or detract from the joy of the harvesting. The one drawback is the distant market and the high freights which have to be disbursed to reach it. Against this chief drawback, the scarcity of labor and perhaps the lack of adequate machinery for farming operations on a large scale, and the taxes on it which a high tariff imposes, are wholly subordinate. The chief grazing-region lies in the district of Alberta, on the slopes of the Rocky Mountains, where cattle and horses range winter and summer without shelter. The census of 1891 gives the following as the live-stock of the Territories: Horses, 42,956; horned cattle, 233,721; sheep, 64,920; and swine, 16,293. To the north of the Territories stretch the vast solitudes utilized by the Hudson Bay Company as "the last great fur preserve of the world," and organized in 1895 into the districts of Mackenzie and Franklin, and the territory of Yukon. (Pop. 1901), 52,709.

NORTH WILMINGTON, a borough of Lawrence Co., Pa., near Volant; is the site of Westminster College, a co-educational institution, organized in 1854, having, in 1898, 11 instructors, 291 pupils, and a library of 4,000 vols. Pop. 1900, 791.

NORTHWOOD, a village, the capital of Worth Co., Iowa, 23 miles N. W. of Osage, on the Burlington, Cedar Rapids and Northern railroad; has a newspaper office, graded schools, and a flour-mill; is in a farming district. Pop. 1896, 859; 1900, 1,271.

NORTH YAKIMA, a city and the capital of Yakima County, central southern Washington, 30 miles S. of Ellensburg, on the Northern Pacific railroad, and at the confluence of the Yakima and Natchess rivers; is in a rich agricultural district, and has good water-power from the Yakima River, for its mills. Grain, fruit, tobacco, sorghum, hops, and

alfalfa are grown; dairy products and live-stock are shipped. Population 1900, 3,154.

NORTON, ANDREWS, theologian, was born at Hingham, Mass., on December 31, 1786, and was graduated from Harvard College in 1804. In 1809 he was a tutor at Bowdoin, in 1811 a tutor at Harvard, in 1812 editor of the *General Repository*, a theological journal, in 1813 a lecturer on Biblical criticism at Harvard, and from 1819 to 1830 professor of sacred literature. He was the author of *The Latest Form of Infidelity*, *Evidences of the Genuineness of the Gospels*, *Tracts Concerning Christianity*, *A Translation of the Gospels*, and other works, wrote much for periodical literature, and did much editorial work on books and journals. He was one of the ablest Unitarian theologians of his time. He died at Newport, R. I., on Sept. 18, 1852. W.F.J.

NORTON, CHARLES ELIOT, an American *littérateur* and art critic; born in Cambridge, Mass., Nov. 16, 1827. He graduated at Harvard in 1846 and entered commercial life in Boston, in the course of which he made a voyage to the East Indies as supercargo in 1849, returning through Europe, to which later, having devoted himself to literary pursuits, he made several trips. From 1862 to 1868 he was associate editor, with Lowell, of the *North American Review*. In 1874 he was chosen professor of the history of art at Harvard University, a position he held until 1898, when he retired with the title of professor emeritus. He is widely known as a student, translator, and exponent of Dante's works, and an acknowledged critic in the realms of art. He was the founder, in 1879, of the Archæological Institute of America, and for many years its president and most active member. Among his works are *Historical Studies of Church Building in the Middle Ages* and *Notes of Travel and Study in Italy*. He has edited some of the correspondence, works, etc., of many men of letters, including J. R. Lowell, G. W. Curtis, Thomas Carlyle, R. W. Emerson, John Ruskin, etc. E.E.T.

NORTON, LILLIAN, an American opera singer, better known as Madame Nordica. See DOME, MRS. Z. F., in these Supplements.

NORTON, WILLIAM EDWARD, an American marine-painter; born in Boston, in 1843. He was a house-painter in his youth, and, while his fellow-workmen were anxious for all the easy, indoor work he was ready to do graining and similar work outdoors in the roughest weather, for the sake of the study. He came of a ship-building family, and took two or three sea-voyages to get sea effects, having determined to become a marine-painter even in those early days. This discipline and conscientious study, added to his natural gifts, made him a decided success in the world of marine-painters. After painting in Boston for several years, he went abroad in 1877, and opened a studio in London, where he continued to reside. Among his early works, which made his name in Boston, are *Gathering Help; Whaleships Trying Out;* and *Early Morning*. At the Philadelphia Centennial Exhibition of 1876 he exhibited *Fog on the Grand Banks;* and in recent Royal Academy exhibitions he had *The Thames Near Blackwell; Twilight on the Banks of Newfoundland;* and *Becalmed on the Grand Banks*. At the World's Columbian Exposition in Chicago he was represented by *Moonlight on the River; Return of the Herring Fleet, Holland; A Moment's Rest; Off the Dutch Coast;* and *Mid-Channel*.

NORUMBEGA, a name, whether of Indian, Norse or Spanish origin is uncertain, by which the early French explorers of America designated a region or city on the northeastern shore of New England, or possibly within the limits of what are now known as the British Provinces. According to B. F. De Costa, in his work on *Norumbega and the English Explorers*, a very similar name occurs in the map of Verrazano (1529). With various spellings the name also appears in maps and records of other authors of the period, the site of the lost city being variously located, on the Penobscot in Nova Scotia, Newfoundland, the country of the lower Hudson, and, lastly, by the late Professor Eben N. Horsford, along the lower reaches of Charles River, Massachusetts. See also LEIF ERICSON, in these Supplements; and AMERICA, Vol. I. pp. 619–620.

NORWALK, a township of Connecticut, for the geographical location of which see NORWALK, Vol. XVII, p. 588. It is on the New York, New Haven and Hartford R.R.; has two savings and three national banks; two public libraries and sixteen churches. Pop. of township 1900, 19,932; of city, 6,125; of South Norwalk city, 6,591.

NORWALK, a city and the capital of Huron County, northern Ohio; 16 miles southeast of Sandusky and 56 miles southwest of Cleveland. It is in a farming region where considerable attention is given to dairying. It has manufactories of agricultural implements, pianos, organs, sewing-machines, etc. Pop. 1890, 7,195; 1900, 7,074. See also NORWALK, Vol. XVII, p. 588.

NORWAY. (For general article on the kingdom of Norway see NORWAY, Vol. XVII, pp. 558–606.) Norway has an area of 124,445 square miles. The

COUNTIES.	AREA, ENGLISH SQ. MILES.	POPULATION, DEC. 30, 1900.
Kristiania (town)	6	227,626
Akershus	..,055	116,228
Smaalenene	1,600	136,886
Hedemarken	10,621	126,182
Kristians	9,793	116,280
Buskerud	5,790	112,676
Jarlsberg og Larvik	896	104,554
Bratsberg	5,865	99,052
Nedenes	3,609	79,935
Lister og Mandal	2,805	81,567
Stavanger	3,532	127,592
Söndre Bergenhus	6,026	135,752
Bergen (town)	5	72,251
Nordre Bergenhus	7,132	89,041
Romsdal	5,788	136,137
Söndre Trondhjem	7,184	135,382
Nordre Trondhjem	8,791	83,433
Nordland	14,517	152,144
Tromsö	10,134	74,362
Finmarken	18,296	32,800
Totals	124,445	2,239,880

latest official census (1900) placed the population at 2,239,880. The preceding table gives the population by provinces:

The population of the principal towns (1900) was:

Kristiania	227,626	Fredrikstad	14,635
Bergen	72,251	Larvik	10,668
Trondhjem (and suburbs)	38,180	Fredrikshald	11,957
Stavanger	30,613	Kristiansund	12,050
Drammen	23,093	Skien	11,394
Kristiansand	14,666	Aalesund	11,777

CENTRAL EXECUTIVE GOVERNMENT. The year following the coronation of Charles XIII, a charter (the riksakt) was promulgated, establishing new fundamental laws on terms of perpetual union with Sweden, declaring such union indissoluble and irrevocable, yet without prejudice to the separate local government of each country. The law of succession to the throne was the same in both countries. In case of absolute vacancy of the throne, the two diets were to assemble for the election of the future sovereign, and should they not be able to agree upon one person, an equal number of Swedish and Norwegian deputies would meet at the city of Karlstadt, in Sweden, for the appointment of the king; this nomination was absolute. The common affairs were decided upon in a council of state, composed of Swedes and Norwegians. In case of the minority of the king, the council of state was exercised by the sovereign power until a regent or council of regency was appointed by the united action of the Diets of Sweden and Norway.

A revision of the constitution of Norway was made in 1889. Under its provisions the legislative power of the realm continued to be vested in the "Storthing" or Great Court, declared to be the "representative of the sovereign people." The king of Sweden and Norway, however, possessed the right to veto laws passed by the Storthing, but only for a limited period. The royal veto could be exercised twice; but if the same bill passed three storthings formed by separate and subsequent elections, it became the law of the land without assent of the sovereign. The king had the command of the land and sea forces, and made all appointments, but, except in a few cases, was not allowed to nominate any but Norwegians to public offices.

The Storthing assembled every year. New elections took place every three years. The meetings took place *suo jure*, and not by any writ from the king or the executive. They began in February each year, and had to receive the sanction of the king to sit longer than two months. Every Norwegian citizen of twenty-five years of age could vote, who, in the year before election, had paid income tax on an annual income of at least five hundred kroner in the country districts, or eight hundred kroner in the towns (provided that he had resided one year in the electoral district at the time when the election took place, and that he did not belong to the household of another as a servant), or who was or had been a public functionary, or possessed property in land, or had been tenant of such property for five years at least, or was a burgess of any town, or possessed real property in a town of the value of six hundred kroner.

Under the same conditions, citizens thirty years of age, and settled in Norway for at least ten years, were entitled to be elected. No election took place for vacancies, which were filled by the persons who received the second largest number of votes. Of the total male population, 45 per cent. were 25 years of age and above. The Storthing had 114 members—38 from towns, 76 from rural districts.

The Storthing, when assembled, divided itself into two houses, the "Lagthing" and the "Odelsthing." The former was composed of one-fourth of the members of the Storthing, and the other of the remaining three-fourths. Each house nominated its own presidents. If the Odelsthing and Lagthing did not agree, the two houses assembled in common sitting, to deliberate, and the final decision was given by a majority of two-thirds of the voters. The same majority was required for alterations of the constitution. The Storthing could also form itself into a high court of justice for the impeachment and trial of ministers, members of the chief court of justice and members of the Storthing. While in session, every member of the Storthing had an allowance of 12 kroner a day, besides traveling expenses.

The executive was represented by the king, who exercised his authority through a Council of State, composed of two ministers of state and at least seven Councilors. Two of the Councilors, who changed every year, together with one of the ministers, formed a delegation of the Council of State, residing at Stockholm, near the king. Ministers and Councilors of State were entitled to be present in the Storthing and to take part in the discussions when public, but without a vote.

INDEPENDENT GOVERNMENT. Shortly after the revision of the Constitution, an effort was made by the Radicals for a special Ministry of Foreign Affairs for Norway and a distinct diplomatic and consular service. This scheme, however, was not favored by the reigning monarch, King Oscar II., but after the election of 1897, in which the Radical party gained an overwhelming victory, King Oscar gave his consent to a law removing the emblem of Sweden from the flag of Norway, but a bill in 1900 providing for separate consular service for Norway failed to secure the royal approval. A bill in 1898 was passed and enacted into law providing for choosing members of the Storthing by direct vote. This measure was further enlarged in 1901 by granting suffrage to all adult males and such women as paid a tax on an income of more than 300 kroner. In 1902, another attempt was made, through a committee representing both countries, for separate consular service, and although an agreement was reached which was ratified by both Norway and Sweden and signed by the king in 1903, the latter country took no steps to carry the resolution into effect, and after Norway's repeated failures to secure satisfactory arrangements she took steps towards the dissolution of the dual kingdom. The Storthing, ac-

cordingly, weary of Sweden's delay and indecision, proposed and unanimously passed a resolution June 7, 1905, proclaiming Norway an independent and sovereign state. On August 13, the question of separate national existence being submitted to a referendum vote was carried almost unanimously. On the 23d of the following month, a protocol was signed at Karlstadt by the Swedish and Norwegian delegates, providing for a peaceable disunion. The Storthing then negotiated with Prince Charles of Denmark for the Norway crown, and on the submission of the question to the people met their approval. Prince Charles accepted the proffered throne and on November 27, 1905, was crowned constitutional sovereign of Norway, under the adopted title of King Haakon VII. He avowed strict compliance with the constitutional provisions of the kingdom.

NORWEGIAN LANGUAGE. See SCANDINAVIAN LANGUAGES. Vol. XXI, p. 385.

NORWICH, a city of New London County, southeastern Connecticut, on the Central Vermont and the New York and New England railroads. It has two public libraries, a hospital and art museum. The population of the town was, in 1900, 24,637; of the city, 17,251. See also NORWICH, Vol. XVII, p. 610.

NORWICH, a village and the county seat of Chenango County, New York, in the south-central part of the state. It is on the Chenango River, in an agricultural, dairying and hop-growing region, and contains car shops, creameries, breweries and wood-working factories. It is reached by the Delaware, Lackawanna and Western and the New York, Susquehanna and Western railroads, and had in 1900 a population of 5,766. W.F.J.

NOSE, DEVELOPMENT OF. See SENSE-ORGANS, in these Supplements.

NOSOLOGY. See CULLEN, WILLIAM, Vol. VI, p. 614.

NOSTOC, a genus of the *Schizophytes*, or fission-algæ, found in water and damp places, and often occurring in cavities of higher plants. The plant body is a chain-like filament of cells, in which occur certain larger cells known as *heterocysts*. The cell-walls secrete such abundant mucilage that numerous cell-chains become imbedded together in structureless masses of jelly, which may attain the size of a plum or larger, and are found floating in the water or attached to other bodies.

NOTACANTHIDÆ, a family of elongated fishes, living in the cold, deep oceans. They have nothing of popular interest connected with them.

NOTATION, algebraic. See ARITHMETIC, Vol. II, pp. 460–463. For astronomical notation, see COMET, Vol. VI, pp. 163–173. For chemical notation, see CHEMISTRY, Vol. V, pp. 87–89. For musical notation, see MUSIC, Vol. XVII, p. 87.

NOTHINGARIANS OR GORTONIANS. See GORTON, SAMUEL, in these Supplements.

NOTIDANIDÆ, a family of sharks, characterized by having more gill-clefts than ordinary sharks. The representatives are inhabitants of the warmer seas. *Notidanus*, the type-form, is the cow-shark of warm, temperate waters. See SHARKS, Vol. XXI, p. 815.

NOTOCHORD. See SKELETON, Vol. XXII, pp. 117–118.

NOTOPTERIDÆ, a family of fresh-water fishes. See ICHTHYOLOGY, Vol. XII, pp. 711–733.

NOTORNIS, a bird of the family of rails, which formerly inhabited New Zealand. See MOOR-HEN, Vol. XVI, p. 835; and BIRDS, Vol. III, p. 634, note.

NOTRE DAME, UNIVERSITY OF, a Roman Catholic institution located at South Bend, Indiana; founded in 1844 by the Rev. Edward Sorin, and conducted by the members of the Congregation of the Holy Cross. It is the largest, and possibly the most important, of the Roman Catholic universities in the United States. It has a roll of 82 professors and instructors, and usually about 850 students. The library has about 55,000 volumes; the value of the scientific apparatus is $35,000, and of the property $800,000. The institution is conducted independently of all endowment, the sole revenues being derived from the fees, the annual charge to each student being $300. The courses embrace the classics, mathematics, science, law and fine arts. Phonography, telegraphy and typewriting are also under the care of competent instructors. The scientific side provides special advantages for the study of natural and physical sciences, mechanical engineering and applied electricity.

NOTT, ELIPHALET, an American educator; born in Ashford, Conn., June 25, 1773. He was largely self-taught, and he received no collegiate education; but he studied divinity, and at the age of 21 was sent on mission work in central New York. In passing through Cherry Valley, Otsego County, N. Y., he accepted a call to take charge of the Presbyterian church at the place, and, in addition to the pastorate, conducted the academy. Two or three years afterward he was called to the Presbyterian church at Albany, N. Y., and in 1804 he was chosen president of Union College, Schenectady, N. Y., which position he held till his death. He was instrumental in building up the college from a condition of poverty to a comfortable foundation. He was an earnest advocate of temperance. He took out over 30 patents on heating-devices, and invented a stove which was long in use. He died in Schenectady, Jan. 29, 1866. E.E.T.

ELIPHALET NOTT.

NOTTINGHAM, the chief town of Nottinghamshire, England, has been considerably enlarged in its municipal boundaries since the writing of the account in Vol. XVII, pp. 612–615. By an act of Parliament passed in 1877, the boundaries of the town were extended, and now include Lenton, Radford, Basford, Sneinton, Bulwell, the Park, Carrington, Sherwood, Brewhouse Yard and parts of Wilford and Gedling. The population of the county borough, co-extensive with Parliamentary borough

is 239,753. The area of the borough is 10,935 acres. Besides a town and county hall, an exchange, St. Mary's, and several other churches and places of worship, Nottingham has a grammar school, a free library, a natural history museum, university buildings (built at a cost of one hundred thousand pounds, and opened in 1881), a school of art, an arboretum, a spacious theater; several fine public halls, including the Albert, seating about three thousand persons; a Gothic fountain, erected as a memorial of John Walter of the *Times*, for a short time member of Parliament for the town; and a statue of the late Samuel Morley who also represented Nottingham in Parliament; high schools for boys and girls, middle schools and 57 primary schools, Blind Institution, Art Museum, free public libraries, Mechanics' Institute, People's Hall (founded by G. Gill). Here is produced nearly all the British machine-made lace. For making machines for the lace trade there are, in Nottingham, shops and large factories. The markets for corn and cattle are among the largest held in the midland counties. Several fairs take place annually, the most important being the "Goose Fair," in October. There is a fine race-course to the northeast of the town. Nottingham publishes four daily newspapers. The Parliamentary borough is divided into three districts, each of which returns one member: East Nottingham, population, 75,794; South Nottingham, 72,046; and West Nottingham, 92,037. The castle, fired by rioters, Oct. 8, 1831, on the rejection of the Reform Bill by the House of Lords, remained a ruin till 1877, when the property was leased to the corporation of Nottingham for five hundred years, and was restored at a cost of thirty thousand pounds for the purposes of a Fine Arts Museum, opened in 1878.

NOUKHA, a town of Russia, in Transcaucasia, built on the southern slope of the Caucasus Mountains, 80 miles S.W. of Derbend. It is inhabited by native Tartars belonging to the Mohammedan creed, by Armenians, and a few Russians, chiefly officials. Breeding the silk-worm is the staple branch of industry. The native breed of silk-worms is somewhat coarse, and is now being supplanted by the Italian breed.

NOVACULITE, an exceedingly compact form of hornstone which is used as a hone or whetstone for sharpening knives. See also MINERALOGY, Vol. XVI, p. 405.

NOVALES, the pseudonym of HARDENBERG, FRIEDRICH VON, Vol. XI, p. 422.

NOVA SCOTIA, called by the French Acadia, and now one of the maritime provinces of the Canadian Dominion, for an account of which see NOVA SCOTIA, Vol. XVII, pp. 616–618. Much of the land is still covered by forests, which produce much fine timber, and there are large and valuable coal-deposits, which form a considerable source of the provincial revenue. Along the shores of the Bay of Fundy there are rich dike-lands, which have been cultivated for centuries by the Acadians and their modern French and Scottish descendants, and where the apple and other fruits flourish. The transportation facilities of the province are still mainly those of the steamship lines, there being but 825 miles of railway. The Intercolonial railroad, which has its eastern terminus at Halifax, connects the province with the west. The population, in 1901, was 459,574, of whom 122,452 are Roman Catholics. The Presbyterians come next, with a membership of 108,520. Capital, Halifax. Pop. (1901), 40,832.

Though there is now a school of agriculture in Nova Scotia, farm products are not much of a source of revenue. Wheat is cultivated but little. Hay, oats and potatoes are the chief products raised. In 1891 the hay-yield was 63,000 tons; oats yielded 1,500,000 bushels, and the potato crop exceeded 5,000,000 bushels. In the same year there were 9,000,000 pounds of butter and 600,000 pounds of cheese manufactured. The yield of wool was over a million pounds, while the apple crop of the year exceeded 1,000,000 bushels. The following are the census returns of the live-stock on farms for 1891: Horned cattle, 309,776; horses, 62,419; sheep, 318,885; swine, 45,760.

The fisheries are a large and profitable industry in Nova Scotia. The number of men engaged in this pursuit in 1899 was close upon 5,325 in vessels and 11,305 in boats, with a total investment in the trade of $3,080,000. The value of the fish-catch of the province was, for 1899, $7,347,604, of which $5,000,000 worth was exported. The chief catch was of cod, lobsters, herring and mackerel. The increase in this trade in the last ten years was in value over a million dollars.

Coal-mining is the most important industry of the province, the output of which was, for the year 1900, nearly 3,357,000 tons. The production of this commodity during the last ten years exceeds 26,000,000 tons. Much of the current output is sold to the neighboring provinces, and about ten per cent is exported to Newfoundland and other countries. Gold-mining is another profitable industry in the province, the yield from which, between the years 1862 and 1899, was, in round figures, 15,000 ounces from 40,000 tons of quartz crushed. The average yield in value is about $14.50 a ton. The area of the provincial gold-measures has been estimated to be from five to seven thousand square miles. There are 35 localities in the province in which workable deposits of gold have been found, and from three thousand to four thousand persons are engaged in or dependent on the industry. The returns show that as yet only forty square miles has been worked partially, from which $15,000,000 worth of the metal has been mined since the discovery of the gold. The yield in 1900 was in value $607,152.

The other industries of Nova Scotia are shipbuilding, fish-canning, sugar-refining, and the manufacture of woolen goods, cotton duck, glassware, boots and shoes, gunpowder and other explosives. The annual revenue of the province is about $1,000,000, $432,800 of which is the Dominion subsidy; while over $400,000 is raised annually from a tax on the mines. The provincial debt has nearly trebled in the last ten years; the gross debt in 1900 was a little over $4,000,000, with total assets of one and a third millions. The province has a legislature of 38 members, including an executive of 9 ministers, of whom 6 are without portfolios,

They represent the population of 18 counties. There is also a legislative council of twenty members. Nova Scotia is represented in the Federal Parliament by 10 members in the Senate and 20 members in the Commons. Education in the Province is represented by 6 colleges, 1 normal school and 2,417 common schools. The latter are supported by direct taxation upon the municipalities and by an annual government grant (year 1900) of $248,309, or of $887,852 for the whole purposes of education. The enrolled attendance in the public schools in 1900 was 100,129, and the average attendance 56,224.

NOVA SCOTIA SHIP RAILWAY. See CHIGNECTO BAY, in these Supplements.

NOVEL. See ROMANCE, Vol. XX, pp. 648–678.

NOVELLO, JOSEPH ALFRED, an English organist, composer and musical publisher; born in London in 1810. He was the eldest son of Vincent Novello (born 1781). The father rose to a high position in the English musical world, and had three daughters, Cecilia, Mary and Clara, the last being the greatest oratorio singer of modern times, becoming Countess Gigliucci in 1843. The father published editions of sacred music as early as 1811. At the age of 19, Joseph Alfred established himself as a musical publisher, and shortly afterward invented a process of printing music which revolutionized the sale of cheap music. He was a friend of Felix Mendelssohn, and in 1847 published *The Messiah* and *The Creation*, and adapted the English text to the *Lobesang* and *St. Paul.* These works were issued at low prices. The house has published 67 oratorios and many works of the standard composers at the uniform price of one shilling, produced in the best manner, equaling any work turned out by continental firms. His house became the greatest music-publishing house in the world, and to him can be given the credit of first bringing music within the reach of "the masses." To him was due the abolition of the printers' guild law, and he was actively engaged in the repeal of the advertisement duty, the paper duty, the stamp on newspapers, and other imposts known as "taxes upon knowledge." He aided Bessemer in producing the metal known by the name of the latter. In 1856 he retired from business and went to reside at Nice, whence he removed to Genoa. In Italy he was made one of the four commissioners to look after the interests of the British shareholders in the Italian Irrigation Company (Cavour canal), involving £5,000,000 of British money. He devoted much attention to the construction of ships, and published an *Epistle to Naval Architects.* He died in Genoa, July 17, 1896.

NOVOROSSICK, a seaport town of Russia, on the E. coast of the Black Sea, 30 miles S.E. of Anapa; is the terminus of a railway opened in 1888. The town is built on a slope terminating in lofty heights, and is defended by forts. Population 1897, estimated 16,208.

NOYES, JOHN HUMPHREY. See ONEIDA COMMUNITY, Vol. XVII, pp. 794–795.

NUBAR PASHA, Egyptian statesman; born in Smyrna, Jan., 1825, of an Armenian Christian family. He was educated in Switzerland and in France. In 1842 he became secretary of Bogos-Bey, who was then Minister of Foreign Affairs in Egypt. Two years later he was made secretary-interpreter to Mehemet Ali, and afterward to Ibrahim Pasha. In 1866 Ismail Pasha made him Minister of Foreign Affairs, and sent him to Constantinople to obtain from the Sultan the title of Khedive for himself. Nubar Pasha's efforts were directed to introducing European customs into the administration of Egyptian affairs. In 1878 he became president of the Egyptian Cabinet. But he was compelled to resign after six months. In 1884 he was called to the head of affairs again, when his administration proved even more acceptable to the Egyptians than before. He came into collision with the British policy, and as a result of his financial recommendations was dismissed by Tewfik, June 8, 1888. He was recalled in 1894 by the new Khedive, Abbas Hilmi, son of Tewfik. He resigned Nov. 11, 1895, on account of failing health, having been in the service of the state 53 years. Died in Paris, Jan. 14, 1899.

NUBIA. See AFRICA, in these Supplements.

NUCLEOBRANCHIATA, a group of mollusks. On grounds of priority, the term *Heteropoda* is now adopted. See HETEROPODA, in these Supplements.

NUCLEO-PLASM. See HEREDITY, in these Supplements.

NUCLEUS, in botany, one of the essential organs of a plant-cell. It is usually a roundish body, imbedded in the cytoplasm, and consists of a variety of proteid substances. In its resting-stage it is bounded at the surface by a membrane, and consists of a semi-fluid clear ground-substance (*paralinin*), in which lies a fibrillar network of denser substance (*linin*), in which are distributed granules of *chromatin.* Other bodies lying in the ground-substance are known as *nucleoli*, whose history is still problematical. In ordinary cell-division the nucleus passes through a remarkable series of changes, which have been described under KARYOKINESIS in these Supplements.

NUCLEUS, of the Earth. See GEOLOGY, Vol. X, pp. 199–202.

NUDIBRANCHIATA, a group of opisthobaruchiate gasteropod mollusks, which have no mantle or shell. Gills are sometimes present, and hang freely into the water, hence the name, signifying naked gills. The larval form possesses a shell. Most of these mollusks live near the shore. The group contains numerous species, mostly in the warm seas. *Doris*, *Æolis* and other genera are common along the coasts of the United States.

NUEVO LEON, a state of eastern Mexico, included within the states of Tamaulipas on the northeast and east, San Luis Potosi south and southwest and Coahuila west and north, having an area of 23,592 square miles. It is traversed by the eastern Sierra Madre, running from northwest to southeast, and is watered by three principal rivers, the Salado in the north, the Sans Juan in the center and the Del Tigre in the south. A considerable part of the territory on the southwest of the Sierra is in the Mexican plateau, having an elevation of about 6,000 feet. On the northeast slope of the mountains there are low lands or plains extending

toward the Rio Grande. The climate varies with the elevation, being mild and agreeable on the mountain slopes and the plateau, and hot and unhealthy in the low lands. The products, largely agricultural, include maize on the plateau and sugar-cane in the lower districts. The mineral wealth of the state is considerable, but the mines are not extensively worked. The population, a large part of which resides along the northeastern slope of the Sierra, by the census of 1900, was 326,940.

NUISANCE, in law. See NUISANCE, Vol. XVII, pp. 627–628; and ABATEMENT, in these Supplements.

NULLIFICATION, in the history of the United States, the action of the legislature of South Carolina, in 1832, declaring certain acts of Congress unconstitutional, and therefore null and void. See CALHOUN, Vol. IV, p. 606; and WEBSTER, Vol. XXIV, p. 499.

NUM OR NUMRA, an Egyptian deity. See EGYPT, Vol. VII, p. 620.

NUMBERING-MACHINE. Blank-book manufacturers and printers use a variety of machines for consecutively numbering the pages of account-books, tickets of admission and the like. The most simple are in the form of a hand-stamp, bearing figure-wheels below. With these, pressure on the handle brings down the wheels so that a number is printed. A spring then automatically turns one of the figure-wheels, so that the next consecutive number is brought into place, and with the same motion the figures are inked for another impression. The larger machines work on similar principles, but are operated by treadle or power, while the work to be numbered is fed in, somewhat as in a treadle printing-press.

NUMIDIDÆ, a family of African birds, including the well-known guinea-fowls. The heads are bare, crested, or with a small feathered patch. The birds are noted for their peculiar shrill voice. The common domesticated guinea-fowl is *Numida meleagris*. See GUINEA-FOWL, Vol. XI, p. 234.

NUMMULINIDA, a family. See FORAMINIFERA, Vol. IX, pp. 334–338, 340.

NUNCIO. See AMBASSADOR, Vol. I, p. 577; and LEGATE, Vol. XIV, p. 413.

NUNDA, a village of Livingston County, central western New York, 18 miles S.S.W. of Geneseo, on the Erie and the Western New York and Pennsylvania railroads. It has furniture, shoe, knife and casket factories; is on the Genesee Valley Canal, and is a summer resort. Population 1900, 1,018.

NUÑEZ, RAFAEL, author and statesman, was born at Cartagena, Colombia, on September 28, 1825, and became interested in war, politics, and literature. He was proclaimed president of Colombia on April 1, 1880, to succeed President Zyaldua, and was regularly elected president in September, 1883, and again in August, 1886, for a term of six years. He was elected a third time in 1892, and died in office on September 18, 1894. He was at one time the editor of a Spanish paper in New York City, and was the author of a number of brilliant works in prose and poetry, including *Ensayos de Critica Social*, and *La Reforma Politica en Colombia*. W.F.J.

NUNIVAK, an island of Alaska, in Bering Sea, off Cape Vancouver, lat. 60° N., long. 165° to 167° W.; length of island, 70 miles, and about 30 miles wide; peopled by Esquimaux, who trade in fox-skins, oil and ivory.

NUN OF KENMARE, THE. See CUSACK, MARY FRANCES, in these Supplements.

NUR-ED-DIN, MAHMOUD MALEK-AL-ADEL, a Sultan of Syria, the son of Zengui, or Omad-ed-din, who ruled over northern Syria; was born in Damascus in 1117, and obtained the sovereignty of Aleppo on the death of his father by poisoning at the hands of the eunuchs, at the siege of Jabbar in 1145. He resisted the Christian crusaders, defeated Joscelin de Courtnay, Count of Edessa, and Raymond, Prince of Antioch, whose head he sent as a trophy to the caliph at Bagdad. He then made himself master of Damascus. As a ruler he exhibited the quality of prudence, and as a warrior he was one of the heroes of the Moslem faith. He was a patron of the arts and sciences, and founded cities, establishments of learning, hospitals and mosques. The first employment of pigeons as carriers of messages has been ascribed to him. He died suddenly at Damascus, while preparing to set out for Egypt, in the year 1173. For his struggle with the Templars, see TEMPLARS, Vol. XXIII, p. 176; and for his operations in Egypt, see EGYPT, Vol. VII, pp. 652–653.

NURSERY CULTURE. See ARBORICULTURE, Vol. II, pp. 281, 282.

NURSE-SHARK, a local name for sharks of the genus *Somniosus*. They are large fishes of the cold northern seas. The name probably refers to their habit of resting or basking for long periods of time. Some of these sharks reach a length of twenty feet. A smaller shark (*Ginglymostoma*) of the tropical Atlantic has been sometimes called nurse-shark.

NURSING. (For preliminary account, see HOSPITAL, Vol. XII, p. 319.) Fifty years ago a well trained and qualified nurse was almost unknown, and consequently the care of the sick often devolved upon persons totally unfit for and ignorant of the duties required of them. That time is fortunately passed. Well-educated women are now to be obtained from various institutions at moderate rates,—women who are regarded by medical attendants as most valuable assistants.

One of the earliest, if not the very first, of the training institutions for nurses of a superior class, was the St. John's Sisterhood, founded in 1848 in London. It is now, with its affiliated institution, the Nursing Sisters of St. John the Divine, under the patronage of the Archbishop of Canterbury, and has a very influential council or committee, and a large staff of nurses, some of whom are laboring gratuitously amongst the poor. Much care is taken in their selection, and they are trained carefully.

After the Crimean War, a great impulse was given to the movement, in commemoration of the heroic self-denying labor of Miss Florence Nightingale (q.v., in these Supplements), and a fund was raised for the purpose of training hospital nurses. In 1887, Queen Victoria devoted the surplus of the Women's Jubilee Offering, amounting to $350,000.

to the foundation of a scheme for the training of nurses. The interest of this sum, about $10,000, is employed in the maintenance of central institutions, where nurses are trained for this special work. There are, at present, four of these centers,—in London, Edinburgh, Dublin and Cardiff. Nurses who have gone through the required training at any of these homes are eligible to be entered on the roll of the Queen's Institute, and are entitled to wear the badge as Queen's nurse.

The army and navy nurses of Great Britain must all be women of good social position, and are required to undergo three years' training in a general hospital. They are called Her Majesty's Nursing Sisters, and may be ordered on active service in any war. As a reward for special service they receive the order of the Royal Red Cross. The Royal National Pension Fund, an insurance company for nurses, was founded in 1887. In 1889 four English gentlemen placed $100,000 at the permanent disposal of the fund, to afford nurses a safe means of providing an allowance during sickness and a certain income when their strength is declining. On the continent of Europe the employment of male nurses to attend male patients is common, and in the Roman Catholic countries the nursing of the hospitals is for the most part in the hands of Sisters of Mercy. In Germany a great impetus was given to improvements in nursing by the interest shown in the matter by the late Empress Augusta, the Empress Frederick and the late Princess Alice of Hesse. The training of nurses on the lines adopted in Great Britain was instituted in Paris during 1877, by the establishment of *L'École de Garde-malades et d'Ambulancières.* In America the practice of nursing is very thoroughly taught in many of the hospitals, particularly those in the Northeastern states, such as the Bellevue Hospital in New York, the Long Island Hospital in Brooklyn, the Philadelphia and Pennsylvania hospitals in Philadelphia, and many others.

One of the leading Western schools is the Illinois Training-School, in Chicago. This school is a large one, giving the fullest training possible, both practical and theoretical. Class-instruction is given by the superintendent and her assistants, and lectures by some of the most prominent physicians of the city. The practical training is obtained in the private rooms, wards and operating-rooms of the Presbyterian and Cook County hospitals, embracing the care of medical, surgical, gynæcological and obstetrical patients, the care of sick children, and special or private duty nursing. The practical work is supervised by the officers of the school and by the head nurses, many of whom are graduates. The number of pupils is generally about 130, varying a little from month to month; besides the pupils, there are 12 graduate head nurses and from 10 to 20 probationers.

The work of a nurse is very hard, but, by judicious arrangement of the hours of work, recreation, sleep and meals, this is in a large measure compensated for. The three years' course was inaugurated in June, 1896, by means of which it is hoped that the strain of the hardest mental and physical work, which used to come at the same time, will be lessened. All training-schools for nurses in the country have improved greatly in all respects during the last ten years, particularly in the theoretical instruction and the details of practical work. Discipline is an important point in the training of nurses; it is also a great advantage to have the home in a building apart from the hospital where the work is done, thereby giving the nurses greater relaxation when off duty and taking them entirely away from the atmosphere of sick people. Every large city has several schools, and many of the smaller cities have at least one. Some of these give training in only one or two branches, others in all but one or two, while comparatively few give a complete course, embracing all branches.

It is quite evident that the results of the establishment of training-schools for nurses to care for the sick in hospitals has been most satisfactory, because the number has increased constantly and rapidly. The best proof of this is the fact of the increasing demand for graduates of training-schools to care for the sick in their own homes, and to take charge of new schools and hospitals, or to fill the places of non-graduates who have formerly held hospital positions. The profession supports a weekly journal, *The Trained Nurse*, published in New York City.

The following gives a synopsis of the three years' course of the Illinois Training-School:

Class-Work. Elementary anatomy and physiology, *materia medica*, and practical nursing, embracing the whole care of ordinary medical, surgical and gynæcological patients, with text-books, models and demonstrations.—*Lectures.* On hygiene, anatomy and physiology; on *materia medica*, bacteriology; on surgical, medical and gynæcological nursing.—*Cooking Lessons.* Practical and theoretical work.—*Class-Work.* Obstetrical nursing, care of the new-born, care of children, special nursing, care of operation patients, private duty, surgical technique and operating-room work.—*Lectures.* Obstetrics, special gynæcological work, the care of sick children, the examination and testing of urine, care of the nervous and insane, advanced medical and surgical subjects. No class-work.—*Lectures.* Eye, ear, throat, skin, electricity, massage, training-school administration. During the senior year nurses will serve as head nurses, and special nurses to private patients in the Presbyterian Hospital. It is designed to finish as nearly as possible the theoretical training during the first two years, thus relieving special and head nurses of that excessive mental application heretofore demanded by the shorter course.

NUSAIRIEH. See ANSARS, in these Supplements.

NUTATION, a term in physiological botany to denote certain spontaneous changes in the position of growing-points,—a movement common to all growing-points, but especially noticeable in slender structures, such as tendrils. By reason of this nutation the path described by the growing-point is not a straight line, although the axis of the organ may become permanently straight, but a spiral whose section is circular or elliptical. In the case of flat organs, such as a leaf, the path of the nutating growing-point is a zigzag line.

NUTATION. Of the equinoxes, see ASTRONOMY, Vol. II, pp. 694, 695. Of tides, see Vol. XXIII, pp. 384–385. In geology, see Vol. X, p. 201.

NYACK, a village of Rockland County, New York, in the southeastern part of the state, on the

west bank of the Hudson River, at the northern end of the Palisades, twenty-five miles north of New York city. It is a favorite place of residence, and has manufactories of musical instruments, boots and shoes, yachts, engines, etc. It is reached by the Erie and New York, Ontario and Western railroads, and had in 1900 a population of 4,275. W.F.J.

NYANGWE, an Arab trading station on the Upper Congo, or Lualaba, at the edge of the Manyema country, in 4° 13′ S., 26° 21′ E. From that point Henry M. Stanley commenced the descent of the Lualaba in 1876.

NYASA, the southernmost of the equatorial great lakes of East Africa, situated about 260 miles S. E. of Tanganyika, and 400 inland from the east coast. It lies at an altitude of 1,575 feet, is very deep in the middle, and shelves rapidly from the shores, which are rocky and high. Long and narrow, it measures 350 miles from north to south, and an average of 25 miles from east to west, and has an extreme depth of over 200 fathoms. The river Shiré emerges at its southern extremity, and flows south to the Zambezi. The waters of the lake are sweet, and abound in edible fish. Although the Portuguese had knowledge of the existence of the lake under the name of Maravi early in the seventeenth century, Livingstone was the first to fix, in 1859, its exact situation and to navigate it. He found a numerous population in the mountains (which rise from 10,000 to 12,000 feet above the level of the lake), growing maize, cassava, tobacco, and English peas, which had been introduced by Arab traders.

NYÂYA PHILOSOPHY. See SANSKRIT, Vol. XXI, p. 305; and BRAHMANISM, **Vol. IV, pp. 188,** 189.

NYCTAGINACEÆ, a family of dicotyledonous plants characterized by the funnelform or tubular calyx, colored like a corolla, and falling away from a persistent lower portion, which completely closes over the seed-like fruit, and in some genera becomes winged. The species are found especially in the tropics of South America. The best-known genus is *Mirabilis*, whose species, known as four-o'clocks, are extensively cultivated as ornamental plants.

NYCTITROPIC, a term in physiological botany to denote certain movements of leaves, by which they shift their position so as to vary the surface-area presented to the sky. As these movements are usually associated with the alternation of day and night, they are called sleep-movements, or nyctitropic movements. The nyctitropic movement, caused by diminished intensity of light and falling temperature, reduces the surface-exposure of the leaves, either by presenting their edges to the zenith, or, in compound leaves, by folding the leaflets together.

NYE, EDGAR WILSON, an American humorist; born in Shirley, Maine, Aug. 25, 1850. At the age of two years his parents removed to St. Croix County, Wisconsin, and the boy received his early education at Rivers Falls. He studied law in the same state and practiced for a short time. In 1875 he settled in Laramie, Wyoming, and having contributed several successful articles to the press, in 1880 was invited to contribute to the *Tribune* of Denver, Colorado. The next year he established, at Laramie, *The Boomerang*, in which he "wrote up" that town in the style characteristic of "Bill Nye," the name by which he was always known in the press. This effort inverted the usual proportions and order of things, exaggerating the small things, such as a peanut-stand into a mammoth enterprise, and minimizing the greater institutions and persons, and so on. The inhabitants were sensible enough to enter into and enjoy the joke, and showered honors on the genius who had drawn attention to their town. While editing *The Boomerang*, he was made a justice of the peace, postmaster, school superintendent, United States commissioner, and a member of the legislature. *The Boomerang*, however, had not scope enough in Laramie, and Nye was obliged to suspend its publication. He returned to Wisconsin, and lived and wrote in Hudson for some years, when he was enticed to New York to work on a salary which to him appeared fabulous. His first book was published at Chicago in 1881, its title being *Bill Nye and the Boomerang*. He then entered into an arrangement with James Whitcomb Riley for a joint lecturing tour. He also appeared as a playwright in 1891, when *The Cadi* was produced at Union Square Theater, in New York city. He also wrote *The Stag Party*, in collaboration with Paul Potter. His other works are *The Forty Lyars and Other Lies* (1883); *Baled Hay* (1884); *Bill Nye's Blossom Rock* (1885); *Remarks by Bill Nye* (1886); *Bill Nye's Thinks* (1888); *Bill Nye's History of the United States* (1894). *Bill Nye's History of England* was the latest work he produced. Died at his home at Buck Shoals, near Asheville, N. C., whither he had gone for his health, Feb. 22, 1896. *Revised by* R.W.C.

NYEZHIN, NIZHAN, OR NEJIN, an ancient town, in Chernigof government, Russia, on the Oster, 80 miles N.E. of Kiev. It is an industrious place, many of the inhabitants being descended from Greek immigrants who settled there during the reign of Catherine II. Its chief industry is tobacco-growing, and large quantities of leaf tobacco are sent to St. Petersburg, Riga, and Mittau. It fell into the hands of the Lithuanians in 1320, and of the Poles in 1386, but was annexed by Russia in 1654. Pop. 1897, 32,108.

NYKÖPING, a seaport of Sweden, 62 miles S.W. of Stockholm; manufactures machinery, cotton, steamboats, locomotives, steam-engines, and cloth; port has a depth of 13 feet at entrance; the quay has a length of 1,213 feet. The castle, now ruined, ranked in point of strength next to those of Stockholm and Calmar. King Waldemar was imprisoned here after his dethronement in 1288 till his death in 1302. Population 1900, 7,375.

NYMPHON, a genus of insects. See ARACHNIDÆ, Vol. II, p. 243.

O

OAK—OAXÁCA

OAK, the common name of species of *Quercus*, a genus of forest trees too well known to need extended description. Their variable but usually lobed leaves, their characteristic fruit, the acorn, and their valuable wood, have made them familiar plants to all nations and throughout history.

OAKELEY, Sir Herbert Stanley, an English composer, the second son of Sir Herbert Oakeley; born in Ealing, Middlesex, July 22, 1830. He was educated at Rugby School and at Christ Church, Oxford, (B.A. 1853, M.A. 1855). After having graduated he went abroad to complete his studies in music, for which, from earliest childhood, he had shown a marked predilection. At Leipsic he studied pianoforte-playing under Professors Moscheles and Plaidy, and at Bonn organ-playing under Dr. Breidenstein, professor of music in that university, and afterward under the great organist Dr. Johann Schneider of Dresden. While resident in London he acted for some years as musical critic and correspondent. In 1864 he was enrolled in Rome as member of the Society of "Quirites." In 1865, on the death of Professor Donaldson, he was elected professor of music in the University of Edinburgh. In 1871 he received the degree of doctor of music from the Archbishop Tait of Canterbury. In recognition of musical services for Scotland, the honor of knighthood was conferred on him in August, 1876. In 1879 his own university, Oxford, gave him the degree of Mus. D., *honoris causâ*; and in 1881 that of LL.D. was presented to him by the University of Aberdeen, and in the same year he was created composer for the Queen in Scotland. In 1887 he received the degree of Mus. D. from Dublin University. He wrote for the church, for chorus, orchestra, organ and pianoforte, and published vocal quartets, etc., including a *Jubilee Album*, dedicated to the Queen, and a *Jubilee Cantata* (1887). He originated the Reed concerts in Edinburgh, and prepared a scheme for musical graduation in the University of Edinburgh. He died October 27, 1903.

OAK HARBOR, a village of Ottawa County, northern Ohio, near Port Clinton, 15 miles from Sandusky, on the Portage River and the Lake Shore and Michigan Southern railroads; has saw and planing mills, and manufactures of sashes, blinds, wagons and lumber. Population 1900, 1,631.

OAKLAND, a city of Alameda County, California. It is essentially a residence city for San Francisco business men, and hundreds of fine residences are to be seen just outside the business portion of the town. The transportation facilities include both street-cars, the Southern Pacific railroad and ferry-boats.

The following figures taken from the census of 1900 will show something of the business of Oakland: Number of mechanical and manufacturing industries reported, 752; aggregate capital invested, $6,364,651; average number of employees, 4,359; total amount of wages paid, $2,448,861; total value of products, $9,174,257. In 1900 there were 21 public schools, 2 colleges, the Pacific Theological Seminary (Congregational), 7 private academies, a private normal school, 8 libraries and 4 daily papers. Population 1890, 48,682; 1900, 66,960. See also **Oakland**, Vol. XVII, pp. 713–714.

OATES, William C., an American public man; born in Pike County, Alabama, Nov. 30, 1835. He was self-educated, studied law, was admitted to the bar in 1858, and became a successful lawyer and business man; entered the Confederate army as captain of Company G, Fifteenth Alabama Infantry, in July, 1861; was appointed colonel in the provisional army of the Confederate States, May 1, 1863, and was assigned to the command of his old regiment; the Forty-eighth Alabama Regiment also was placed under his command subsequently. He was wounded four times slightly and twice severely, losing his right arm in front of Richmond, Aug. 16, 1864, in the twenty-seventh battle in which he was engaged. In 1868 he went as a delegate to the national Democratic convention held in New York which nominated Seymour for the Presidency; was a member of the Alabama house of representatives and chairman of the committee on ways and means at the sessions of 1870–71 and 1871–72. He was a member of the constitutional convention in 1875, and chairman of its judiciary committee; and was elected to Congress for the Third Alabama District in 1881, and served several subsequent terms. Governor of Alabama 1895–96.

OATS, the popular name of *Avena sativa*, or of its grain, a grass of the Old World, whose cultivation is recorded from the most ancient times. It is soft and smooth, with a loose panicle of large drooping spikelets, one flower of which has a long twisted awn on the back.

OATS IN THE UNITED STATES. See Agriculture, in these Supplements.

OAXÁCA, Mexico, a maritime state on the Pacific coast, bounded north by the state of Vera Cruz separating it from the Gulf of Mexico. It has an area of 35,382 square miles, traversed west to east by the Sierre Madre Mountains with a parallel range on the south and spurs projecting northward; it is drained by the Rio Verde, Tehuantepec, Tehuacan, Trinidad, Copalita and Yogondoi rivers. An export trade in gold, farming and forest products, etc., is facilitated by a railway across the Isthmus of Tehuantepec and the Mexican Southern railroad penetrating to Oaxáca, the capital. Pop., 1900, 947,910. C.L.S.

OAXÁCA, Mexico, capital of Oaxáca, a city on the Rio Verde in the Sierre Madre Mountains, and on the Mexican Southern railroad, 230 miles

S. E. of Mexico city. It was the Aztec *Huaxyacac* founded by Montezuma's soldiers in 1486, and is one of the handsomest cities of the Republic, with various manufactures and an active trade. Population, 35,049. C.L.S.

OB OR OBI, a bay and river of SIBERIA; q. v., Vol. XXII, p. 9.

OBAN, a seaport town on a bay of the same name, in Argyleshire, Scotland, on the Sound Kerrera, 20 miles N. W. of Inverary, a terminus of the Caledonian railroad; a place of call for coast excursion steamers; has manufactures of silk and straw hats, and exports whisky, fish, pig-iron, wool, kelp and slates; has a fine harbor, with twenty fathoms of water, and a pier 250 feet long and 30 feet wide; is a great resort for tourists. It has fine hotels and many villas on the heights overlooking the town. To the north are the ruins of Dunolly Castle, and three miles away is Dunstaffnage Castle, a place of very early Scottish kings. Oban is a Parliamentary borough, and its scenery is enchanting. Population, 5,373.

OBEID, EL. See EL OBEID, Vol. VIII, p. 141.

OBER-AMMERGAU PASSION PLAY (1900). Ober-Ammergau is a picturesque village in Bavaria, 45 miles S. W. of Munich, famed for the Passion Play performed there at intervals of ten years, by the peasants of the village and district. The play, which represents in a very serious and realistic manner the passion and death of Christ, was instituted as far back as 1634, in token of gratitude, on the part of the simple villagers, for the abatement of a plague. The decennial representations extend over the summer months, from May to September, and attract large numbers of visitors from all parts of the world. The performances, which are given three times a week (usually on Sunday, Monday, and Friday), extend from 8 a. m. to 5 p. m., with a mid-day intermission of an hour and a half. The cast numbers about 600 performers (about a third being children), and all are chosen for their several parts by the inhabitants themselves. Ober-Ammergau is the only place where the mystery or miracle play is now performed, in true mediæval fashion. Humble and religious as are the villagers, the performance is most artistic as well as impressive; and though severe in its simplicity the whole is admirably staged, with dramatic regard for the massing of the performers, for the grouping of the principal actors, for the combination of color in the dresses of the chorus, and for effective scenic display. The building in which the performance is given will seat several thousand spectators, and with its partially open ends and spans of iron girders rather resembles a huge railway station than a modern theatre.

The chief characters in the play, who, as has been said, are the inhabitants of the village, and are locally known as Herod, Pilate, Caiaphas, St. John, etc., seem to have been selected for their parts with an eye for dramatic effect, aided by religious instinct and pious training. In the performance of 1900, the speaker of the Prologue, Josef Meyr, was he who took the part of Christus ten years previously. His acting was characterized by dignity of manner and appearance, as, staff in hand, he led on to the stage one wing of the chorus, clad in "gold-bordered white dresses, with colored cloaks, also gold-bordered, and clasped across the breast." The other chief members of the cast were, in 1900, as follows: Caiaphas the High Priest (Sebastian Lang); Judas (Johann Zwink); Peter (Thomas Rendl); John (Peter Rendl); and Christ (Anton Lang). Each appeared and acted his part with striking and characteristic fitness. The personations of Peter, of "the beloved disciple," and of our Lord were specially distinctive and impressive, the effect being heightened in each case by fine personal appearance and tender acting. The Judas was also an effective personation, whose rendition of the forbidding rôle was so dramatic as to bring tears to the eyes of the spectators, and caused many a heart to ache. The most striking of the tableaux were the entry of Christ into Jerusalem, the Parting at Bethany, the Last Supper, the Agony in the Garden, the Despair of Judas, the Condemnation of Jesus, the Way of the Cross, the Crucifixion, supplemented by scenes representing the Resurrection and the Ascension. G. MERCER ADAM.

OBERLIN, a village of Lorain County, northern Ohio, 7 miles S. W. of Elyria and 35 miles W. of Cleveland, on the Cleveland, Lorain and Wheeling and the Lake Shore and Michigan Southern railroads; the seat of Oberlin College (q. v. below); has a bank, a plaining mill, a flour mill, a carriage factory, and 3 newspaper offices. Population 1890, 4,376; 1900, 4,082.

OBERLIN COLLEGE, a non-sectarian co-educational institution located at Oberlin, Ohio. It was founded in 1833 as a private institution, and chartered in 1834 as Oberlin Collegiate, and in 1850 as Oberlin College. It is divided into the theological, collegiate, and preparatory depart-

PETERS HALL, OBERLIN COLLEGE.

ments. Especial attention is given to the teaching of music. The theological department is not under the direct control of any denomination, but is indirectly associated with the Con-

gregationalists. In 1904 the value of the institution's property, including its endowment, was $2,355,000. In the same year there were 129 instructors, and 1,848 students. The library contained 177,000 volumes. The number of graduates from 1833 to 1905 was 3,975. Henry Churchill King, D.D., is president. *Revised by* R.W.C.

OBESITY. See CORPULENCE, Vol. VI, pp. 385, 386; and PATHOLOGY, Vol. XVIII, pp. 397, 398.

OBITUARIES, NOTABLE AMERICAN AND FOREIGN (1899–1900).

Allen, Grant, English author, Oct. 25, 1899.
Argyll, George Douglas Campbell, Duke of, April 24, 1900.
Bidwell, General John, Am. Prohibitionist, April 4, 1900.
Blackmore, Rich. D., Eng. novelist, Jan. 21, 1900.
Bland, Senator, June 15, 1899.
Bonheur, Rosa, animal painter, May 25, 1899.
Bunsen, Prof. R. W. E., physicist, Aug. 16, 1899.
Busch, Moritz, German author, Nov. 16, 1899.
Castelar, Emilio, Spanish statesman, May 25, 1899.
Cherbuliez, Victor, French novelist, July 1, 1899.
Church, Fred. Edwin, Am. artist, Apr. 7, 1900.
Coues, Elliot, American naturalist, Dec. 25, 1899.
Crane, Stephen, Am. novelist and war correspondent, June 5, 1900.
Daly, John Augustin, Am. dramatist, June 7, 1899.
Dawson, Sir J. Wm., Canad'n geologist, Nov. 19, 1899.
Dingley, Nelson, Am. legislator, Jan. 13, 1899.
Edinburgh, Duke of, Saxe-Coburg and Gotha, July 30, 1900.
Erckmann, Emile, French novelist, Mar. 14, 1899.
Faure, F. F., President of France, Feb. 16, 1899.
Field, Mr. Justice Stephen I., April 9, 1899.
Field, Mr. Justice Walbridge A., June 15, 1899.
Flagler, Brig.-Gen'l Daniel A., Mar. 29, 1899.
Flower, ex-Governor Roswell P., May 12, 1899.
Forbes, Arch'd, Eng. war correspondent, Mar. 29, 1900.
Foster, Birket, English artist, Mar. 28, 1899.
Grove, Sir George, English writer on music, May 28, 1900.
Henry, Brig.-Gen'l Guy V., U. S. A., Oct. 27, 1899.
Herschell, Lord Farrer, Eng. jurist, Mar. 1, 1899.
Hobart, Garret A., Vice-Pres. U. S., Nov. 21, 1899.
Huntington, Collis P., Am. railway magnate, Aug. 13, 1900.
Ingalls, John J., American senator, Aug. 16, 1900.
Ingersoll, Robt. G., Am. lawyer and orator, July 21, 1899.
Joubert, Petrus J., Boer general, Mar. 27, 1900.
Kingsley, Miss Mary, English scientist and traveller, June 3, 1900.
Logan, Major John A., U. S. A., Nov. 12, 1899.
McGlynn, Rev. Dr. Edward, R. C. priest, Jan. 7, 1900.
Marryat, Florence (Mrs. Lean), Eng. novelist, Oct. 27, 1899.
Marsh, Prof. Othniel C., Am. paleontologist, Mar. 18, 1899.
Martineau, Rev. Dr. James, Eng. theologian, Jan. 11, 1900.
Mivart, Dr. St.-George, Eng. (R. C.) scientist, Apr. 1, 1900.
Monier-Williams, Sir Monier, Eng. Sanscrit scholar, Apr. 11, 1899.
Morrill, Justin S., U. S. Senator, Dec. 28, 1898.
Munkácsy, Mihaly, Hungarian painter, May 1, 1900.
Muravieff, Count Michael, Russian statesman, June 21, 1900.
Oglesby, Rich. J., U. S. Senator, Apr. 24, 1899.
Paget, Sir James, Eng. surgeon, Jan. 3, 1900.
Phelps, Hon. Ed. John, Am. diplomatist, Mar. 9, 1900.
Philip, Rear-Adm'l J. W., U. S. N., June 30, 1900.
Rhea, Hortense, French actress, May 10, 1899.
Ridpath, John Clark, Am. author, July 31, 1900.
Ruskin, John, English author and art critic, Jan. 20, 1900.
Russell, Lord, of Killowen, Eng. jurist, Aug. 10, 1900.
Sarcey, Francisque, French dram. critic, May 15, 1899.
Steevens, Geo. W., English journalist and war correspondent, Jan. 9, 1900.
Steinitz, Wm., Bohemian chess player, Aug. 13, 1900.
Strauss, Johann, Austrian composer, June 3, 1899.
Vanderbilt, Cornelius, Am. millionaire, Sept. 12, 1899.
Von Caprivi, Count Georg Leo, German statesman, Feb. 6, 1899.

OBLATES (Lat., *oblatus*, offered up), the name of a class of religious bodies in the Roman Catholic Church that form a distinct order by not being bound by the solemn vows of the religious profession. The oblates were instituted by St. Charles Borromeo in the diocese of Milan at the close of the 16th century. They lived in community and were bound by a promise to the bishop to devote themselves to any service which he should consider desirable in the interest of religion. St. Charles made use of their services, chiefly in the wild and inaccessible Alpine districts of his diocese. The members consisted of secular priests and others without orders. The institute still exists and has establishments in France, England, and the United States. The chief object of the order is to assist the parochial clergy by holding missions for the religious instruction of the people in any district to which they may be invited. There is also a female institute of Oblates which was established in Rome in 1440, the Oblates of Mary Immaculate of Marseilles founded in 1815, and the Oblate Sisters of Providence founded in Baltimore, 1825. W.R.B.

OBLIGATION, DAYS OF, holidays on which faithful Catholics are bound to abstain from servile work, and hear mass. These are, for the United States, Circumcision, Epiphany, Annunciation, Ascension, Corpus Christi, Assumption, All Saints, Immaculate Conception and Christmas day. In some Western dioceses the Circumcision, Epiphany, Annunciation, and Corpus Christi are excepted.

OBLIGATION OF CONTRACTS, a phrase occurring in the constitution of the United States, out of which unexpected and the gravest consequences in jurisprudence have issued. The clause in question recites that "no state shall . . . pass any . . . law impairing the obligation of contracts." (Art. I, sec. 10, subd. 1.) At the time of framing the constitution the phrase was comparatively new, and had not the definitive sense that long adjudicated law-expressions have. However, in the different states, much trouble had arisen from laws depreciating the currency, and making it, or even property, legal tender for debts, and otherwise hindering the enforcement or modifying the effects of private engagements. Such legislation affected not only the citizens of the state making such enactments, but the citizens of other states doing business with them. In the ordinance of 1787 creating the Northwest Territory, with a view to such conduct it was provided that "no law ought ever to be made in said territory that shall in any manner whatever interfere with or conflict with private contracts, or engagements *bona fide* and without fraud previously formed." The phrase went, without serious discussion, into

the fundamental law of the land, and probably with no clearer or larger intent than to protect the sacredness of engagements between man and man from legislative encroachment. From the fact that the constitutional prohibition is imposed only on states, the inference is that Congress may enact laws of such purport within the limits of its powers. If Congress exceeds its express powers with a statute that changes the nature of a contract, such legislation would be unconstitutional. It was on this ground that Chief Justice Chase held the legal-tender clause on United States notes to be *ultra vires* of Congress.

This very simple doctrine of honest dealing received a momentous expansion in 1819, at the hands of the supreme court. The case is famous and memorable as the "Dartmouth College case." In 1815 the trustees removed President John Wheelock from his office in the college. He sued in the courts for restoration, but the legislature intervened in 1816, created a new corporation and changed the name to Dartmouth University, and Wheelock was replaced. The ousted trustees went into the state courts for possession, and were defeated. Thereupon they appealed to the United States courts, retaining Jeremiah Mason and Daniel Webster as counsel. In preparing his brief for the supreme court, Mr. Webster fortified his main argument by the novel side issue that a charter was a contract, and that the legislature of New Hampshire was forbidden by the general constitution to impair, much more to annul, its obligations. Unexpectedly, on this proposition Mr. Webster won his case. In handing down the decision of the court, Mr. Chief Justice Marshall held that the college was a private corporation, for a useful purpose; that the trustees, donors and the crown were original parties to a contract, the terms of which were the charter; that the state of New Hampshire was the successor to all the responsibilities and rights of the crown; that valuable consideration had been given on the faith of the charter; that the charter was a contract within the meaning of the constitution, and the legislature could not rescind it or change it, so long as its terms were complied with.

That this court-made law imported into the constitution a sense never contemplated by its framers will not be denied by historical students, and it profoundly modified American jurisprudence, withdrawing from sovereign states control over their own corporate creations, where any vested interests have grown up in them. This decision, too, is largely responsible for the extreme conservatism regarding property, characteristic of the United States. The principle is not known to other lands. Means have been found to meet the situation created by the Dartmouth decision. It is now well-settled law that corporations have no inferential rights, but only those expressly named in the charter; that collateral agreements with the state will not be implied; that charters may be forfeited for their violation, or for the assumption of powers not granted in them; that the right of the state to exercise police control or to preserve the community from injury cannot be alienated; that licenses do not constitute contracts inviolable by the state. Further protection is secured by making charters terminable at a given time, or by reserving in them a right to modify or repeal them.

It is also unquestioned law that the state may pass laws to regulate the exercise of contract rights, if the regulations are reasonable and for the preservation of the community, as that a railroad must not cross the highway at grade, or pass through cities at a high speed. On the other hand, while a statute is not a contract, contracts may grow up under them, as in a case where a conveyance of land is called for in the law, or taxes are remitted for a term to promote manufactures or secure a public good. The ramifications of the doctrine of "obligation of contracts" are many, affecting marriage, divorce, bankruptcy laws, procedure in enforcing contracts, etc. Under it has grown up much litigation, notwithstanding which there are obscure cases constantly arising for adjudication. See also CONTRACTS, Vol. VI, pp. 326–328; and OBLIGATION, Vol. XVII, p. 724.

O'BRIEN, CORNELIUS, clergyman, was born at New Glasgow, Prince Edward's Island, on May 4, 1843, and was educated at the College of the Propaganda at Rome. He was ordained to the priesthood of the Roman Catholic Church in 1871, and was a parish priest until 1880, when he visited Rome, and in 1882 was made archbishop of Halifax. He has built a fine church at Halifax, reorganized St. Patrick's Home, has written several books, and is conspicuous in the Imperial Federation League. W. F. J.

O'BRIEN, JOHN, an American actor, better known by his stage-name of "John T. Raymond," was born in Buffalo, New York, April 5, 1836. He made his *début* at the Rochester Theater in 1853, in *The Honeymoon*. His first tour was made with E. A. Sothern in *Our American Cousin*, he taking the part of Asa Trenchard. After playing in various other comedies, Raymond, in 1871, went to New York, where he scored the success of his life, in *The Gilded Age*. This play he made peculiarly his own, and delighted thousands with his whimsically humorous rendition of Colonel Sellers. He made a European tour in the character, but did not meet with success, and soon returned to America. He made his last appearance on the stage in Hopkinsville, Kentucky. He died in Evansville, Indiana, April 10, 1887.

OBSERVANTS, an order of friars and nuns. See FRANCISCANS, Vol. IX, pp. 615–616.

OBSERVATORY. To the very complete description of modern observatories given in the ninth edition of the Werner ENCYCLOPÆDIA, Vol. XVII, pp. 728–737, there is not much to be added. In the United States, the most important additions have been the Lick Observatory, on Mount Hamilton, California; the Observatory of Yale University, at New Haven; and the Yerkes

Observatory, at Lake Geneva, Wisconsin, erected for the use of the University of Chicago. The latter is remarkable in possessing what now is, and long may be, the greatest refracting telescope in the world. (See TELESCOPE, in these Supplements.)

The Lick Observatory, on Mount Hamilton, was completed in 1888, and under the energetic administration of Professor Holden assumed a position among the leading institutions of its kind. Its refracting telescope was the greatest in the world until the completion of the Yerkes instrument. It has been made famous by the observations of Barnard, Schaeberle, Campbell, Keeler, Tucker and others. The work of these astronomers has covered all the fields that could be cultivated with the instruments at their disposal. Here Keeler brought the art of determining by the spectroscope the motion of stars in the line of sight to a degree of perfection never reached before, and reached since only by the Astrophysical Observatory, at Potsdam.

The Yale Observatory has been devoted principally to work of the highest order in astronomical measurement, by Dr. W. L. Elkin. The most noteworthy instrument which it possesses is its heliometer, a masterpiece from the workshop of the Repsolds, and the only instrument of its kind in use in the United States. With this instrument Dr. Elkin took a prominent part in the campaign for determining the solar parallax in 1889; made a new triangulation of the Pleiades, and is now completing an investigation of the motions of the satellites of Jupiter and of the mass of that planet.

The Leander McCormick Observatory of the University of Virginia has, as its principal instrument, a 26-inch refractor, the twin brother of the Washington telescope. With this instrument Professor Stone recently made measurements of the satellites of Saturn, with the view of determining their orbits and motions.

The new Naval Observatory at Washington was completed and occupied in 1892. Since that time the work of Professor Hall with the great telescope has been continued by Professor Brown; Assistant Astronomer Skinner has observed a zone of stars for the International Astronomical Society with the transit circle, and Assistant Astronomer Hill has made observations for the variation of latitude.

At Philadelphia a small but not unimportant observatory has been erected by the University of Pennsylvania. The astronomer, Professor Doolittle, is getting it into active operation, and has decided to continue his investigations on the variation of latitude and the motion of the earth's axis.

At Albany, a new building has been erected for the Dudley Observatory, which has been supplied with an excellent telescope by Brashear. Professor Boss, in 1896, was actively engaged in getting his meridian circle at work in making new standard determinations of the positions and proper motions of certain stars. SIMON NEWCOMB

OBSTRUCTION AND OBSTRUCTIONISTS. See HOME RULE, in these Supplements.

OCALA, a city and the capital of Marion County, central eastern Florida, 35 miles S.S.E. of Gainesville, and midway between Jacksonville and Tampa, on the Florida Central, the Savannah and the Florida Southern railroads; is in the vicinity of orange groves, market gardens, cotton, sugar-cane and sweet-potato farms, and phosphate beds in working. Population 1900, 3,380.

OCAÑA, a town of the department of Santander, in Colombia, 220 miles S.E. of Cartagena; is a center of trade between Lake Maracaibo and the Magdalena region; picturesquely situated at an elevation of 3,800 feet, and in a fertile country. It was founded in sixteenth century.

OCARINA, a recent Italian instrument of flute-like sound, made of pottery, pierced with small holes and shaped like the body of a bird, without head or neck. A series of seven ocarinas are used to produce operatic melodies. The tone is soft and sweet.

OCCOM, SAMSON, an American clergyman; born in Mohegan, Conn., about 1723. He was an Indian by birth, and when 19 years old he entered the Indian school of Mr. Wheelock at Lebanon, and remained there four years. In 1748 he kept a school in New London, but shortly after removed to Montauk, L. I., where he taught and preached to the Indians. In 1766 Mr. Wheelock sent him to England as an agent for Moore's Indian charity school. Being the first Indian preacher who had visited that country, he was successful in attracting large audiences and obtaining donations. After his return to America, Occom preached at various places, passing his latter years within the bounds of the Albany presbytery. He wrote an account of the Montauk Indians, and published a sermon which he had preached on the subject of the execution of an Indian at New Haven in 1772. He died in New Stockbridge, New York, in July, 1792.

E.E.T.

OCCULTATION. See *Eclipses of the Sun and Moon*, under ASTRONOMY, Vol. II, pp. 702, 703.

OCCUPANCY, a legal term denoting one method of obtaining title to real and personal property,—a notion derived from Roman law, and supposed to originate in laws of nature, especially in those things which are open to, and therefore presumably the property of, all. Such titles to land can only arise in special cases; one of which is the accretion of land from the ocean shore, a navigable stream or a lake; another, where a defect in law provides no legal owner for a given time.

OCCUPATION, MILITARY, is the act of taking and holding possession of a city, town or other territory belonging to an enemy, by military forces. The place is generally put under martial law during the continuance of such occupation. The occupation extends to such adjoining territory as the military forces may be able to hold under actual control. The military law established over territory thus occupied suspends the local law,

but in practice only so much of it as may conflict with peaceful possession. It continues so long as the conquering power may occupy the territory or until the cessation of hostilities. The citizens of a territory occupied by a hostile power will incur no liability from recognizing the authority of the power in control, because when a government is unable to protect its citizens its claim to their allegiance is suspended.

OCEAN CURRENTS, in the Atlantic. See ATLANTIC, Vol. III, pp. 18, 19. In the Pacific. See PACIFIC OCEAN, Vol. XVIII, pp. 121–122; see also INDIAN OCEAN and NORTH SEA.

OCEAN DEPTHS. See DREDGE, Vol. VII, pp. 397–404; also PACIFIC OCEAN, Vol. XVIII, pp. 124–125.

OCEAN GROVE, a religious summer resort founded and controlled by the Methodist Episcopal Church, on the Atlantic coast, in Monmouth County, New Jersey, 33 miles south of New York, where it is reached by the New Jersey Central and Pennsylvania railroads. Established as a "camp-meeting" ground, it has been developed into a large community of hotels and cottages, in which strict Sabbatarian and other religious laws prevail, and in which during the summer innumerable religious meetings and conventions are held. The entire property is under the control of the Ocean Grove Camp-Meeting Association. Its permanent population is about 2,000, and in midsummer reaches tens of thousands. W.F.J.

OCEANICA. See POLYNESIA, Vol. XIX, pp. 431–442.

OCEAN LIFE. See DISTRIBUTION, Vol. VII, pp. 240–244.

OCHER, a native ferruginous clay, which is used as a pigment. See PIGMENTS, Vol. XIX, pp. 95, 96.

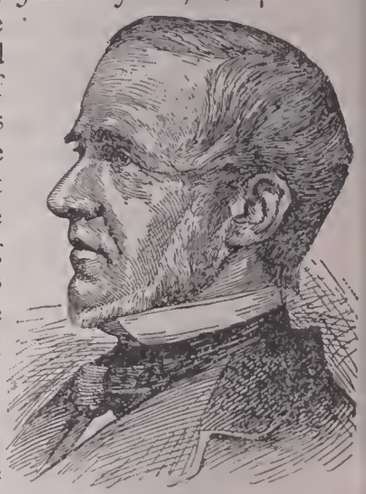
OCMULGEE, a river, a branch of the ALTAMAHA. See GEORGIA, Vol. X, p. 390.

O'CONNOR, THOMAS POWER, journalist and politician; was born at Athlone, Ireland, on October 5, 1848, and was graduated from Queen's College, Galway, in 1866. He became a reporter in Dublin, and in 1870 went to London, where he became a sub-editor of the *Daily Telegraph* and a correspondent of the New York *Herald*. Subsequently he founded and edited in London the *Star*, the *Sun*, the *Weekly Sun*, *M. A. P.* (*Mainly About People*), and *T. P.'s Weekly*. He has long been familiarly known as "T. P." In 1880 he was elected to Parliament from Galway, in 1885 from Liverpool, and has been successively re-elected ever since. He has been a leader of the Irish Nationalist movement, made a lecturing tour in its behalf in America in 1881–82, and in 1883 was made president of the Irish National League of Great Britain. In addition to his journalistic activities he has written *Lord Beaconsfield: A Biography; The Parnell Movement; Gladstone's House of Commons; Some Old Love Stories; Napoleon; The Phantom Millions*, and almost innumerable magazine and review articles. He has also edited a *Cabinet of Irish Literature*. W.F.J.

T. P. O'CONNOR.

OCONOMOWOC, a city of Waukesha County, southeastern Wisconsin, and a noted summer resort, about 30 miles W. of Milwaukee and 15 miles N.W. of Waukesha. It is the seat of a young ladies' seminary, and has a thriving local trade. It is beautifully situated on Oconomowoc Creek, and is surrounded by many charming lakes. Population, 1900, 2,880.

O'CONOR, CHARLES, an American lawyer; born in New York city, January 22, 1804. He studied law at twelve years and was admitted to the bar at the age of twenty. For many years he was recognized as one of the ablest and most brilliant members of the New York bar. Among his most celebrated cases were the Forrest divorce case; the Slave Jack case; the Lispenard will case; the Lemon slave case, and the Mme. Jumel suit. During the Civil War he was in sympathy with the South and was a strong advocate of states' rights. He was associated with William H. Evarts and Wheeler H. Peckham in the prosecution of the Tweed Ring conspirators in New York city. In 1869 he was elected president of the Law Institute of New York. In 1872 he was nominated for President of the United States by a convention at Louisville, Kentucky, composed of those Democrats who declined to indorse the Liberal Republican nomination of Horace Greeley. He died in Nantucket, Massachusetts, May 12, 1884. W.M.C.



CHARLES O'CONOR.

OCONTO, a city and the capital of Oconto County, eastern Wisconsin, on Green Bay, at the mouth of the Oconto River, and on the Chicago, St. Paul and North-Western railroads, 149 miles N. of Milwaukee. It has large steam saw-mills and exports pine lumber; has iron foundries, wagon factories and planing-mills. Population, 1890, 5,219; 1900, 5,646.

OCTANE, one of the normal paraffins. See CHEMISTRY, Vol. V, p. 483.

OCTAVE THANET. See FRENCH, ALICE, in these Supplements.

OCTOCORALLA. See ACTINOZOA, Vol. I, pp. 120, 121.

OCTOPODA, suborder of *Dibranchiata*. See MOLLUSCA, Vol. XVI, pp. 695, 696.

OCTOPUS, a genus of cephalapodous mollusks, typical of the suborder of eight-armed cuttle-fishes (*Octopoda*). The various members

of the suborder *Octopoda* are popularly known as devil-fishes. They are widely distributed, and are common near the shores of warm seas. The structural features are fully discussed in the article MOLLUSCA, Vol. XVI, p. 695.

ODD FELLOWS, INDEPENDENT ORDER OF. See BENEFIT SOCIETIES, in these Supplements.

ODENWALD. See FORESTS, Vol. IX, p. 352.

ODIC OR ODYLIC FORCE. See MAGNETISM, ANIMAL, Vol. XV, pp. 279, 280.

ODIN. See ASGARD, Vol. II, pp. 279, 280.

ODIN, a village of Marion County, south central Illinois, 64 miles E. of St. Louis, on the Illinois Central and the Baltimore and Ohio railroads; has an academy, a broom factory, a woolen-mill and a flour-mill. Population 1890, 817; 1900, 1,180.

ODLING, WILLIAM, was born Sept. 5, 1829, in Southwark, England; was educated at private schools, and, for the medical profession, at Guy's Hospital. He was graduated at the University of London in 1851, and was appointed demonstrator of chemistry at Guy's Hospital in 1850; lecturer on chemistry at St. Bartholomew's Hospital in 1863; Fullerian professor of chemistry at the Royal Institution in 1868; Waynflete professor of chemistry in the University of Oxford, June 17, 1872; and elected a fellow of Worcester College on the following day. Dr. Odling published a *Manual of Chemistry* (1861); *Lectures on Animal Chemistry* (1866); *Course of Practical Chemistry* (1876); and various scientific memoirs, especially on chemical theory.

ODOBÆNUS, same as TRICHECHUS. See MAMMALIA, Vol. XV, p. 450.

ODOMETER OR HODOMETER, an instrument employed for registering the number of revolutions of a carriage-wheel and thereby recording the distance traveled. The instrument consists of a number of cog-wheels attached to the axle of the wheel and registering the revolutions on a dial. Similar mechanisms are employed in the pedometer and cyclometer.

ODONATA, suborder of *Orthoptera*. See INSECTS, Vol. XIII, p. 158.

O'DONOVAN, DENIS, a British writer, was born in Kinsale, County Cork, Ireland, in 1836, and was educated in Ireland and France. He arrived in Queensland in 1874, and was appointed Parliamentary librarian. Mr. O'Donovan had previously filled the position of professor of modern languages in the Collège des Hautes Études, afterward in the Catholic University of Paris, and lecturer in one of the colleges of the University of France. He was one of the editors of the *Ami de la Religion*, and the author of *Memories of Rome*, and some minor works. His latest work is his *Analytical Catalogue of the Queensland Parliamentary Library*. He also published a number of lectures on art and architecture.

O'DONOVAN, WILLIAM RUDOLF, an American sculptor; born in Preston County, Va., March 28, 1844. He was self-taught in art, and after the Civil war, in which he served on the Confederate side, he established a studio in New York. He has executed many important portrait busts and bas-reliefs; statues of Washington for Caracas, Venezuela, for the Peace Monument at Newburgh, N. Y., and for the Trenton battle monument; a statue of Archbishop Hughes for St. John's College, Fordham, New York; etc.

E.E.T.

ODONTOPTERIS, a genus of fossil ferns occurring in the carboniferous rocks of various parts of Europe and many localities in the United States. Both *Odontopteris* and the closely allied *Neuropteris* had fronds of great size.

ODONTORNITHES, a group of extinct birds, whose remains are found in the cretaceous strata on the plains east of the Rocky Mountains. There are two groups of these birds, with few common characters except teeth. The *Odontotorinæ* were small birds, with bi-concave vertebræ and teeth set in sockets. The *Ichthyornis* and *Apatornis* were representatives. The birds of the second group, *Odontoholcæ*, were sometimes six feet long, with a very large tail. The wings were rudimentary and the vertebræ resembled those of existing birds. *Hesperornis* is the type of this group.

ODONTOSCOPE, an apparatus for viewing the human teeth, used by dental surgeons. It has a minute electric light and a circular dental mirror, and when inserted in the mouth enables the dentist to obtain a clear view of the teeth from all points.

ŒDEMA. See DROPSY, Vol. VII, p. 407.

ŒNOTHERA, a large genus of plants of the family *Onagraceæ*. The numerous species are known as evening primroses and are all American, especially from western and southwestern United States. They are extensively cultivated for their showy flowers. They are chiefly herbs, either leafy-stemmed or acaulescent, with regular four-parted yellow, purple or white flowers, the calyx-tube prolonged beyond the ovary, and bearing at its throat the brightly colored petals and eight stamens. *Œ. biennis* is the common yellow-flowered species of the eastern United States. By many botanists this large genus is broken up into numerous genera.

ÖREBRO, an ancient town of Sweden, at the entrance of the Svarta into the Hjelmar Lake, 170 miles W. of Stockholm. It has an ancient castle, in which many diets have been held; it is an important center for the iron trade, and has manufactories of woolens, knit goods, matches, etc. Population 1900, 22,013.

OERSTED, ANDERS SANDOE, statesman, was born in Denmark on December 21, 1778, was educated at the University of Copenhagen, was admitted to the bar in 1799, and soon rose to the foremost rank in his profession. In 1825 he was made attorney-general, and drafted many of the laws of Denmark. After the revolutions of 1830–31 he framed the constitution which the king then granted to Denmark, and thereafter he was for some years a cabinet minister. He was made prime minister in 1853, but was forced by public opposition to retire a year later. He afterward wrote some historical and political books,

and philosophical treatises. He died at Copenhagen on May 1, 1860. He was a brother of Hans Christian Oersted, q. v. W.F.J.

OERSTED, Hans Christian, a Danish physicist; born in Rudkjoebing, on the island of Langeland, August 14, 1777. He was graduated from the University of Copenhagen in 1799. In 1806 he became professor of physics there. Electro-magnetism and cognate subjects were his particular studies, and he may be said to have been the originator of the electro-magnetism theory. He was the author of *The Soul in Nature*, translated by Miss Horner, and *Manual of Mechanical Physics* (see Denmark, Vol. VII, p. 80.) He died in Copenhagen, March 9, 1851.

O'FERRALL, Charles Triplett, governor of Virginia; born Oct. 21, 1840, near Brucetown, Frederick County, Virginia; entered the Confederate army as a private and attained to the rank of colonel; graduated in law at Washington and Lee University; elected county judge, served in the legislature, in Congress for several successive terms, and 1894–98 was governor of Virginia. In Presidential campaign of 1896, he supported the "sound-money" candidates, despite the opposition of the State press. Died Sept. 22, 1905.

OGDEN, a city of Utah. This city is the location of machine and repair shops of the Central Pacific, and of iron-works, shops for producing mining-machinery and farm-implements, planing, woolen, saw and flour mills, furniture, confectionery, sash, baking-powder, cornice, brick and cigar factories, fruit canning, electric-light and broom factories, together with two breweries. It is the seat of Utah University, the construction of which, at a cost of $500,000, was begun in 1890. The institution is of the Methodist Episcopal denomination. There are here Ogden Academy (Congregational), a military academy, 12 public schools, 1 state and 3 national banks, and 1 loan and trust company. Ogden has a Mormon Tabernacle, an opera-house, and six hotels, one of which was erected at a cost of $150,000. On account of its evenness of climate the city is a favorite health-resort, the waters of the famous hot springs being especially efficacious in certain forms of scrofula, rheumatism and other diseases. Population 1890, 14,889; 1900, 16,313. See Ogden, Vol. XVII, p. 753.

OGDEN, Aaron, an American statesman; born in Elizabethtown, N. J., Dec. 3, 1756. He graduated at the College of New Jersey (now Princeton University) in 1773. In 1777 he entered the army and served with distinction throughout the whole Revolutionary war, notably in the battles of Brandywine, Monmouth, and Springfield, the Virginia campaign of 1781, and the siege of Yorktown. He then studied law, was admitted to the bar, and commenced practice. He was a Presidential elector in 1800, and was appointed one of the commissioners for adjusting the disputed boundary between the States of New York and New Jersey. In 1800 also he was elected to the United States Senate from New Jersey, to succeed James Schureman, resigned, and served from March 3, 1801, to March 3, 1803. He resumed the practice of law till 1812, in which year he filled the gubernatorial chair of New Jersey, returning again to the practice of his profession until his death. Toward the close of his life he was involved in litigation with Robert Fulton over questions of monopoly in steamboat navigation which were then rife. He was president-general of the Society of the Cincinnati at the time of his death, which took place in Jersey City, N. J., April 19, 1839. E.E.T.

OGDEN, Robert Curtis, merchant and philanthropist, was born in Philadelphia on June 20, 1836. Since 1885 he has been a member of the mercantile house of John Wanamaker in Philadelphia and New York. He is an officer of Hampton Institute, Union Theological Seminary, Tuskegee Institute, and the Southern Education Board. W.F.J.

OGDEN, William Butler, pioneer and railroad president, was born at Walton, N. Y., on June 15, 1805, settled in Chicago in 1835, was its first mayor in 1837, was first president of the Union Pacific railroad, and was identified with the Rush Medical College, the University of Chicago, and other institutions. He died on August 3, 1877. W.F.J.

OGDENSBURG, a port of entry in St. Lawrence County, New York. It is the headquarters of the Northern Transportation Company, a line of steamers plying between Chicago and intermediate points on the lakes, and annually carrying a large amount of grain and lumber, besides general lake and river freight. The city has also several fine public parks. The St. Lawrence River at this point is over two miles wide. Population 1890, 11,662; 1900, 12,633. See Ogdensburg, Vol. XVII, p. 753.

OGLESBY, Richard James, an American soldier and statesman; born in Oldham County, Ky., July 25, 1824. He removed to Decatur, Ill., in 1836. Here he received a limited education, became a carpenter, studied law, and began practice in 1845. He served in the army during the Mexican war, and next spent two years in mining in California. Returning to Illinois in 1851, he resumed the practice of law, and in 1860 was elected State senator, but served for only one session, resigning to enter the Union army as colonel of the 8th Illinois Volunteers. He was desperately wounded at Corinth, was promoted brigadier-general, and in 1863 became major-general. He resigned in 1864, and was elected governor of Illinois, serving from 1864 to 1869. He was again elected governor in 1872, but resigned the gubernatorial chair in 1873 to enter the United

RICHARD J. OGLESBY.

States Senate, in which he sat from January 13, 1873, to March 3, 1879. He was re-elected governor in 1885, and died in Elkhart, Ill., April 24, 1899. E.E.T.

O'HARA, THEODORE, soldier and poet, was born at Danville, Ky., on February 11, 1822, and was graduated from St. Joseph's College. He became a teacher, a lawyer, and an employe in the U. S. Treasury. He was in the Mexican War, in Lopez's Cuban and Walker's Nicaraguan expeditions, edited several papers in the South, and was a Confederate officer in the Civil War. He wrote the poem entitled *The Bivouac of the Dead*, which is known the world around. He died on June 6, 1867. W.F.J.

OHIO had a population in 1900 of 4,157,545, a gain of 485,229 over 1890. From 1840 to

STATE SEAL OF OHIO.

the taking of the census of 1890 Ohio had occupied the third place in rank of population, but the eleventh census placed it fourth, and after Illinois. The number of inhabitants (1900) was 102.0 to the square mile, a greater destiny than that of any other of the states of the north central division, the average of which was only 20.68. The cities of Ohio having a population of 8,000 or more numbered 38, in which resided 1,599,840 inhabitants, making the urban population 38.5 per cent of the state. The male inhabitants numbered 2,102,655, the female 2,054,890, a more equal division of the sexes than in any other state of the group to which Ohio belongs. The percentage of native-born citizens was 89.0, of foreign-born 11.0. The number of negroes was 96,901, an increase since 1890 of 9,788. The population also included 371 Chinese, 27 Japanese and 42 civilized Indians.

Ohio has been near the center of population of the United States since 1830. In that year the center was in the neighboring state of West Virginia; in 1860 it was in the southern part of Ohio, twenty miles from Chillicothe, the first capital. In 1870 it had shifted to a point 48 miles N.E. of Cincinnati; in 1880 it was eight miles S.W. of that city; in 1890 it had moved slightly to the northwest, still within forty miles of Cincinnati.

The gross area of Ohio is 41,060 square miles, of which 300 is water surface, leaving 40,760 square miles, or 26,086,400 acres of land surface.

Almost ninety per cent of this land surface is under cultivation in Ohio, and all branches of agriculture receive attention. Fruit-raising is a large industry, and the state is famed for its apples, peaches, plums and grapes.

The production of the cereals in Ohio in 1889 is shown in the accompanying table, the percentages being that of the entire crop of the United States:

PRODUCT.	ACRES.	PER CENT.	RANK	BUSHELS.	PER CENT.	RANK
All cereals	6,785,280	4.84	7th	191,818,162	5.45	6th
Corn	3,189,553	4.42	7th	113,892,318	5.37	6th
Wheat	2,269,585	6.76	5th	35,559,208	7.59	5th
Oats	1,215,355	4.29	10th	40,136,732	4.96	7th
Barley	37,092	1.15	13th	1,059,915	1.35	11th
Rye	59,643	2.75	12th	1,007,156	3.54	10th
Buckwheat	14,052	1.68	9th	162,833	1.34	9th

The increase in the acreage of oats since 1879 was 304,967, and the average yield recorded for 1889 was 33+ bushels per acre. The yield of barley for the year mentioned was 28+ bushels to the acre, which was greater than the average either for the United States or for the north central group. In rye, the acreage of 1889 was more than double that of 1879, the average yield more than sixteen bushels per acre, while the average yield for the United States was 13.09 bushels per acre. The first statistics of the flax crop were gathered in 1849, at which time Ohio was one of three states producing 57.38 per cent of the entire seed product, and individually producing more than two and one half times as much as any other state. Between 1879 and 1889 Ohio fell off 85.10 per cent in the production of fiber and 75.46 per cent in the production of seed. In rank, Ohio, which had produced more flax during fifty years than any other state, occupied the eighth place, following close behind the states of the far West. In the production of hemp, in 1889 Ohio stood fifth in acreage, sixth in amount produced, eighth in average yield per acre, sixth in total value of product and second in average value per ton. In tobacco, Ohio increased the acreage planted in 1889 over the area in 1879 by 9,627 acres. The rank among the states was fifth, the number of acres 44,303; the percentage of total area 6.37; the rank in production was third; the production in pounds was 37,853,563 and the percentage of the entire product of the United States was 7.75.

The following additional agricultural items are from the census report of 1900:

Pounds of maple sugar produced	613,990
Gallons of maple molasses made	923,519
Gallons of sorghum molasses made	341,523
Acres of meadow-land mown for hay	3,015,261
Tons of hay produced	4,192,871
Bushels of clover-seed produced	336,318
Bushels of other grass-seed produced	52,403
Acres of Irish potatoes	167,590
Bushels of Irish potatoes produced	13,709,238
Acres of sweet potatoes	3,796
Bushels of sweet potatoes produced	249,767
Acres of broom-corn	802
Pounds of broom-corn produced	537,160
Acres of tobacco	71,422
Pounds of tobacco produced	65,957,100

The number of farms in Ohio in 1900 was greater than that of any other state of the Union the aggregate being 276,719

TABLE SHOWING THE RELATIVE SIZE OF THE FARMS.

Under 10 acres	17,347
10 acres and under 20 acres	18,115
20 acres and under 50 acres	57,566
50 acres and under 100 acres	89,774
100 acres and under 500 acres	92,837
500 acres and under 1,000 acres	916
1,000 acres and over	164
Average size of farms, acres	88.5

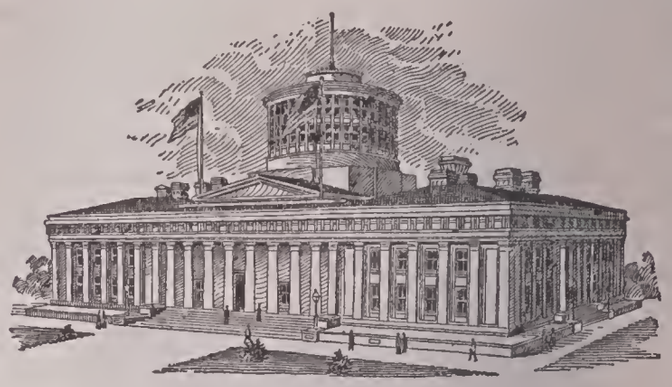
Of these, 200,788, or 72.5 per cent, were cultivated by the owners; 24,051, or 8.7 per cent, were rented for money; 51,880, or 18.8 per cent, were rented on shares.

The aggregate acreage of the farms of the state by the census of 1900 was 24,501,985, of which area almost eighty per cent was improved. The total value of the lands, fences, buildings, farm implements and machinery and live-stock was given as $1,198,923,946; the estimated value of the farm products of 1899 was $257,065,826; the number of horses was 878,205; mules and asses, 17,021; neat cattle, 2,053,313; swine, 3,188,563; and sheep, 2,648,250, whose wool clipped the season previous amounted to 20,350,721 pounds. In sheep, Ohio stood second only to Texas, although a decrease had taken place, since 1880, of 2,053,313 head. In 1890, Ohio reported the largest number of sheep to the square mile of land surface of any state. The weight of fleeces had been increased from 5.10 pounds to 5.70 pounds per sheep, the majority of which were merinos or grade merinos. In 1889 more than 250,000 head of swine died of disease in Ohio; the total number of swine in the state was 100,000 in excess of that of 1879. The number of neat cattle on farms was between forty and fifty to the square mile. Ohio had the highest percentage of pure-bred cattle of any of the north central states, and was second in the annual production of milk per cow, the average in Ohio being 411.31 gallons. In 1889 Ohio and Iowa were the only states reporting over one million pounds of cheese made on farms.

The report of the Ohio State Board of Agriculture for 1900 gives the following statistics relative to the crops of the preceding year:

	ACRES.	BUSHELS.
Wheat	3,209,074	50,376,800
Corn	3,826,013	152,055,390
Oats	1,115,149	42,050,910
Barley	34,058	1,053,240
Rye	17,583	257,120

In the production of minerals Ohio stood fifth among the states, the total value of the output of 1889 amounting to $26,653,439. In the item of iron ore, 70 mines were reported as producing 254,294 long tons, of the value of $532,725. Coal-mines to the number of 2,068 reported an output of 9,976,787 tons, of the value of $9,355,400. The number of employees was 19,591, the wages paid amounted to $6,892,604, all expenditures reached the sum of $8,232,183, and the capital invested was given as $14,018,236. The output of crude petroleum amounted to 12,471,466 barrels, of the total value of $2,173,995. Illuminating oil to the amount of 317,037 barrels was refined, the value being $340,683. Lubricating oil to the amount of 1,240 barrels returned $10,334, and fuel oil yielded 12,153,189 gallons of the value of $1,822,978. The number of petroleum wells was 2,640, of which 785 were flowing wells and 1,855 required pumping. The



CAPITOL BUILDING, COLUMBUS.

aggregate capital invested (1900) in petroleum oil within the state reached the sum of $10,912,818; the number of employees was 1,008 and the wages paid amounted to $551,692. The value of paper and wood pulp produced during the year was given as $6,543,513; the capital invested, $7,872,913; the number of employees, 3,184; the wages paid, $1,118,040, and the expenses for material, $3,768,572.

In the production of useful stone, Ohio ranks second, the number of quarries being 413 and the value of the product $4,361,590; limestone, valued at $1,514,934; sandstone, at $3,046,656. Other mineral products are grindstones, gypsum, metallic paint and mineral waters. The reported value of the salt produced in 1900 was $818,200.

The fisheries of the state in 1889 had 2,012 persons engaged, the capital invested was $1,328,428, and the value of the product was $746,396.

The census reports of 1900 give the number of specified manufacturing industries as 32,398, in which $605,792,266 were invested; 375,872 employees engaged, $183,306,375 paid in wages; and finished products valued at $832,438,113 were turned out. The principal industry was that of iron and steel, which yielded a return of $138,935,256. Twenty-six other industries yielded products valued at from $72,399,632 for foundry and machine-shop products, down to electrical apparatus, etc., which amounted to $6,504,847. Among other industries named as producing more than $8,000,000 were flouring and grist mills, factories, carriages and wagons, malt liquors, refined petroleum, lumber and other wood-working mills, agricultural implements, tobacco, and slaughtering and meat-packing.

The commissioner of common schools of Ohio makes the following report for the year 1895:

Number of districts	11,230
Number of teachers employed	25,004
Number of women teachers	14,738
Number of men teachers	10,266
Number of children, 6 to 21 years	1,159,258
Number of pupils enrolled in schools	817,490

Daily attendance	593,465
Number of schoolhouses	13,039
Value of schoolhouses and grounds	$38,925,896
Available for expenditure	$18,887,597
Amount expended	$13,805,105
Amount paid teachers	$ 7,907,860
Number of teachers' institutes held	88
Continuing in days	567
Attendance at institutes	20,013
Expended for institutes	$ 26,486

TABLE OF THE DENOMINATIONAL INSTITUTIONS OF OHIO FOR HIGHER EDUCATION.

LOCATION.	INSTITUTION.	RELIGIOUS DENOMINATION.
Akron	Buchtel College	Universalist.
Alliance	Mount Union Coll.	Methodist Epis.
Berea	Baldwin Univ.	Methodist Epis.
Berea	Ger. Wallace Coll.	Methodist Epis.
Cincinnati	Bartholomew Sch.*	Protestant Epis.
Cincinnati	St. Joseph's College.	Roman Catholic.
Cincinnati	St. Xavier's College.	Roman Catholic.
Cleveland	Calvin College	Reformed.
Cleveland	St. Ignatius College.	Roman Catholic.
Columbus	Capital University	Lutheran.
Delaware	Ohio Wesleyan Univ.	Methodist Epis.
Findlay	Findlay College	Church of God.
Gambier	Kenyon College	Protestant Epis.
Glendale	Female College	———
Granville	Denison Univ.	Baptist.
Granville	Female College*	Presbyterian.
Granville	Shepardson Coll.	Baptist.
Hillsboro	Hillsboro College	Methodist Epis.
Hiram	Hiram College	Christian.
Lima	Lima College	Lutheran.
New Concord	Muskingum College.	United Pres.
Oxford	Oxford College	Presbyterian.
Rio Grande	Rio Grande College	Free Baptist.
Scio	Scio College	Methodist Epis.
Springfield	Wittenberg College	Lutheran.
Tiffin	Heidelberg Univ.	Reformed.
Urbana	Urbana University	N. Church.
W. Farmington.	Farmington College.	Methodist Epis.
Westerville	Otterbein Univ.	United Brethren.
Wilberforce	Wilberforce Univ.	African Meth. Epis.
Wilmington	Wilmington College.	Friends.
Wooster	Univ. of Wooster	Presbyterian.

TABLE OF NON-SECTARIAN INSTITUTIONS OF OHIO.

LOCATION.	INSTITUTION.
Athens	Ohio University.
Bainsville*	Lake Erie Seminary.
Cincinnati	University of Cincinnati.
Cleveland	Western ReserveUniversity.
Columbus	Ohio State University.
Defiance	Defiance College.
Germantown	Twin Valley College.
Hopedale	Hopedale Normal College.
Marietta	Marietta College.
New Athens	Franklin College.
Oberlin	Oberlin College.
Oxford	Miami University .
Richmond	Richmond College.
Yellow Springs	Antioch College.

In 1890 there were in Ohio 9,345 church organizations, 8,857 edifices, a membership of 1,215,409, which was 33.19 per cent of the population, and church property of the value of $42,138,862. Forty-nine denominations and 5 independent organizations were enumerated; the leading ones are: Baptists (all bodies) 846, Roman Catholics 586, Christians 273, Christian Union 103, Congregationalists 247, Disciples of Christ 475, Dunkards 153, Evangelical Association 216, Friends 131, German Evangelical Synod 107, all Lutherans 588, all Methodists 2,798, all Presbyterians 828, Protestant Episcopal 169, Reformed 299, and United Brethren 995.

* Exclusively for girls.

March 30, 1905, there were 1,182 newspapers and other periodicals published in Ohio, one or more in all of the 88 counties, and in 404 cities, towns, and villages of the state, of which 88 were county seats. Of the whole number of papers, 171 were dailies, 6 triweekly, 38 semiweekly, 779 weekly, 2 fortnightly, 11 semimonthly, 160 monthly, 5 bimonthly, and 10 quarterly.

The report of the state treasurer shows that the total receipts from all sources for the fiscal year 1900 amounted to the sum of $5,222,355, which included a balance of $802,264 carried over from 1899. The expenditures of the year were $4,909,453, leaving a balance at the close of 1899 of $312,902. The total state debt, Jan. 1, 1898, was $1,241,665, all of which will be extinguished July 1, 1900. Within the period from 1892 to 1896 more than $1,500,000 of the funded debt of the state was paid.

The value of all taxable real estate and personal property in Ohio, according to the consolidated tax duplicate of 1895, was as follows:

Real estate in cities and villages	$ 625,179,132
Real estate not in cities and villages	589,748,953
Chattel property	527,589,429
Total	$1,742,517,514

The taxes for 1896 were as follows:

For state purposes ($2\frac{75}{100}$ mills)	$ 4,790,054
For county purposes	9,986,407
Township, city, school and special taxes	25,747,573
	$40,524,035
Minor sources of revenue	4,087,255
Total	$44,611,290

TABLE OF STATE PUBLIC INSTITUTIONS, THEIR LOCATION, COST OF MAINTENANCE, AND AVERAGE NUMBER OF INMATES FOR 1895.

INSTITUTION.	LOCATION.	NO. INMATES.	MAINTENANCE.
Athens State Hospital (a)	Athens	828	$134,594
Columbus State Hosp. (a)	Columbus	1,149	184,656
Dayton State Hosp. (a)	Dayton	792	136,385
Cleveland State Hosp. (a)	Cleveland	929	143,923
Massillon State Hosp. (a)	Massillon	----	64,446
Toledo State Hosp. (a)	Toledo	1,183	180,598
Ohio Hosp. for Epileptics	Gallipolis	351	142,288
Longview Asy. for Ins. (c)	Longview	750	128,398
Ohio Institution for Feeble-minded Youth	Columbus	952	148,651
Girls' Industrial Home	Delaware	340	41,204
Ohio Inst. for the Blind	Columbus	230	64,584
Ohio Working Home for the Blind	Iberia	60	8,831
Institution for the Deaf and Dumb	Columbus	456	97,843
Ohio State Reformatory	Mansfield	----	50,000
Ohio Soldiers' and Sailors' Home	Sandusky	1,257	171,419
Ohio Penitentiary	Columbus	2,020	387,733

(a) For the insane.
(b) In course of erection.
(c) Partially supported by city of Cincinnati.
(d) Not completed for occupancy.

The report of the commissioner of railroads and telegraphs, made in 1895, gives the following facts:

Railroad corporations in the state	84
Miles of track in the state	12,596
Miles not of standard gauge	200
Miles steel-rail track	11,123
Mileage and equipment investment	$560,250,961
An average per mile of	$65,739
Earnings in 1894 in Ohio	$ 60,140,831
Decrease from 1893	$ 22,982,910
Operating expenses for 1894, in Ohio	$ 43,230,655
Decrease from 1893	$ 10,291,881
Persons employed during the year	54,733
Amount of salaries	$ 30,546,709
Passengers carried during the year	27,231,220
Tons of freight hauled	59,639,559
Telegraph companies doing business in Ohio	6
Miles of line in operation	53,353
Capital stock, aggregate	$103,440,625

In 1895 the state of Ohio appropriated $133,415 for the support and maintenance of the National Guard, which had a total strength of 6,039 officers and enlisted men. There were 102 companies of infantry, 8 batteries of artillery and 2 troops of cavalry. There were 8 full regiments of infantry, a battalion of 3 companies of negroes, an unattached company of infantry mounted on bicycles. During the preceding year there had been many calls on the Guard of the state, and the expenses attendant on these special calls approximated $143,000. The Federal appropriation for the Guard was about $20,000.

The following is a list of the principal cities and towns of Ohio, with the populations as given in the census reports of 1900: Cincinnati, 325,902; Cleveland, 381,768; Columbus, 125,560; Toledo, 131,822; Dayton, 85,333; Youngstown, 44,885; Springfield, 38,253; Akron, 42,728; Canton, 30,667; Zanesville, 23,538; Findlay, 17,613; Sandusky, 19,664; Hamilton, 23,914; Lima, 21,723; Newark, 18,157; Mansfield, 17,640; Steubenville, 14,349; Portsmouth, 17,870; Chillicothe, 12,976; East Liverpool, 16,485; Ironton, 11,868; Tiffin, 10,989; Massillon, 11,944. In addition to these there were 47 cities and towns having a population less than 10,000 and more than 4,000.

State flower, Scarlet Carnation or Golden Rod.

List of the governors of Ohio, beginning with the first governor after admission of the state into the Union in 1802:

Edward Tiffin	1803–07
Thomas Kirker	1807–08
Samuel Huntington	1808–10
Return Jonathan Meigs	1810–14
Othniel Looker	1814
Thomas Worthington	1814–16
Ethan Allen Brown	1816–22
Allen Trimble	1822
Jeremiah Morrow	1822–26
Allen Trimble	1826–30
Duncan McArthur	1830–32
Robert Lucas	1832–36
Joseph Vance	1836–38
Wilson Shannon	1838–40
Thomas Corwin	1840–42
Wilson Shannon	1842–44
Thomas W. Bartley	1844
Mordecai Bartley	1844–46
William Bebb	1846–49
Seabury Ford	1849–50
Reuben Wood	1850–53
William Medill	1853–56
Salmon P. Chase	1856–60
William Dennison	1860–62
David Tod	1862–64
John Brough	1864–65
Charles Anderson	1865–66
Jacob Dolson Cox	1866–68
Rutherford B. Hayes	1868–72
Edward F. Noyes	1872–74
William Allen	1874–76
Rutherford B. Hayes	1876–78
Richard M. Bishop	1878–80
Charles Foster	1880–84
George Hoadley	1884–86
Joseph B. Foraker	1886–90
James E. Campbell	1890–92
William McKinley, Jr.	1892–96
Asa S. Bushnell	1896–1900
George K. Nash	1900–04
Myron T. Herrick	1904–06
John M. Pattison, 1906–June 18, '06	
Andrew L. Harris, June 18, 1906–08	

OHIO RIVER, the largest eastern tributary of the Mississippi, which river it joins at Cairo, about 1,200 miles from the Gulf of Mexico, after following a west-southwesterly course of 975 miles from Pittsburg, where it is formed by the junction of the Allegheny and the Monongahela. After leaving the state of Pennsylvania, through the western part of which it flows, it forms the boundary between Ohio, Indiana and Illinois on the right and West Virginia and Kentucky on the left. Its chief tributaries are the Muskingum, Scioto, Miami and Wabash on the north and the Great Kanawha, Big Sandy, Licking, Kentucky, Green, Cumberland and Tennessee on the south. The area of the region drained by the Ohio has been variously estimated at from 202,000 to 214,000 square miles, and the volume of water discharged into the Mississippi, 158,000 cubic feet per second, is greater than that carried by the Missouri, which is but 120,000 cubic feet.

There are no rapids of importance in the river, except those at Louisville, which are avoided by means of a canal, and navigation is carried on from Pittsburg to the Mississippi on flat-bottomed steamboats during all of the year but a few weeks in the summer, when the water becomes so low that the river is fordable at many points above Cincinnati. The river shows great variations in level, the difference between low water and the high water during the freshets of the spring and early summer being fifty and sometimes sixty feet. Of the numerous islands in the course of the Ohio, some are fertile and others are mere sand-bars, known as "tow-heads." The river varies in width from 500 to 1,400 yards, and is spanned by bridges at Wheeling and Cincinnati.

The chief cities on its banks are Pittsburg, Wheeling, Portsmouth, Cincinnati, Covington, Newport, Louisville, Madison, New Albany, Evansville and Cairo.

OHIO STATE UNIVERSITY, an institution for the higher education of both sexes, maintained and controlled by the state of Ohio; located at Columbus. In 1862 Congress granted each state a certain acreage of land out of the public domain, the receipts from the sale of which were to be used in endowing a state institution of higher learning. Ohio accepted this grant, but did not organize a university until 1872, when the present institution was established and given a campus of about 340 acres in what is now the heart of Columbus. Liberal annual appropriations for its support have been made by the state legislature. Complete scientific laboratories have been equipped, and a library of 50,000 volumes in 1904 had been collected. The agricultural and industrial instruction, in some states separated from the collegiate courses, is carried on in Ohio at the State University. In

addition to these and the collegiate courses, instruction is given in pharmacy, engineering, law, and veterinary medicine. In 1907 there were 175

OHIO STATE UNIVERSITY.

in the faculty and 2,277 students. Inclusive of the class of 1904, 1,527 had graduated. The endowment of the institution was valued at $550,469, and the annual income in 1904 was $582,360. The annual tuition fee is $15.

OHIO UNIVERSITY, a co-educational, nonsectarian institution, located at Athens, Ohio. Provision was made in 1787 by the Ohio Company, in its purchase contract with the United States government, for an institution of learning, which was to be maintained by the legislature of the new state. In 1804 the Ohio University was established at Athens in compliance with the terms of this contract. Annual appropriations have been made to the institution by the state legislature, liberal at first but small of late. The first class was graduated in 1815. In 1904, 582 had been graduated. There were 53 in the faculty and 1,319 students. The school possessed in 1907 a library of 27,000 volumes. The productive funds in 1904 amounted to $137,000, and the annual income was $169,067. The institution is governed by a board of trustees, who are appointed by the governor of the state.

OHIO WESLEYAN UNIVERSITY, a co-educational institution, located at Delaware, Ohio. It is maintained and governed by the Methodist Episcopal Church, and was established in 1844. In addition to the regular collegiate courses, instruction is given in music, art, and commercial studies. It has an endowment estimated, in 1898, at $686,026, and that year its income was $66,701. In 1907 there were 108 in the faculty, 1,178 students in attendance, 55,000 volumes in the library, and 3,431 had been graduated.

OHM'S LAW. See ELECTRICITY, Vol. VIII, pp. 38–41; and ELECTRICITY, § 110, in these Supplements.

OHNET, GEORGES, a French novelist; born in Paris, April 3, 1848. He entered the journalistic field immediately after the close of the war of 1870, and was on the staff of the *Constitutionnel* and *Le Pays*. He wrote a drama, *Regina Sarpi*, in conjunction with Denayrouze, and a second, of which he was the sole author, *Marthe*, in 1877. He published *Battles of Life*, a collection of romances, and followed it with a number of novels and dramas. Among his later novels are *Le Doctor Rameau* (1889); and *Dette de Haine*, *Les Dames de Croix Mort* (1886); *Volonté* (1888); (1891); *Le Maitre des Forges* ("The Ironmaster") and *La Grande Marnière* were two of his dramas, among many, that had exceptional successes.

OIL CITY, a city of Venango County, western Pennsylvania, 13 miles N.E. of Tionesta, and 8 miles E.N.E. of Franklin, on the Allegheny River and the Allegheny Valley railroad. It is the principal oil market in the Pennsylvania petroleum region; contains several large oil refineries, pipeworks, iron foundries, engine and boiler works, and railroad shops; has a city hospital, a public library, and an oil exchange. A point of interest is Clark's Summit, within two miles of the city. Population 1890, 10,932; 1900, 13,264.

OIL RIVERS, West Africa, a deltaic region of British Southern Nigeria, extending between the Bights of Benin and Biafra in the Gulf of Guinea. It is formed by the Niger River and its numerous outlets, through which enormous quantities of palm oil (hence the name) and other tropical products are brought from the interior to the various shipping ports along the coast, chief of which is Akasa at the principal mouth of the Niger. The first official name, the Oil Rivers Protectorate, was changed to Niger Coast Protectorate, and now has no political significance except as a colloquial designation. C.L.S.

OIL-TESTERS. Numerous forms of testers have been devised for ascertaining the flashing-point of petroleum oils designed for illumination, etc. Various tests have been legalized or prescribed by different states and governments. The Abel tester was the first to come into general use. This apparatus has been improved and modified by various inventors, Braun of Berlin applying a magnetic-pendulum arrangement for applying the test-flame; Engler and Hass, a stirrer for the oil-cup; and several have made use of the electric spark to fire the vapor. The Pensky and Pensky-Martens testers are used to determine the flashing-point of lubricating oils. A description of the Gray tester, a recent form for the same purpose, will serve pretty nearly for other makes as used for heavy oils generally. A brass oil-cup, about two inches in diameter, and of the same depth, stands on a tripod. It has a tight-fitting lid, through which is a steel shaft, the latter bearing within the cup two stirrers, one for oil, the other for vapor. The shaft is rotated by means of bevel wheels and a hand crank. The lid has three holes, and in the sliding cover are two more holes, which may be brought into correspondence with the two in the lid. By drawing back the shaft the openings may be uncovered, and the test-flame applied. A gas-flame or a lamp commonly is used for heating the oil-cup to the desired temperature.

OIL WELLS. See PETROLEUM, Vol. XVIII, pp. 729, 730.

OJEDA, ALFONSO DE, a Spanish explorer; born

in 1465 in Cuenca; Ojeda was one of the numerous adventurers who took part in the Spanish exploring expeditions which followed Columbus's discovery of America. He was with Columbus on the second voyage, and gave Venezuela its name, in 1499, while on an independent voyage. He was regarded as one of the greatest adventurers of his time, and Cortes, Pizzarro and Americo Vespucci were with him in some of his expeditions. He suffered hardships, was imprisoned, and died in great poverty in Santo Domingo, West Indies, in 1515.

OKAPI, an animal, known to the natives of central Africa by that name, and discovered at the end of the nineteenth century by the British governor, Sir Harry Johnston, in the forests of Uganda. Its hips and legs indicated, at first, a kinship to the zebra, but it was soon proved to be a ruminant instead of an equine. In the absence of any distinct classification, it was assumed to be a connecting link between giraffes and horned cattle. Some zoölogists have discovered a striking resemblance of the Okapi to the god Set found on Egyptian sculpture, which has led to the presumption that it may be a descendant of a species of animal imaged on stone more than 5,000 years ago, then had vanished from the ken, the memory and traditions of the civilized world.

OKAYAMA, Japan, a prefectoral town in the S. W. of Hondo, the central island, on a bay of the Inland Sea, 75 miles by rail west of Kobe. Population, 1903, 81,025. C.L.S.

OKECHOBEE LAKE, the largest lake in the southern part of the United States, situated in southern Florida; is partly included in Brevard and Dade Counties; is about forty miles long and 25 miles wide; its greatest depth is about twenty feet. The shores of the lake are mostly swampy, and the lake itself almost inaccessible.

OKEFENOKEE SWAMP is a vast swamp lying in the southeastern part of Georgia, and extending into Florida. It occupies most of Charlton County, Georgia, contains three lakes, is partly drained at the south by the St. Mary's River, and is heavily timbered. W.F.J.

OKLAHOMA, the youngest state of the Union, admitted by Congress on June 16, 1906, entered on November 16, 1907, is bounded on the north by Kansas and Colorado, on the east by Missouri and Arkansas, on the south by Texas and on the west by Texas and New Mexico. It is formed from the former Indian and Oklahoma Territory and has an area of 70,470 square miles (Oklahoma 39,030, Indian Territory 31,440). The population on July 1, 1907, was 1,414,719 (Oklahoma 733,064, Indian Territory 685,115). Oklahoma proper lies, within the boundaries of the Louisiana purchase of 1803, and was carved out of Indian Territory, to which was added "No Man's Land," a strip 170 miles long and 35 miles wide, lying between Texas on the south and Kansas and Colorado on the north, and so called because not included in any state or organized territory. This strip, with 5,439,865 acres in Indian Territory, purchased from the Creeks and Seminoles in 1889 for $4,193,799, was thrown open to settlement by proclamation of the President, April 22, 1889. More than 50,000 persons entered on the first day to occupy the land. For almost a year the people were without an organized government, but early in 1890 the territory of Oklahoma was created. The section of country known as the Cherokee Strip was to be added to it when the title of the Indians should be extinguished. In 1891 almost 300,000 acres of land, formerly belonging to the Sac and Fox, Pottawatomie, Shawnee, Cheyenne and Arapahoe Indians, were thrown open to settlement; and in 1893 the Cherokee Strip of 6,000,000 acres was also opened. Some 90,000 people entered the Strip on the day named by the President, and much suffering ensued from lack of water and provisions.

TERRITORIAL SEAL OF OKLAHOMA.

The census reports of 1900 gave the population of the territory at 398,331, Wyoming, Arizona and Nevada, in the order named, standing below it. The number of males was 214,359; the number of females, 183,972, the percentage of native-born population was 96.1; the number of negroes, 18,831; of Chinese, 31; and of civilized Indians, 6,018.

In 1892 the population was reported by the governor at 133,100, the count having been made by a commission appointed by Congress. In 1893 the number of inhabitants was estimated at 151,213, and the residents of the Cherokee Strip numbered an additional 100,000. In 1894 the returns of the assessors showed a population of 212,635; on June 30, 1895, the total number of inhabitants was given by the Interior Department as 275,000; and in 1898 as 311,400.

The soil and products of Oklahoma Territory are very similar to those on similar meridians in Kansas and Texas, and the latter include almost every crop grown in the United States. The cereals thrive and grasses grow luxuriantly. Grapes and apples are well adapted to the uplands and fruits of all kinds are yielded abundantly.

The following statistics appear in the twelfth decennial census:

Number of farms	62,495
Acreage in farms	15,719,258
Improved land in farms, acres	5,511,994
Unimproved land in farms, acres	10,207,264
Valuation of land, fences, buildings, farm implements and machinery, and live-stock	$185,343,818
Horses	303,631
Mules and asses	57,198
Neat cattle	1,709,752
Swine	584,878
Sheep	48,535

With the increase in population came increased activity in all agricultural pursuits. In 1900 the following statistics were given out for 1899:

	Acres.
Corn	1,320,506
Wheat	1,279,826
Oats	156,619
Cotton	240,678
Sorghum cane	9,788
Broom-corn	12,366
Hay and forage	695,313
Potatoes	7,677
Castor beans	13,997
Total farm acreage	3,736,770

From 1890 to 1900 horses had increased 278,077; mules, 52,275; sheep, 31,970; swine, 562,916; and the number of milch cows was 149,096, and other cattle, 1,433,701.

In 1900 the value of the cotton crop was $2,217,119.

In the state of Oklahoma there are about 100,000 farms aggregating some 23,000,000 acres of land under cultivation. In 1906, 220,000,000 bushels of grain, wheat, corn, oats, rye, barley, etc., were produced and 900,000 bales of cotton, while the value of live stock was estimated to exceed $100,000,000. In 1907 the stock of Oklahoma proper comprised 198,000 milch cows, and 1,378,150 other cattle, 655,173 hogs, 58,380 sheep, 432,360 horses and 38,958 mules. The yield of petroleum of the state of Oklahoma amounted in 1906 to 21,718,000 barrels and the mineral output to $10,686,240. The area of coalfields in Oklahoma is about 30,000 square miles. In 1905 Oklahoma proper had 2,624 miles of railroads. Of the industries the manufacture of cotton-seed oil and oil-cake is the most important. The output of factories at large was, in 1905, estimated at $16,549,656. There were in Oklahoma proper (1906) 283 banks with a paid in capital stock of $4,135,000 and individual deposits of $16,638,800. The coal output of the Indian Territory proper in 1906 amounted to 2,860,200 short tons, valued at $5,482,300, the yield of granite and limestone quarries to $45,237. There were, in 1905, 466 industrial establishments valued at $7,909,450. The output of flour and grist mills was $2,582,650, of cotton-seed oil and cake $1,505,290, of lumber $588,000 and of printing and publishing newspapers, $588,500. In 1905 Indian Territory proper had 2,638 miles of railroads.

The new state of Oklahoma is, until the next census, entitled to send 5 representatives to the House of Representatives at Washington. The capital is Guthrie until 1913, when a new capital may be selected. The constitution contains provisions respecting religious equality, the sale of spirituous liquors, the maintenance of schools and the administration of justice. The constitution also provides for the initiative and referendum and for the control of public service companies by a commission of 3 members elected by the people for 6 years. Campaign contributions by corporations are forbidden and no stock shall be issued except for money, labor done or property actually received to the amount of the par value of the stock. Trial by jury is granted in contempt cases for violations of injunctions or orders of restraint, and an opportunity to be heard must be given on all contempts before punishment is imposed. Three-fourths jury verdicts are provided for in civil and criminal cases less than felony. The executive authority is vested in a governor, elected for a term of 4 years. The state has also a treasurer and auditor, a commissioner of insurance, and an attorney-general. The Supreme Court of Justice consists of a Chief Justice and 2 Associate Justices, appointed by the President, with the consent of the Senate, for a term of 8 years. There are District Courts and a Probate Court. In each of the District Courts a Supreme Court Justice sits.

The state has a school system embracing elementary and high public schools, normal schools, and colleges for higher instruction. Separate schools have been provided for whites and negroes, all children not negroes being classed as whites. In 1906, there were in Oklahoma proper 3,870 teachers and 149,368 enrolled pupils in the elementary common schools; in high common schools there were 88 teachers and 2,105 pupils, and in the 4 normal schools 72 teachers and 1,471 students. The University had (in 1906) 36 professors and 600 students, the Agriculture and Mechanical College had 555 students, while the colored Agricultural and Normal University with 13 instructors had 363 students. In 1906, the elementary schools of Indian Territory proper had 1,305 teachers and 47,620 pupils enrolled, while the public high schools had 20 teachers and 458 pupils.

One of the most promising towns of the state is Chichaska, a city of 12,500 people. It has 4 miles of concrete walks and asphalt paved streets, and an abundant supply of water-power plants, furnishing manufacturers with cheap power. The town is the cotton market of South Oklahoma. Guthrie, the capital, with 20,000 inhabitants has fine paved streets, cotton mills and other factories, 9 lines of railroads and 42 passenger trains leaving and entering daily. West of Guthrie are the Wichita national forests. An effort is made by the Bureau of Forestry in Washington to foster these woodland tracts by a project to provide for growing forests, exempt from taxation so that the owners may be able to hold land for full tree maturity. At Ardmore asphalt is mined just outside the city and is found in limitless quantities. At McAlester, a city of 15,000, 4,000,000 tons of coal are put out annually. Around the city are four million acres of timber land.

Territorial Governors: G. W. Steele, 1890-92; A. J. Seay, 1892–3; Wm. C. Renfrow, 1893–97; C. M. Barnes, 1897; T. B. Ferguson, 1901. The Governor of Oklahoma is C. N. Haskell 1906–1910.

OKLAHOMA, University of, a non-sectarian institution of higher learning established by act of the Oklahoma territorial legislature at Norman (q. v. in these Supplements) in 1892. In 1907 there were 40 instructors and 700 students. It has a library of 15,000 volumes. The institution is supported by a state tax and by endow-

ment from the United States Government. Its total income in 1904 was $74,800.

OKLAHOMA CITY, a city, and the capital of Oklahoma County, central Oklahoma, on the North Fork of the Canadian River, and on the Atchison, Topeka and Santa Fé and the Choctaw, Oklahoma and Gulf railroads. The population in 1908 was 40,000. Over $3,000,000 have been invested during the preceding year in building. It is the market of 100,000 bales of cotton every season. Harvest products amount to $20,000,000 in one year. It has a convention hall seating 5,000, and municipal water works, costing $500,000, 4,000 telephones, 46 miles of cement walks and 36 miles of street railway. The churches are valued at $1,000,000 and the Epworth University at $1,000,000.

OKOLONA, a village of Chickasaw County, northeastern Mississippi, about seventy miles S. of Corinth, on the Mobile and Ohio railroad. It contains a number of prosperous educational institutions and business houses. Population 1890, 2,099; 1900, 2,177.

OKRA. See GUMBO, Vol. XI, p. 244.

OLAF, SAINT. See NORWAY, Vol. XVII, p. 601.

OLAF, TRYGVASON. See NORWAY, Vol. XVII, pp. 600, 601.

OLATHE, a city and the county seat of Johnson County, Kansas, on the eastern border of the state. It lies in the rich farming country just south of the Kansas River, has some industrial establishments, and is the seat of a state institution for the deaf and dumb. It is twenty miles southwest of Kansas City and is reached by the Atchison, Topeka and Santa Fé and the Missouri, Kansas and Texas railroads. Its population in 1900 was 3,451. W.F.J.

OLD GERMAN LANGUAGE. See GERMANY, Vol. X, pp. 462–464.

OLDHAMIA, a fossil of undetermined affinities found in the Cambrian system in Ireland. Some authors consider it a polyzoon or a hydrozoon, while others think it may be a plant.

OLD MAN'S BEARD. See FRINGE TREE, in these Supplements.

OLD POINT COMFORT, a village of Elizabeth City County, Virginia, at the south end of Chesapeake Bay, adjacent to Fortress Monroe, at the mouth of James River, and about 14 miles N. of Norfolk; is a well-known watering-place, and has good bathing-grounds and a fine hotel.

OLD RED SANDSTONE. See GEOLOGY, Vol. X, pp. 301–306.

OLD TOWN, a village of Penobscot County, southern central Maine, near the west bank of the Penobscot River, on the Maine Central and the Bangor and Aroostook railroads, 12 miles N.E. of Bangor; has extensive water-power, and is chiefly supported by its lumber business. Population 1890, 5,312; 1900, 5,763.

OLD-TWO-SEED-IN-THE-SPIRIT PREDESTINARIAN BAPTISTS. See BAPTISTS IN THE UNITED STATES, in these Supplements.

OLEACINIDÆ, a family of air-breathing gasteropod mollusks. The term is equivalent to *Glandinidæ*. The most important genus is *Glandina*, of which several species are common in the southern United States.

OLEAN, a city of Cattaraugus County, southwestern New York, 70 miles S. of Buffalo, on the Olean Creek, and on the Erie, the Western New York and Pennsylvania, and the Central New York and Western railroads. It has oil and manufacturing interests, and is in a dairying district. Population 1890, 7,358; 1900, 9,462.

OLEASTER, a name applied, in general, to members of the family *Elæagnaceæ*, a species of *Shepherdia* and *Elæagnus*, the well-known buffalo-berries and silver-berries.

OLEFIANT GAS. See ETHYLENE, in these Supplements.

OLEIC ACID, one of the acids present in olive, almond and other oils, in which it exists as glyceryl oleate, the compound being known as olein or elain. At temperatures above 57° F. it exists as a colorless liquid fluid, of an oily consistence, devoid of smell and taste, and if it has not been exposed to air, exerts no action on vegetable colors. At 40° it solidifies into a firm, white, crystalline mass, and in this state it undergoes no change in the air; but when fluid, it readily absorbs oxygen—very slowly if pure—becomes yellow and rancid, and exhibits a strong acid action with litmus paper. Oleate of potash forms a soft soap, which is the chief ingredient in Naples soap; while oleate of soda is a hard soap, which enters largely into the composition of Marseilles soap. Of recent years, a large number of oleates have come into use in medicine, which depend for their activity on the remarkable ease with which they are absorbed by the skin. Such are the oleates of zinc, mercury, lead, tin, morphia, etc., which in this form produce more rapid results than when applied as ointments.

OLEFINES. See CHEMISTRY, Vol. V, pp. 484, 485.

OLEOMARGARINE. See OLEOMARGARINE, Vol. XVII, p. 782; and BUTTER, in these Supplements.

OLEOMETER, an areometer or balance for ascertaining the densities of fixed oils. It consists of a very delicate thermometer-tube, the bulb being large in proportion to the stem, so weighted and graduated as to adapt it to the densities of the leading fixed oils. On the scale is marked the principal oils of commerce, with their specific gravity opposite. The standard temperature of the oleometer is 59° F.

OLIBANUM. See FRANKINCENSE, Vol. IX, p. 624.

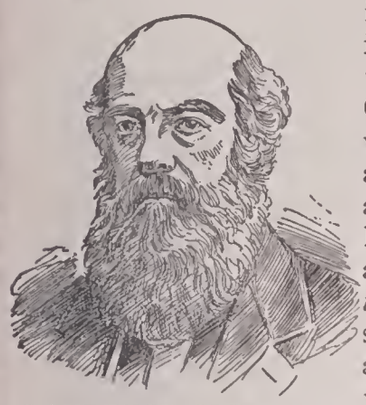
OLIFANT RIVER, a forked stream of Cape Colony, which rises in the mountains N.E. of Cape Town, and, after a northwesterly course of 150 miles, enters the Atlantic. Area of drainage basin, 13,000 square miles. Another stream bearing the same name rises in the Transvaal, and goes east to join the Oori.

OLIGARCHY, a form of GOVERNMENT; q v Vol. XI, pp. 11 et seq.

OLIGOCHÆTA, a family of worms. See ANNELIDA, Vol. II, pp. 61, 62.

OLIPHANT, CAROLINE. See NAIRNE, BARONESS, Vol. XVII, p. 174.

OLIPHANT, LAURENCE, a British traveler and author; born in Cape Town, South Africa, in 1829. He was educated in England but went out while very young to Ceylon, where his father was chief justice. He afterward visited Nepaul, and upon his return published his observations in a work entitled *A Journey to Katmandu*. He next studied law at Edinburgh, and at Lincoln's Inn, and was called to the bar in 1855. In 1852 he went to Russia, and, among other provinces of that country, visited the Crimea. In the following year he produced an account of his wanderings in a work entitled *The Russian Shores of the Black Sea*. His next occupation was as private secretary to the Earl of Elgin, whom he accompanied to Canada; and when the earl was appointed high commissioner to China, Mr. Oliphant again acted in his former capacity. In 1856 he published *The Transcaucasian Campaign of Omar Pasha*. Toward the close of the year 1860 he gave to the public an account of his observations in China and Japan, in his *Narrative of the Earl of Elgin's Mission in the Years 1857–8–9*. He then wrote *Patriots and Filibusters, or Incidents of Political and Exploratory Travel*, and *Piccadilly*. In 1861 he was made *chargé d'affaires* at Pekin, a post he resigned in 1862, in consequence of wounds received in an encounter with assassins. For a short period he was Paris correspondent of the *Times*, and from 1865 to 1868 sat in Parliament for Stirling Burghs. In 1870 he went to the United States and joined a mystic brotherhood near Dunkirk, New York, presided over by Thomas Lake Harris, a remarkable impostor. After losing both health and fortune he went to Egypt and resumed his literary labors. *The Land of Gilead* appeared in 1881, and *Sympneumata, or Evolutionary Forces Now Active in Man*, in 1885. His other works include *Traits and Travesties, Social and Political* (1882); *The Land of Kheim* (1882); *Altiora Peto* (1883); *Haifa* (1887); *Episodes in a Life of Adventure* (1887), and *Scientific Religion* (1888). He died in Twickenham, England, December 23, 1888. W.M.C.



LAURENCE OLIPHANT.

OLIPHANT, MRS. MARGARET O. (WILSON), a British novelist and biographer, and a prolific writer; born in April, 1828, in Wallyford, near Musselburgh, Scotland; died in Wimbledon, June 25, 1897. The first of her numerous works of fiction, which abound, in part, in delightful delineations of Scottish life and character, with other and varied studies of English domestic and social life, appeared in 1849, under the title of *Passages in the Life of Mrs. Margaret Maitland*. This won for its author instant success, and she followed it by a number of other stories, always written in easy, unaffected English, and with a scrupulous regard for conventionalities. The best of her early novels are *Adam Graeme of Mossgray* (1852); *Magdalen Hepburn* (1854); *Katie Stewart* (1856); and *The Quiet Heart* (1856). These are characterized by much delicate and quiet humor, with occasional touches of tender pathos. In 1866 her fame as a novelist was much heightened by the publication, in *Blackwood's Magazine*, of *The Chronicles of Carlingford*, and its pendant, *Salem Chapel*, the latter dealing with English dissent. These were followed by a sheaf of novels in a wide range of fiction, in which Mrs. Oliphant interests without descending to sensation or touching forbidden themes. Her later stories, which were most successful, are *The Perpetual Curate* (1864); *Miss Marjoribanks* (1865); *Agnes* (1866); *John* (1868); *The Laird of Norlaw* (1869); *White Ladies* (1871); *The Cuckoo in the Nest* (1892); *The Second Son* (1888); *He That Will Not When He May* (1880); *The Heir Presumptive and the Heir Apparent* (1891); *Kirsteen* (1890); *The Ladies Lindores* (1883); and *The Marriage of Elinor* (1893). A civil-list pension of £100 was conferred on Mrs. Oliphant in 1868. In addition to her industry as a novelist, she published the following biographies: *Life of Edward Irving* (1862); *St. Francis of Assisi* (1870); *A Memoir of Count de Montalembert* (1872); with monographs on *Dante* and *Cervantes* in the series, which she edited, of Foreign Classics for English Readers. In 1888 appeared her *Memoirs of Principal Tulloch;* in 1891, a *Life of Laurence Oliphant;* in 1893, a study of *Thomas Chalmers;* and in 1896, *Joan of Arc*. She also wrote a work entitled *Royal Edinburgh* (1890), and a series of antiquarian and art volumes, on *The Makers of Florence* (1876); *The Makers of Venice* (1888); and *Jerusalem* (1894). In criticism she produced *The Literary History of England* from *1790 to 1825* (1882); and a continuation, *The Victorian Age of English Literature* (1892). *A Little Pilgrim* (1882), speculations about the unseen world, though published anonymously, is understood to be from Mrs. Oliphant's pen.

MRS. OLIPHANT.

OLIVENZA, a fortified town of Spain, near the Portuguese frontier, 20 miles S.W. of Badajoz. Population, 8,210.

OLIVER, PETER, an American jurist; born in Boston, Mass., March 26, 1713. He graduated at Harvard in 1730; afterward filled several stations in Plymouth County; and in September, 1756, was promoted to the chief-justiceship of the superior court. In March, 1774, the House of Representatives, voting the judges of the superior court sufficient salaries from the Colonial

treasury, ordered them to refuse any gifts from the king. Oliver refused to comply, was impeached, and went to England, where he was pensioned. He was an enthusiastic antiquarian, and carried away with him many valuable records. He died in Birmingham, England, Oct. 13, 1791. E.E.T.

OLIVER OPTIC. See ADAMS, WILLIAM TAYLOR, in these Supplements.

OLIVET, a village of Eaton County, in central southwestern Michigan, 30 miles S.W. of Lansing, on the Chicago and Lake Huron railroad; known principally as having Olivet College (non-sectarian) a co-educational institution organized in 1859, and having in 1904, 24 instructors, 287 pupils and a library containing 29,550 volumes. Population 1900, 800.

OLIVIDÆ, a family of gasteropod mollusks especially abundant in tropical seas. The beautiful oval shells known as olive shells are eagerly sought by collectors. The harp-shells belong to the family. Many species are found in the United States.

OLIVINE GROUP. See MINERALOGY, Vol. XVI, p. 427.

OLLIVIER, ÉMILE, a French statesman; born in Marseilles, July 2, 1825. Having studied law in Paris, he began to practice as an advocate in that city, and by clever pleading established a reputation at the bar, and after 1864 acquired influence as a member of the Legislative Assembly. In 1865 the viceroy of Egypt appointed him to a high judicial office in that country. But he still took an active interest in French politics, and in January, 1870, Napoleon III charged him to form a constitutional ministry. He was displaced after the first reverses in the rash invasion of Germany, and retired to Italy. He wrote *Lamartine* (1874); *Thiers* (1879); *L'Église et l'État au Concile du Vatican* (1879); *Principes et Conduite* (1875); *Nouveau Manuel de Droit Ecclésiastique Français* (1885); *1789 et 1889* (1890). He, in 1872, became a member of the French Academy.

OLMSTED, FREDERICK LAW, an American landscape gardener; born in Hartford, Conn., April 26, 1822. He studied engineering and agricultural science at Yale, and practised farming. He made several tours in Great Britain, the continent of Europe and the southern and southwestern States for purposes of agricultural and landscape study. He embodied the results of some of these tours in *Walks and Talks of an American Farmer; Our Seaboard Slave States; A Journey Through Texas; A Journey in the Back Country; The Cotton Kingdom;* etc. In 1856 he was appointed superintendent of the proposed Central Park, New York, and the following year the plans prepared by Calvert Vaux and himself were accepted, and Mr. Olmsted was appointed architect and chief engineer. He was secretary of the United States Sanitary Commission, 1861–63, and, with his partners, has designed public parks in New York, Brooklyn, Boston, Detroit, Rochester, Niagara Falls, Bridgeport, Trenton, Montreal, Buffalo, Chicago, Milwaukee, Louisville, etc. He died in Boston, Mass., Aug. 28, 1903. E.E.T.

OLNEY, a city in the township of the same name, and the capital of Richland County, southeastern Illinois, about 115 miles from St. Louis, Missouri, 31 miles from Vincennes, Indiana, and 53 miles from Mattoon, Illinois, on the Baltimore and Ohio Southwestern and the Peoria, Decatur and Evansville railroads. It is handsomely built, containing, among other structures of note, a county courthouse, school-building and national bank, ten churches, three flouring-mills, a brass-foundry and woolen manufactory. The city supports three weekly papers. Population 1890, 3,831; 1900, 4,260.

OLNEY, JESSE, geographer, was born at Union, Conn., on October 12, 1798, and became the author of some of the most widely used text-books of the time. His *Geography and Atlas*, published in 1828, revolutionized the methods of teaching geography, and for a generation stood at the head of works of that class. His school reading books, his *Common School Arithmetic* and his *History of the United States*, also had great and well deserved popularity. He published other books, including a volume of poems. He died on July 31, 1872. W.F.J.

OLNEY, RICHARD, an American statesman; born in Oxford, Massachusetts, Sept. 15, 1835. He was graduated from Brown University in 1856, and spent the next three years at the Harvard Law School. He was admitted to the bar of Massachusetts and began the practice of his profession in Boston. He was successful as a lawyer, and took high rank in his state. Beyond holding a seat in the Massachusetts legislature in 1874, he took no part in politics. He was chosen by the Democratic party once as their candidate for attorney-general of Massachusetts, but was defeated in the election. He was made a member of Cleveland's second Cabinet, holding the portfolio of Attorney-General. Upon the death of Secretary of State Gresham, Olney was appointed, June 10, 1895, served until 1897.

RICHARD OLNEY.

OLSHAUSEN, JUSTUS, a German Orientalist; born at Hohenfelde, Holstein, May 9, 1800; from 1823–53 professor at Kiel; in 1853 chief librarian and professor of Oriental languages at Königsberg, and in 1858 a counselor; retired in 1874; died Dec. 28, 1882. He wrote *Pelehwe Legenden auf den Münzen der Letzten Sassaniden; Emendation Zum Alten Testament; Das Lehrbuch der Hebräischen Sprache.* G.A.S.

OLYMPIA, a city and the capital of Washington, and the county seat of Thurston County, in the southwestern part of the state. It lies on a peninsula at the head or southern end of Puget Sound, on the Des Chutes River. It is principally concerned in the lumber industry and

ship-building, being surrounded by fine forests of pine and fir, and having an ample water power and a commodious harbor. The city contains the various state buildings and offices, and is well equipped with schools, libraries and churches, and the general appurtenances of an urban community. It is reached by the Northern Pacific railroad and by steamers on Puget Sound, and had in 1900 a population of 3,863. W.F.J.

OLYMPIADS, periods of time in ancient Greece. See CHRONOLOGY, Vol. V, pp. 617, 618.

OLYMPIAN GAMES. These memorable Panhellenic games, which were abolished by the Emperor Theodosius in A.D. 394, are past beyond restoration, but a reminiscence of them was attempted, April 6–9, 1896, in Athens. The suggestion of reviving these sports came from Baron de Coubertin, a French lover of athletic games, and he was supported by the French Union of Athletic Clubs. The project appealed to Hellenic pride, and rich Greeks in London, Paris and Alexandria gave freely to this purpose. The old Stadium at Athens had been excavated in 1869–1870, and Mr. Averoff of Alexandria bore the cost of its restoration for the purpose of reviving there scenes that his ancestors applauded centuries before at Olympia, in Elis. The Stadium is 656 feet long and 160 wide, and can seat nearly 50,000 persons.

Competitors came forward from Greece, France, Germany, England, Australia and the United States. Of the ancient games, the chariot-races, boxing and wrestling matches were not revived; the foot-races and throwing the discus had the traditions of twenty-six centuries behind them; but vaulting, hurdle-racing, the hop-skip-and jump, fencing and bicycling were contributions of modern athletics to the contest. There were 44 events to come off in four days, and the King presided. It is believed that the games were witnessed by 100,000 persons, many of whom were visitors in Athens. The principal event was a foot-race from the battle-field of Marathon to the goal at the Stadium, a distance of 26.1 miles, over the road taken by the messenger of Miltiades, who reached Athens with breath enough to cry the defeat of the Persians and then fell dead in his tracks. Appropriately, this race was won by Loues, a Greek peasant, who made the distance in 2 hours 48 minutes. It was the only victory that fell to the Greeks, but it was the most notable one. A Princeton student, Robert Garrett, threw the discus 95.6 feet, exceeding by 6 inches the ancient record of Phayllus. Of the other principal contests the Americans carried off the honors for the hop-skip-and-jump, the long jump, the 400-meter race, and putting the weight; a Dane won the first place in weight-lifting; an Australian took the olive wreath for the 1,500-metre-race; while for bicycling and fencing that distinction fell to the French.

The second Olympiad was celebrated at Paris in 1900, the third at St. Louis in 1904, the fourth in Athens 1906, and the fifth at London, in the Olympic Stadium in the grounds of the Franco-British Exposition, from July 13–27, 1908. The Americans carried off the honors for the Marathon race—John J. Hayes; of the 1500 meter race—M. F. Flannagan; the 110 meter hurdle-race—F. C. Smithson; the 400 meter hurdle-race—C. J. Bacon; the relay race of 1600 meter—an American team of 4; of the hammer throw—J. F. Flannagan; for free-style and Greek style discus throw—M. Sheridan; for putting the weight—R. Rose; for standing broad and standing high jump—R. C. Ewery; for running broad jump—F. C. Jones; for running high jump—H. F. Porter; for pole vault—A. C. Gilpert and E. F. Cooke; for 100 meter swim—C. M. Daniels; for wrestling—Geo. Mehnert.

OLYPHANT, a borough of Lackawanna Co., Pennsylvania, eight miles N. of Scranton. It is an important mining-town, and enjoys a large trade connected with the coal business. Population 1900, 6,180.

OMAHA, the county seat of Douglas County, Nebraska, and the chief city of that state, lies on the western bank of the Missouri River, opposite the city of Council Bluffs in Iowa, and a few miles north of the mouth of the Platte River. It is fifty miles northeast of Lincoln, the capital of the state. Omaha first rose into national prominence as the eastern terminus of the Union Pacific railroad, and was greatly exploited during the building of that road by George Francis Train and others. It has ever since maintained its place as one of the greatest railroad centers of the west, among the roads entering it being the Union Pacific, the Missouri Pacific, the Chicago, Burlington and Quincy, the Chicago, Northwestern and Wabash, the Chicago, Rock Island and Pacific, the Chicago, St. Paul, Minneapolis and Omaha, and the Fremont, Elkhorn and Missouri Valley. It is the headquarters of the entire Union Pacific railroad system. The commercial and industrial activities of the city are commensurate with its transportation facilities. Its slaughter and packing houses are second only to those of Chicago, and it is a wheat market of vast proportions. The census of 1900 showed it to contain 837 manufacturing or other industrial establishments, with a capital of more than $34,200,000, a yearly output valued at more than $42,900,000, an army of 7,422 employees, and a pay roll of $3,755,816 a year. There are many fine business buildings, rivalling in size those of the largest cities. The social, educational and religious interests of the city have been cared for commensurately with its material development. It has numerous churches, representing nearly all important bodies. It has seven public libraries, an institution for the instruction of the deaf and dumb, and is the seat of Creighton University, a large Roman Catholic institution founded in 1878, and several other seats of learning of high academic rank. There is an extensive and well planned park and boulevard system, and a large rural cemetery, known as Forest Lawn, at the northwest corner of the

city. The population of Omaha in 1900 was 102,555. W.F.J.

OMAHAS. See INDIANS, Vol. XII, p. 871.

OMAN, DISTRICT OF. See ARABIA, Vol. II, pp. 207, 208.

OMAR PASHA, a Turkish general; born in Plaski, Croatia, in 1806. His father was an Austrian officer. The son, under his proper name, Mikail Lattas, served for a time in the Austrian army. To escape punishment for some breach of discipline, he fled to Turkey, and there, having embraced the Moslem faith, changed his name to Omer. He became connected with the households of several high officials, and was made tutor to the heir apparent to the Turkish throne. He was advanced rapidly in rank and position, was made Pasha in 1843, and given command of the army in Armenia and Bosnia. He was at the head of the Turkish forces against the Russians in 1853–56, and was successful in every battle, with the exception of Kars. He was afterward governor of Bagdad, and put down the rebellion of the Montenegrins in 1862. Died April 18, 1871.

OMAYYADS, a Turkish dynasty. See MOHAMMEDANISM, Vol. XVI, pp. 588–600.

OMBAY OR ALLOR, Dutch East Indies, an island in the chain of the Malay Archipelago between Pantar and Wetta islands, on the east, and separated from Timor on the south, by Ombay Pass. The island is 60 miles long with a maximum width of 20 miles, and partakes of the volcanic, mountainous, and other characteristics of the archipelago and region. Allor on the northwest and Bailoko on the south are the principal Dutch trading settlements on its shores. Population, 105,000. C.L.S.

OMDURMAN, town in Egyptian Sudan (opposite the site of Khartum), founded in 1886 by the Khalifa, who razed Khartum to the ground and removed its population to this place. It was captured by Lord Kitchener (q. v., in these Supplements) after the battle of Omdurman, Sept. 2, 1898. Population about 60,000.

OMMANNEY, SIR ERASMUS, a British admiral; born in London in 1814. He entered the navy in 1826; in 1837 served against Portugal and at the battle of Navarino; was with James Ross in the Arctic expedition of 1835; became commander in 1840. As captain, he was one of the government relief committee during the Irish famine of 1846; and in 1850 went with Austin on the Franklin search expedition, and was the first to discover traces of the lost ships. He was deputy controller of the British coast guard until 1854, and in 1854–55 was commander of the White Sea and Gulf of Riga squadrons in the war with Russia. He was made rear-admiral in 1864, and knighted. He soon retired and devoted himself to astronomical study. Died at Portsmouth, Eng., Dec. 21, 1904.

OMNIBUS, STEAM. See AUTOMOBILE VEHICLES, in these Supplements.

ON, an ancient Egyptian city, also called Heliopolis. See EGYPT, Vol. VII, p. 667.

ONAGER OR KOULON, a wild ass of Central Asia. See Ass, Vol. II, p. 626.

ONATE, JUAN DE, a Spanish explorer and colonial governor; born in Guadalajara, Mexico, about 1555. He was a son of the founder Guadalajara and married a granddaughter of Cortes. In 1595 permission was granted him by Velasco to colonize the district north of the Rio Grande but he was not given full power as governor until 1598. He then set out on his expedition with a large force of soldiers and Indians. He crossed the Rio Grande River and founded San Juan, the first capital of New Mexico. During the next ten years the colony prospered and Onate made numerous expeditions into Arizona. He died in San Juan, New Mexico, in 1611. W.M.C.

ONAWA, a town and the county seat of Monona County, Iowa, in the center of the western border of the state. It lies in the agricultural region between the Little Sioux and Missouri rivers, and is reached by the Chicago and Northwestern and Illinois Central railroads. Its population in 1900 was 1,933. W.F.J.

ONCHIDIUM, a genus of air-breathing gasteropod mollusks, found in warm regions. Some species are terrestrial, others aquatic. An Indian species which lives on the shores between tidemarks is of great interest because of the condition of the eyes. These are scattered over the whole upper surface, and in their structure and development closely resemble the vertebrate eye.

ONEIDA, a village of Madison County, New York, in the central part of the state. It is five miles southeast of Oneida Lake and twenty-seven miles east of Syracuse, is reached by the New York Central and Hudson River and New York, Ontario and Western railroads, and had in 1900 a population of 6,364. W.F.J.

ONEIDA INDIANS. See INDIANS, Vol. XII, pp. 867, 871; and IROQUOIS, in these Supplements.

ONEIDA LAKE, a fine sheet of water in the north-central part of New York state, bounded by and forming parts of Oneida, Madison, Onondaga and Oswego counties. It is twenty miles long from east to west, and five miles wide from north to south. W.F.J.

O'NEILL, a village and capital of Holt Co., N.E. Nebraska, 38 miles S.W. of Nebraska City on the Fremont, Elkhorn and Missouri Valley and the Sioux City, O'Neill and Western railroads; has railroad repair-shops. The district is devoted to agriculture and stock-raising. Pop., 1900, 1,107.

ONEONTA, a village of Otsego County, New York, in the central part of the state. It is nineteen miles south by west from Cooperstown, in an agricultural region of great fertility and beauty, and is reached by the Delaware and Hudson Canal Company's railroad. It is upon the upper part of the Susquehanna River, which affords it a water supply, and it has some manufacturing industries. It is the seat of a state normal school. Its population in 1900 was 7,147. W.F.J.

ONION. See HORTICULTURE, Vol. XII, p. 297.

ONOMASTICON. See POLLUX, JULIUS, Vol. XIX, p. 417.

ONONDAGA INDIANS. See INDIANS, Vol. XII, pp. 867, 871; and IROQUOIS, in these Supple'ts.

ONONDAGA LAKE, in Onondaga County, two miles N.W. of Syracuse; about five miles in length and one mile wide, its greatest depth being 65 feet. It lies in an ancient and deep excavation in the Onondaga salt group; in the vicinity of this lake are the most productive salt-springs of the United States. Its waters pass by a short outlet to Seneca River.

ONTARIO. In the Canadian Dominion, the province of Ontario (formerly called Upper Canada) holds the chief place, since it is the wealthiest and most populous province, and the most progressive of the commonwealths within the Confederation. Its area is 222,000 square miles, of which only the south-eastern portion as yet is populated. This is the region bounded on the north and east by the St. Lawrence and the Ottawa rivers, and on the south and west by Lakes Ontario, Erie and Huron, with its inland expanse of the Georgian Bay. Within this area the population of the province (which, in 1901, was 2,182,942) is mainly to be found; the remainder being sprinkled along the lines of sparse settlement in the wilderness extension of Ontario, westward to the Lake of the Woods, and northward to the Albany River and James's Bay. The physical aspect of Ontario is unmarked, save for its abounding water. Nowhere do the elevations exceed one thousand feet, and this chiefly along the Laurentian ridge (locally known as the "Height of Land"), that trends northwestward from Labrador, and back of the older and settled portions of the province. South of this ridge, which forms the watershed of the region, the rivers drain into the St. Lawrence system; north of it, they drain chiefly into Hudson Bay. The eastern and southern portions of Ontario, which include the rich and fertile peninsula surrounded by the lakes, is divided, for municipal and electoral purposes, into 42 counties. This is the region of agricultural operations and cognate pursuits, and of the industries that contribute to the commerce and consequent wealth of Ontario. The larger and newer area of the province, lying to the north and west of the more compact and organized section, is divided into six provisional districts, known as Muskoka, Parry Sound, Nipissing, Algoma Thunder Bay, and Rainy River. Here, chiefly, the lumberman and miner find their field of exploits,—the region, so far as it has been surveyed, being rich in arboreal and mineral wealth. The winter in this northern latitude is long, and as a rule severe, and there is usually a heavy snowfall. At Port Arthur, at the head of Lake Superior, and 610 feet above the sea, the mean temperature in summer is 55°, and in winter 9°. At Ottawa City the summer average is 65° and the winter 15°, while at Toronto, the provincial capital on Lake Ontario, the summer average is 64° and the winter 24°.

The climate in the Ontario peninsula is very favorable for farming, cattle-raising, and the growing of the hardier grain and root crops. Horses and cattle thrive well in this region of the province, and find rich pasture. The area of occupied land is in the neighborhood of twenty-three million acres, about half of which is cleared. A little over eight million acres of the cleared land was, in 1894, under crop, while two and three quarter million acres were under pasture, and close upon two hundred thousand acres were in gardens and orchards. In 1900 the cultivated acreage was mainly given to oats, hay, clover, peas, and barley. Wheat (chiefly fall wheat) was raised from a million acres; but of recent years wheat in Ontario has been a precarious and unremunerative crop. In the same year there were about eight million acres in woodland. The yield, in bushels, of the chief field crops was, for 1900, as follows: Wheat, 30,000,000; oats, 90,000,000; barley, 17,000,000; peas, 14,000,000; turnips, 59,000,000; potatoes, 21,500,000; corn (for husking), 27,000,000; mangel-wurzels, 24,700,000. The yield of hay and clover for the same year was 3,500,000 tons. This cereal yield, though it is eclipsed by Manitoba, and by a number of the grain-growing Western states of the Union, is, on the whole, a fair showing, and is better than the yield in such states as New York and Pennsylvania, while the average yield per acre is higher. Cheese-making, as has been said in the statistics of the Dominion, is a large and profitable industry in Ontario. The number of factories operated in the province in 1899 was 1,203 the average output per factory, for the year, being over one hundred thousand pounds. The cheese sales averaged, for 1899, $9.83 per 100 pounds.

Ontario has a prosperous showing in the raising and annual sales of live-stock. The value of horses of all kinds in the province, for the year 1899, was close upon $39,000,000, while the yearly sales average eight per cent of the total. The province owns, in value, about $50,000,000 worth of cattle, of which the annual sales aggregate over $15,000,000. The value of sheep owned in the province, for the same year, exceeded $6,500,000, and the sales netted over $2,500,000. The sales of hogs for the year returned nearly $12,000,000. Of poultry (turkeys, geese and other fowls), $1,131,923 worth were sold in the year 1899, out of a total value of nearly $2,578,000 owned in the province. The net amount realized from sales of live-stock of all kinds for the year 1899 was, for the entire province, about $38,000,000, the average per head being as follows: Horses, $72; cattle, $30.00; sheep, over one year, $5.01; under one year, $3.15; hogs, over one year, $12.23; under one year, $3.92; turkeys, 65 cents; geese, 57 cents. A considerable revenue is raised in the province from wool, the clip for the year 1899 being nearly 6,000,000 pounds. Bee-culture is also a profitable industry in Ontario, while a large sum is derived annually from the apple and grape crops.

The statistics of the province show a decline, in recent years, in the value of farm property, including farm-lands and live-stock, though there is an increase in the value of buildings and implements. The estimated total value of all farm property, including lands, buildings, implements and stock throughout the province, was, in the year 1899, $947,513,360. The average value of farm-land in the province, per acre occupied, was, in 1894, $25.49; in 1883 it was $30.56.

The mineral wealth of Ontario, now that lumbering has receded and become less profitable, is at last in a fair way to be developed. The provincial

government has established a bureau of mining, and issued a report of the labors of a royal commission, appointed to inquire into the mineral resources of Ontario and to suggest measures for their development. The report confirms the conclusion already reached by prospectors, that the province contains almost all of the economic minerals in workable quantities, except coal, and "that it has vast possibilities of mineral wealth." The drawbacks to the development of that wealth are the want of access to a near and free market, the lack and great cost of machinery, and the absence of facilities for cheap transportation. Despite the unfavorable economic conditions, much has been attempted by the province in prospecting regions rich in ores, especially the Sudbury district, north of Lake Nipissing, where copper and nickel mines are already being worked, and the silver district west of Port Arthur. So far as the province has been examined by experts, there is conclusive evidence of the abundance, in the central and eastern counties, of magnetic and hematitic iron ores, gold, galena, plumbago, arsenic, mica, fibrous serpentine, apatite, granite, marble and freestone. Along the north shore of Lake Huron, from the mouth of the French River to Sault Ste. Marie, gold and silver bearing veins, iron, copper, galena and immense quarries of marble have been discovered. Other parts of the province are also rich in a great variety of valuable ores. American and Canadian mining companies are, in many promising sections, beginning operations, while a Welsh mining corporation, with large capital, has already got to work. Already the mineral yield for one year has reached six million dollars: of which one-third was expended for labor.

The trade of Ontario grows apace. It has received, of late, moreover, a considerable impulse in the opening up of the Northwest. Manufactures, taking advantage of cheap labor and the abundant water-power of the province, have sprung up extensively along the St. Lawrence, around the lakes and on the larger waterways of the peninsula. These include ship-building, woolen and cotton products, edged tools, stoves, agricultural implements and machinery of all kinds, tram and car building, woodenware, doors and window sashes, and furniture, organs, pianos, trunks, leather goods, boots and shoes, etc. Many of these articles are exported largely to foreign and other colonial markets. The exports of the province can only approximately be given, for the reason that much of the volume of shipments pass through the seaports of Quebec and the maritime provinces, where they are recorded in Dominion rather than in provincial statistics. It is estimated, however, that the annual exports of Ontario amount to $71,000,000 and the imports to $56,000,000. Of the 38 banks making returns to the Dominion government in 1899, 12 of them are Ontario institutions and have their head offices within the province, with a capital bordering on $20,000,000. There were, in 1899, 95 loan and investment companies and building societies doing business in the province, with an aggregate capital and reserve fund of $109,500,000 and total assest of $137,500,000.

The Dominion census of 1901 gives Ontario a population of 2,182,942; the municipal assessors place the figures, for the same year, at 1,922,121, with a gross property assessment of the value of $819,000,000. The population is distributed thus: In townships, 1,116,347; in towns, 296,675; in villages, 128,634; and in cities, 386,465. The cities, twelve in number, are as follow, the population being that estimated for the year 1901. Toronto (the capital of the province), 208,040; Ottawa (the capital of the Dominion), 59,928; Hamilton, 52,634; London, 37,981; Kingston, 17,961; Brantford, 16,619; Belleville, 9,117; Guelph, 11,496; St. Catharines, 9,946; Stratford, 9,959; St. Thomas, 11,485; Windsor, 12,153. Classified by religions, the provincial returns show that 647,518 were Methodists, 452,712 Presbyterians, 385,999 Church of England, 358,330 Roman Catholics, 96969 Baptists and 72,228 were Lutherans, Congregationalists and members of the Salvation Army.

Toronto is the seat of the provincial government and High Courts of Justice. The affairs of the province are administered by an executive and Legislative Assembly, or Parliament, with a lieutenant-governor, who is advised by the executive, or cabinet, composed of eight members. The constituencies are represented in the local legislature by 94 members, including the executive, who are responsible to the legislature, which meets annually. The province is represented in the Dominion or Federal Parliament by 24 members in the Senate, appointed by the crown, and by 92 members in the House of Commons, elected by the people. Unlike the other provinces of the Dominion, Ontario has no public debt, if we except a subvention in aid of local railways, amounting to $3,135,000, payable within forty years. Instead of a debt, the province has assets of the value of $5,700,000 in investments, bank balances, and debts (bearing interest) due it by the Dominion. The financial expenditure of the province for the year 1900 was $4,003,729, and the receipts were $4,192,940. The chief sources of the revenue are the receipts from crown lands and the annual Dominion subsidy, the province's proportion of the excise and customs levies.

Beside the expenditure by the legislature for the maintenance of hospitals and charities and the administration of justice, Parliament appropriates nearly $700,000 annually for the purposes of education. This, of course, is in addition to the sum (close upon $4,500,000 annually) raised by local assessment as a school tax. The number of schools in the province, in 1899, was 6,006, with an average attendance of 269,090 and a staff of 9,333 teachers, two-thirds of whom were women. There were also 352 separate (Roman Catholic) schools, with 41,800 pupils, and a staff of 660 teachers. The province also maintains, besides two normal schools and a number of county model schools, 128 secondary schools for higher education, of which 35 are collegiate institutes. In the latter there is an average attendance of 13,500, with 570 teachers. At the head of the educational system stands the National University (Toronto University and College). It is undenominational, and has affiliated with it a number of theo

logical colleges, schools of law, medicine, science, music, dental surgery and pharmacy. The other provincial colleges are Queen's (Presbyterian), at Kingston; Victoria (Methodist); Trinity (Episcopal); Wycliffe (Episcopal); McMaster (Baptist); St. Michael (Roman Catholic); and Upper Canada College (Boys' Resident), at Toronto.

ONTARIO, FORT, a fortification at the mouth of the Oswego River, on the eastern bank, near Oswego, New York. It guards the river mouth and the entrance to the harbor. This fort was built by the British in 1756, and was captured by the French under Montcalm that same year. The fort was burned by the French, but rebuilt by the British later, and was the last fortress to be surrendered by the British at the close of the Revolution.

ONTARIO, LAKE. See ST. LAWRENCE, Vol. XXI, p. 189, and Vol. XIV, p. 218.

ONTOLOGY. See METAPHYSIC, Vol. XVI, pp. 85–104.

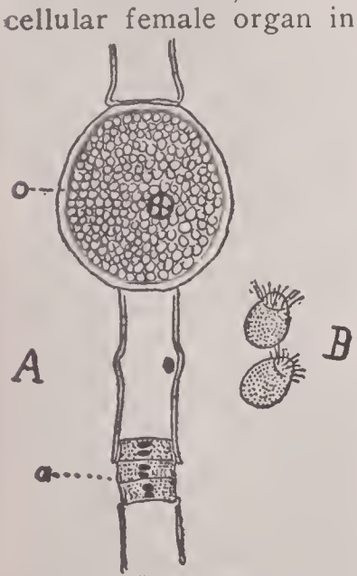
ONTONOGAN, a village and the capital of Ontonogan County, Northern Michigan, forty miles W. of Keenewaur Bay, on the Ontonogan River, and on the Chicago, Milwaukee and St. Paul railroad. It has a copper-smelting furnace, a grist-mill, two steam saw-mills and a cigar factory. Copper is the chief article of export, and is mined about 15 miles from here. Population 1900, 1,267.

ONYCHOTENTHIDÆ. See MOLLUSCA, Vol. XVI, p. 695.

ONYX MARBLE. See MARBLE, Vol. XV, p. 536.

OÖGAMY, a botanical term to denote that the sexual apparatus of a plant consists of the female organ known as the *oögonium*, which contains an *oösphere* (the female gamete) that is fertilized by the male gamete. Oögamy is characteristic of certain algæ and fungi, and is distinguished in the same groups from *isogamy*, in which the gametes are alike, and *carpogamy*, in which the female organ contains no organized oösphere, and is therefore not an oögonium. (See OÖGONIUM in these Supplements.)

OÖGONIUM, a botanical term to denote a unicellular female organ in which a female gamete (*oösphere*) is differentiated. Oögonia are present in certain algæ and fungi, and in them the process of fertilization takes place. In the accompanying figure, A represents a portion of the filament of *Œdogonium*, a common green alga. One of the cells (o) has developed into an oögonium, which contains a single large oösphere (female gamete) which completely fills it. Another region of the filament (a) has divided up into three short cells, each of which is a male organ (*antheridium*) in which is developed the male gametes (*spermatozoids*). B represents two zoöspores, or swimming spores, from the same filament, each of which has the power of producing a new filament, but which has no connection with the sexual work. See MORPHOLOGY in these Supplements.



OÖGONIUM.

OÖLITIC LIMESTONE. See GEOLOGY, Vol. X, pp. 314–317; and BUILDING, Vol. IV, p. 420.

OÖRI, a river of southeastern Africa, which has its source in the heart of the Transvaal, between Pretoria and Potchefstrom, describes a huge curve to the north and joins the Indian Ocean a little north of Delagoa Bay. Its course exceeds eight hundred miles, and it has numerous tributaries, the most important being the Olifant, from the right. It has been ascended fifty miles by steamboat, but its upper reaches are obstructed by rapids and falls.

OÖSPHERE, a botanical term applied to the female sex-cell, or gamete, which is fertilized by the male cell. It is usually developed in distinct female organs (oögonia and archegonia). See ARCHEGONIUM and MORPHOLOGY, in these Supplements.

OÖSPORE, a botanical term applied to the cell which results from the fertilization of an oösphere, is the first cell of a new generation, and in the case of alternate generations, the first cell of the sporophyte. See also MORPHOLOGY in these Supplements.

OOSTERHOUT, a town in North Brabant, Holland, six miles N.E. of Breda. It contains sugar factories, tanyards, breweries and potteries. Population, 10,911.

OPACITE, a name given by petrologists to minute black, opaque, amorphous aggregates, grains and patches of indeterminate mineral matter, which are seen in many igneous rocks when these are viewed in thin slices under the microscope. Opacite is probably, in most cases, hematite, limonite, magnetite, or other iron oxide, and is a product of the chemical alteration of one or other of the original mineral constituents of the rock in which it occurs.

OPELIKA, a city and the county seat of Lee County, Alabama, at the center of the eastern border of the state. It is in a cotton-growing and agricultural region, and is an important railroad center, being reached by the Central railroad of Georgia, the Western railroad of Alabama and the Atlanta and West Point railroad. Its population in 1900 was 4,245. W.F.J.

OPELOUSAS, a town and the parish seat of St. Landry Parish, Louisiana, in the south-central part of the state. It is 122 miles from New Orleans, on the Southern Pacific railroad, and had in 1900 a population of 2,951. W.F.J.

OPEN-HEARTH STEEL. See IRON AND STEEL, in these Supplements.

OPERA, a musical drama. See MUSIC, Vol. XVII, pp. 93–95, 99, 101, 102, 105, 106; and MUSIC IN AMERICA, in these Supplements.

OPERA-GLASS. See TELESCOPE, Vol. XXIII, p. 151.

OPERATIVE SURGERY. See SURGERY, AMERICAN, in these Supplements.

OPHIDIA. See SNAKES, Vol. XXII, pp. 199–210.

OPHIDIIDÆ, a family of fishes. See ICHTHYOLOGY, Vol. XII, p. 730.

OPHIOCEPHALIDÆ, a family of fresh-water

fishes peculiar to Asia. These fishes possess an accessory chamber which retains water to moisten the gills. They breathe air direct, and are able to remain out of water for a long time. They are known as walking-fishes, because of their habit of traveling across land. During droughts they burrow in the mud Their usual habitat is the shallows near the shores. Some species are edible.

OPHIOGLOSSACEÆ, one of the families of ferns, often known as the adder's-tongue family, and composed of rather small ferns, with sessile globular spore-cases (sporangia), opening transversely, and without the ring (*annulus*) found in the ordinary ferns. There are three known genera, *Botrychium*, with sterile part of the frond compound and sporangia in compound spikes; *Ophioglossum*, with sterile part of the frond mostly simple, and the sporangia in a simple spike; and *Helminthostachys*, a genus of the Oriental tropics, with but a single species. The species of *Botrychium* are known as moon-worts; those of *Ophioglossum* as adder's-tongues.

OPHITES. See GNOSTICISM, Vol. X, pp. 626, 627.

OPHITIC STRUCTURE. Same as *Diabase Structure*, in GEOLOGY, Vol. X, p. 210.

OPHIURIDEA, an order of star-fishes. See ECHINODERMATA, Vol. VII, pp. 549, 550.

OPHTHALMOSCOPE. See OPHTHALMOLOGY, Vol. XVII, pp. 808, 809.

OPISTHOBRANCHIA, an order of gasteropodous mollusks, opposed to PROSOBRANCHIA; q.v., in these Supplements, and see MOLLUSCA, Vol. XVI, pp. 679, 684.

OPISTHOCOMI, a group of birds, equivalent to the *Heteromorphæ* of Huxley. The group contains the single genus *Opisthocomus*. This genus has one species, the hoactzin of South America. A full account of this interesting bird may be found under HOACTZIN, Vol. XII, p. 30.

OPPERT, JULIUS, Assyriologist and Orientalist, was born in Hamburg of Jewish parents, on July 9, 1825, and was educated at Heidelberg, Bonn, Kiel and Berlin. He served as professor of German in several French colleges, and was sent with a government expedition to Mesopotamia. In 1857 he was made professor of Sanskrit at the Imperial Library, and in 1869 a professor in the College of France. He developed a masterly plan for deciphering cuneiform inscriptions, which he laid before the Institute of France, and for which the institute awarded him the grand prize of $4,000. His works, of the highest rank in Oriental scholarship, include *Assyrian Studies* (1859–64); a *Sanskrit Grammar* (1859); a *History of the Empires of Chaldea and Assyria from the Monuments* (1866); *Babylonia and the Babylonians* (1869); *The People and Language of the Medes* (1879), and *Mythological Fragments* (1882). Died Aug. 21, 1905. W.F.J.

OPPOLZER, THEODOR, an Austrian astronomer; born in Prague, Austria, Oct. 26, 1841. He established a private observatory in Vienna in 1865. He is known by two works, *The Determination of the Paths of Planets and Comets* (1870–80) and *The Law of Eclipses* (1887). The latter includes a catalogue of eclipses of the sun, both annual and total, between 1200 B.C. and A.D. 2160. He died Dec. 26, 1886.

OPTIC, OLIVER, the pseudonym of ADAMS, WILLIAM TAYLOR; q.v., in these Supplements.

OPTIMISM. See PESSIMISM, Vol. XVIII, pp. 698–704.

OQUIRRH MOUNTAINS, a range in Utah, which forms the boundary of the counties of Tooele and Utah, and extends from the south end of the Great Salt Lake in a southerly direction. It abounds in carboniferous limestone and quartzite, and is the locality of some of the most productive silver-mines that have yet been exploited in this country.

ORANGE, a village of Orange township, Franklin County, northwestern Massachusetts, on Miller's River, 15 miles E. of Greenfield, on the Fitchburg railroad. It is the seat of a variety of manufactories. Population 1900, 5,520.

ORANGE, one of the chief residential cities of New Jersey, lies in Essex County, in the northeastern part of the state, just west of the larger city of Newark and within the "metropolitan district" of New York. It serves as a semi-suburban home for thousands of New York and Newark business men. It is reached by the Erie and the Delaware, Lackawanna and Western railroads, and by numerous electric roads Among its public and semi-public institutions are numerous schools and high schools, a public library, a memorial hospital, a Masonic Temple, and buildings for the Young Men's and Young Women's Christian Associations. Its population in 1900 was 24,141. See Vol. XVII, p. 836. W.F.

ORANGE OR GARIEP, the largest river of South Africa. It rises in the Kathlamba Mountains, in the east of Basutoland, and flows west, with an inclination to the north, to the Atlantic Ocean. It describes numerous wide curves in its course of 1,000 miles, and separates Cape Colony on the south from the Orange Free State, Griqualand West, Bechuanaland and Great Namaqualand, on the north. Area of basin, 325,000 square miles. Its volume varies greatly between the dry season, when it is not navigable, and the rainy season, when it overflows its banks in the upper parts of its course. Its mouth, moreover, is obstructed by a bar, and its chief affluent is the Vaal.

ORANGE, FREE STATE OF (now Orange River Colony). See AFRICA, Vol. I, p. 242; CAPE COLONY, Vol. V, p. 41; and ORANGE RIVER FREE STATE, Vol. XVII, p. 837. For late information, see AFRICA and BOER WAR, in these Supplements.

ORANGEBURG COURTHOUSE, a village and the capital of Orangeburg County, in central South Carolina, 50 miles S. of Columbia, on the Atlantic Coast Line and the South Carolina and Georgia railroads; manufactures cotton goods, rice and wagons; has several educational institutions, including Claflin University (non-sectarian), a co-educational institution for the use of colored students, founded in 1869, which had, in 1907 42 instructors, 600 students and a library containing 6,000 volumes. The State Agri-

cultural College is also here. Population Orangeburg City 1890, 2,964; 1900, 4,455.

ORANGE CITY, a town and the county seat of Sioux County, Iowa, in the northwest part of the state. It lies on the Floyd River, forty miles north by east from Sioux City, and is reached by the Chicago and Northwestern railroad. Its population in 1900 was 1,457. W.F.J.

ORANGE-OIL. See ORANGE, Vol. XVII, p. 835.

ORANG-OUTANG. See APE, Vol. II, p. 130.

ORATORIANS. See MONACHISM, Vol. XVI, pp. 739, 742.

ORBIGNY, ALCIDE DESSALINES D', a French explorer and scientist; born near Paris, September 6, 1802. He was educated at the College of Paris and at the age of twenty-four headed an exploring expedition to South America. He returned to Paris in 1834, but made a subsequent visit to Brazil. He was appointed professor of palæontology at the Paris Museum of Natural History in 1856. He was a contributor to the *Universal Dictionary of Natural History* and also published *Travels in South America* (1847), and the *Palæontology of France* (1854). He died in Pierrefitte, France, June 30, 1857. W.M.C.

ORCEINE. See ARCHIL, Vol. II, pp. 331, 332.

ORCHARD PRODUCTS IN THE UNITED STATES. See AGRICULTURE, in these Supplements.

ORCHARDSON, WILLIAM QUILLER, a Scottish *genre* painter; born in 1835, in Edinburgh, where subsequently he studied under Scott Lauder at the Trustees' Academy. Among his works are *An Old English Song* (1863); *Scene From Shakespeare's Henry IV.* (1868); *On the Grand Canal* (1871); *The Queen of the Swords* (1877); and *A Social Eddy* (1878).

ORCHIDS, the common name of plants belonging to the family *Orchidaceæ*, an immense family of monocotyledonous plants, variously estimated to contain from 6,000 to 10,000 species. Most of the species are tropical, occurring especially as epiphytes on trees or in rock crevices. The orchids of the temperate regions are all terrestrial plants. Their very striking, irregular flowers, of the most bizarre forms, and with extremely showy coloration, elaborately adapted to the visits of insects for the purposes of cross-pollination, have made them much prized as ornamental plants.

ORCINE. See ARCHIL, Vol. II, pp. 331, 332.

ORD, EDWARD OTHO CRESAP, an American soldier; born in Cumberland, Md., Oct. 18, 1818. He graduated at West Point in 1839 and was assigned to the artillery. He served in the Seminole war, and in 1847 was ordered to California and was stationed at Monterey. He took part in the Rogue River expedition in 1856, commanding in several battles with the Indians, and in the Spokane River expedition in 1858. In 1859 he was stationed at Fortress Monroe, and in 1861 was commissioned brigadier-general of volunteers and in 1862 major-general of volunteers. He was severely wounded in the battle of the Hatchie, and on his recovery was assigned to command the 18th Army Corps before Vicksburg. He was also engaged in the capture of Jackson, Miss.; took part in the movements before Petersburg; and was again wounded in the assault on Fort Harrison. In 1865 he commanded the Army of the James, and participated in the operations against Richmond and in the historic scene of Lee's surrender at Appomattox Court House. After the conclusion of the war he commanded successively the Departments of the Ohio, of Arkansas, the fourth Military District, of California, the Platte, and of Texas. He retired in 1881 with the rank of major-general in the United States Army. He died in Havana, Cuba, July 22, 1883. E.E.T.

ORDER, in natural history, a group inferior to *class* and *sub-class*, but superior to *family*, *genus*, etc. The term *natural order* was used in botany formerly to express genuine relationship in contrast to purely artificial grouping, but all orders now recognized are supposed to be more or less "natural."

ORDERS, RELIGIOUS. See MONACHISM, Vol. XVI, pp. 724–742.

ORDINATION. See ORDERS, Vol. XVII, p. 844.

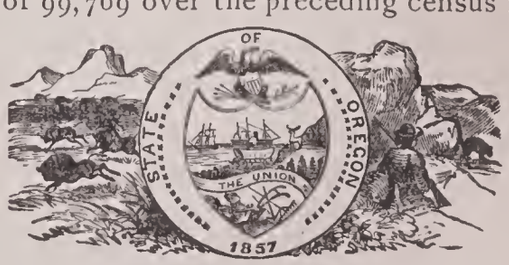
ORDNANCE AND ORDNANCE DEPARTMENT. See ARTILLERY and GUN-MAKING, in these Supplements.

ORDNANCE SURVEY. See SURVEYING, Vol. XXII, pp. 747–748.

ORDOVICIAN, a name sometimes given to a geological formation intermediate between Cambrian and Silurian; otherwise accounted the Lower Silurian strata. It is so called from the Ordovices, an ancient British tribe. See *Lower Silurian*, under GEOLOGY, Vol. X, pp. 293, et seq.

ORDWAY, JOHN MORSE, educator, was born at Amesbury, Mass., on April 23, 1823, and was graduated from Dartmouth College in 1844. For fifteen years he was professor of industrial chemistry and metallurgy in the Massachusetts Institute of Technology, and for a part of that time was also an instructor in Boston University. For thirteen years thereafter he was a professor in Tulane University, New Orleans, and he is now professor of biology in the H. S. Newcomb College of that university. W.F.J.

OREGON had a population in 1900 of 413,536, a gain of 99,769 over the preceding census return.



STATE SEAL OF OREGON.

The area of Oregon is 96,030 square miles, of which 1,470 are water surface. The density of population is 4.4 to the square mile, according to the census of 1900. In 1900, the two cities of the state having a population of 8,000 and over had 98,807 residents constituting 23.9 per cent of the entire number of inhabitants. Of the citizens of the state, 232,985

were males and 180,551 were females; 84.1 per cent were native-born; 1,105 were negroes, a decrease of 81 since 1890; 10,397 were Chinese; 2,501 were Japanese; and 4,951 were civilized Indians. A state census taken in 1895 gave the population at 362,762.

Agriculture. The soil of Oregon is fertile, and throughout that part of the state lying west of the Cascade Mountains and in the northern section lying east of them the rainfall is adequate for crops. In the central and southeastern portions of the state irrigation is generally necessary. By the census of 1900 the area devoted to cereals was 1,222,644 acres, which produced 23,225,381 bushels of grain. Of the total area devoted to the cereals, 71.4 per cent was in wheat, 21.4 per cent in oats, 4.9 per cent in barley, 1.4 per cent in corn, rye and buckwheat, in the order named; 873,379 acres were devoted to wheat, the crop amounting to 14,508,636 bushels. The oat crop was abundant, the amount raised being 6,725,828 bushels; the barley crop amounted to 1,515,150 bushels. The number of farms (1900) was 35,837, an increase from 25,530 in 1890; the number of acres in farms increased within the period mentioned from 6,909,888 to 10,071,328, and the total value of lands, buildings, farm implements, machinery and live-stock from $143,024,800 to $172,761,287. Horses increased from 224,962 in 1890 to 261,794 in 1900; neat cattle from 520,648 to 577,600; milch cows from 114,156 to 122,447; swine from 208,259 to 281,406, and sheep from 1,708,312 to 1,961,355. The clip of wool also advanced from 9,982,910 to 18,349,660 pounds. Almost 732,000 acres were devoted to hay; approximately, 3,761,367 bushels of Irish potatoes were produced; more than 14,675,577 pounds of hops were raised; and the crop of pulse was in excess of 32,000 bushels.

The country west of the Cascades is adapted to dairying. The generous amount of moisture and mild temperature result in continuous green and luxuriant grasses. Cereals, hay, fruits, vegetables and berries flourish near the coast, and in the extreme southern part of the state, Curry County, figs, olives and other semi-tropical products are successfully grown. In the great Willamette valley every product known to the temperate zone can be produced. The valley is a great storehouse of agricultural wealth. Fruits grow to perfection, especially prunes, pears and apples, while root crops and vegetables thrive abundantly. Horses, sheep and swine all find the section adapted to their increase; the wool produced is of excellent quality. The wheat raised in this valley commands the highest market prices for the grain. Other portions of the state, as, for example, the Umpqua and Rogue River valleys, are essentially fruit-raising sections. Prunes, pears, peaches, plums, grapes, berries, melons and apples all do well. East of the Cascades many of the leading fruits are raised, with the aid of irrigation, in the river valleys, especially along the Columbia. Back from the valleys the great wheat-fields spread in all directions, while farther removed the stock-ranges begin.

Manufactures. According to the census of 1900, Oregon had 3,088 manufacturing industries, in which the capital invested amounted to $33,422,393, the number of persons employed to 17,236, their annual wages to $8,333,433, and the total output to $46,000,587. Leading among the industries were car and general shop construction, $1,026,169; fish, canning and preserving, $1,788,809; flouring and grist-mill products, $6,364,023; printing and publishing, $1,078,337; woolen goods products, $937,824; lumber and timber products, exceeding in value $10,000,000; slaughtering and meat-packing, wholesale, $1,638,480. The largest showing made by any county in the state was that of Multnomah, value of products (1900), $24,750,579.

Fisheries. In the twelfth decennial census the value of the fish products of 1900 was given at $3,027,971. Since that date great advances have been made in the industry, legislative action has been invoked for the preservation of the fish and the regulation of the industry, and much additional capital has been invested in canneries. The census reports show 2,832 persons employed, capital to the amount of $913,427 invested, and products amounting to $1,176,936. This did not include the products of the salmon canneries, which were included among the manufactured products. The business has been increased from the figures given above, until, in 1901, the total value of the fisheries of the state were, approximately, $3,200,000.

Minerals. The census reports of 1900 give the total value of the mineral products of 1899 at $2,515,114. Some iron ore is produced but not in large quantities. The gold output was $1,715,762, and the silver $91,500. The value of the different mining-plants was $15,151,203, the expenditures aggregated $1,604,781, and the wages paid were $909,001. Rich deposits of lead, copper, cinnabar and coal are found in many portions of the state, and in Douglas County is the richest deposit of nickel thus far exposed in the United States. In Morrow County fine opals occur, and on the sea beach agates, jaspers, carnelians, jades and chalcedonies are found in abundance and of fine quality. East of the Cascades are large beds of handsome onyx-marble, and in the Siskiyou and Coast ranges are deposits of beautiful blue and gray sandstone, free in texture and of easy manipulation. Granite, marble and limestone abound in various places in great variety. Asbestos, paint-ore, fire-clay and mineral pigments exist in abundance, and are favorably situated for mining and shipment. One coal-mine in Coos County penetrates a huge bed of excellent bituminous coal, from which, from 1885 to 1900, more than 75,000 tons were annually sent to San Francisco. The coal yield (1900) was $260.91.

Forests. More than 25,000 square miles of the mountain and coast lands of Oregon are covered with a fine growth of timber, much of it yielding in sawn lumber from 50,000 to 200,000 feet per acre. Yellow fir is one of the strongest woods known, and is in demand for the ship-yards of France and other European countries. Many other varieties of fir and many kinds of spruce and pine abound, and cedar, oak and ash exist in vast unbroken forests.

Wealth. The total equalized value of assessable property in the state (with all exemptions deducted) was, in 1900, $120,000,000, on which a levy

of 5.16 mills for the taxes of 1901 was made. During the biennial term ending Dec. 31, 1900, the total receipts of the state treasury were $1,894,004, besides a balance from the previous year. The total disbursements for the term were $1,690,697, leaving

THE CAPITOL BUILDING, SALEM.

in the treasury at the beginning of 1901, $944,623. The public debt is practically nothing. Jan. 1, 1901, the total amount of the common-school fund amounted to $2,308,371.

The educational, charitable and penal institutions of Oregon embrace a school for mutes, one for the blind, an insane asylum, the Reform School and a State Penitentiary located at Salem. The latter institution had, Oct. 1, 1895, 326 inmates, for the maintenance of whom the state had appropriated for the succeeding two years $131,250. The State Insane Asylum had at the same time 970 inmates, and the expenses for the period mentioned amounted to $227,768. The inmates of the Reform School numbered 107; the expenditures were $122,115.

The authorized strength of the Oregon National Guard is 2,166. The actual force is composed of one brigade, made up of three regiments of two battalions of four companies each, a separate infantry battalion of two companies, two troops of cavalry and a battery of artillery, the total force numbering 1,469, officers and enlisted men. The state annually appropriates $30,000 for the Guard and the Federal government assists in the way of arms and munitions of war to the amount of from $3,000 to $5,000.

In 1905 newspapers were published in all of the 33 counties of Oregon, the total number in the state being 238, of which 23 were daily, 17 semiweekly, 172 weekly, 2 fortnightly, 2 semimonthly, and 22 monthly. The cities, towns, and villages in which papers were published numbered 115, of which 29 were county seats.

Education. The public-school system of Oregon is on a firm financial basis. The annual interest on the irreducible school fund is nearly $200,000. Besides this, amounts sufficient to maintain the free and normal schools and the State University are derived from taxation. In 1901 the value of the school property of the state was about $3,000,000; the number of children of school age, 135,818; of teachers employed, 3,000; of schoolhouses, 2,060; and the annual expenditures for school purposes approximated $1,160,000. The state normal schools are free to all who desire to become teachers in the public schools of the state. The higher institutions of learning are given in the table below:

Institution.	Location.	Religious Denomination.
Willamette Univ.	Salem	Methodist Episcopal.
Pacific Univ.	Forest Green	Nonsectarian
McMinnville Coll.	McMinnville	Baptist.
Collegiate Inst.	Albany	Nonsectarian.
State University	Eugene City	Nonsectarian.
Corvallis Coll.	Corvallis	Nonsectarian.
Portland Univ.	University Park	Methodist Episcopal.
Philomath College	Philomath	United Brethren.
Pacific College	Newberg	Friends.
LaFayette Sem.	LaFayette	Evangelical Assoc'n.

Communications. The railroad mileage of Oregon in 1900 reached 1,695 miles. Seven distinct lines are operated, giving the state abundant transportation facilities by land, while many of the rivers of the western portion are navigable for steamers at all seasons of the year. Boats ply on the Columbia and the Willamette rivers and on some of their tributaries. The United States government has expended more than $2,000,000 in constructing locks at the Cascades, on the Columbia, 140 miles from the ocean, which, when completed, will allow uninterrupted navigation for 190 miles from the mouth of the river. The falls of the Willamette at Oregon City have had a canal with locks built around them by the state.

The following table of church statistics is taken from the census reports of 1890:

Denominations.	Organizations.	Meeting-places.	Members.	Value Church Property.
Roman Catholic	95	95	30,231	$290,090
Methodist Episcopal	203	201	9,436	614,625
Presbyt'r'ns in the United States of America	73	70	3,935	416,500
Disciples of Christ	74	42	4,067	76,700
Baptist	108	108	5,306	317,325
Methodist Episcopal S'th	70	62	1,936	50,850
United Brethren, Old Constitution	49	46	1,203	24,700
Protestant Episcopal	31	26	1,849	361,930
Congregational	35	38	2,037	160,200
Evangelical Association	25	24	1,199	63,900
Cumberland Presbyterian	23	21	897	22,200
Unitarian	5	5	890	139,500

The principal cities and towns of Oregon, with their population in 1900 are: Portland, 90,426; Astoria, 8,381; Albany, 3,149; Salem, 4,258; Oregon City, 3,494; Baker, 6,663; La Grande, 2,991; Pendleton, 4,406; Ashland, 2,634; Corvallis, 1,819; Roseburg, 1,690; Marshfield, 1,391; Grant's Pass, 2,290; McMinneville, 1,420; The Dalles City, 3,542.

State flower, Oregon Grape.

The following is a list of the governors of Oregon since the admission of the state into the Union: John Whiteaker, 1859–62; Addison C. Gibbs, 1862–66; George L. Woods, 1866–70; Lafayette Grover,

1870–77; S. F. Chadwick, 1877–78; W. W. Thayer, 1878–82; Zenas Ferry Moody, 1882–87; Sylvester Pennoyer, 1887–95; William Paine Lord, 1895–99; Theo. T. Geer, 1899–1903; G. E. Chamberlain, 1903.

See OREGON, Vol. XVII, pp. 845–849.

OREGON, a village, the capital of Ogle County, Illinois, 85 miles W. of Chicago and 25 miles S. of Rockford, on the Chicago, Burlington and Quincy railroad. It has water-power and manufactures of flour, pianos, and iron-castings, and is surrounded by a grain-raising district. Population, 1900, 1,577.

OREGON CITY, a city and the county seat of Clackamas County, Oregon, in the northwestern part of the state. It lies on the Willamette River, twenty miles above its junction with the Columbia River, and about 15 miles from Portland, and is reached by the Northern Pacific railroad. It has a large lumber trade and industries, and also flour and paper mills. Its population in 1900 was 3,494. W.F.J.

O'REILLY, ALEXANDER, soldier and statesman, was born in Ireland in 1725, and became a soldier in Spain, Italy, France, and Austria. In 1765 he saved the life of the King of Spain from a mob, and so ingratiated himself at court as to secure the appointment, in 1768, as governor of Louisiana, then a Spanish province. He assumed authority with a strong hand, banished or imprisoned all who resisted him, reorganized the government, and established a new and severe code of laws. In 1775 he led an unsuccessful Spanish expedition against Algiers, and afterward was commandant of Andalusia, and governor of Cadiz. He died in 1794. W.F.J.

O'REILLY, BERNARD, clergyman, was born in Ireland in 1803, came to America in 1825, and became a Roman Catholic priest in 1831. In 1832 he labored heroically for the relief of sufferers from the epidemic of cholera, and was himself twice stricken with that plague. In 1849 he was made bishop of the diocese of Hartford, Conn. In that office he built many churches, introduced the Sisters of Charity into the diocese, and founded many schools, asylums and other institutions. He did much to remove the antagonism which New England Puritans felt toward the Roman Catholic Church, and was personally esteemed by all who knew him, in the highest degree. In 1855 he went to Rome to secure additional aid for his work, in which mission he was successful. In January, 1856, he sailed for home, on the steamship *Pacific*, which was never heard from after leaving Liverpool. W.F.J.

O'REILLY, JOHN BOYLE, an Irish-American poet and journalist; born at Dowth Castle, County Meath, Ireland, June 28, 1844. He was educated at a public school, entered a printing office as an apprentice, and then became a reporter on a newspaper in Dublin. In 1862 he went to London as an agent of the Fenian Society, and in 1865 enlisted in the British army for the purpose of inducing Irish soldiers to revolt. He was detected in 1866, tried for high treason and sentenced to be shot; but the sentence was commuted to penal servitude for twenty years. From Dartmouth he was transported in 1867 to Australia, where in 1868, with the aid of the Rev. Patrick McCabe, he escaped in a boat, was rescued by the *Gazelle*, an American whaler, and carried to the United States. He landed in Philadelphia, where he was naturalized, and then removed to Boston, where in 1870 he became editor of *The Pilot*. He went to Canada as a reporter for *The Pilot* during the second Fenian raid, and for a time commanded the Irish forces. He was a prominent advocate of Home Rule for Ireland and was one of the leading American champions of the Irish cause. He wrote excellent verse, notably that on Australian themes. His published poems include *Songs of the Southern Seas and Other Poems* (1873); *Songs, Legends, and Ballads* (1878); *The Statues in the Block and Other Poems* (1881); *America* (1882), and *In Bohemia* (1886). Among his prose works are *Moondyne: A Story from the Under World* (1879); a tale of penal life, *The Irish Question* (1886); *The Ethics of Boxing and Manly Sport* (1888), and *Stories and Sketches* (1888). He was one of the founders of the Paygrus Club in Boston, and was one of the most popular of American journalists. He died in Hull, Massachusetts, August 10, 1890. A biography of O'Reilly was published in 1891 by James Jeffrey Roche, who succeeded him as editor of the *Pilot*. W.M.C.

JOHN BOYLE O'REILLY.

O'RELL, MAX. See BLOUET, PAUL, in these Supplements.

ORELLANA, FRANCISCO DE, a Spanish explorer; born in Truxillo, about 1490. He was a friend and lieutenant of Pizarro, and accompanied him to Peru in 1531. He took part in the conquest of Peru and in 1537 founded the city of Guayaquil. In 1540 he accompanied the expedition across the Andes in search of El Dorado, and sailed down the Napo River with a few men to the Amazon, which he followed to its mouth, and because of the stories he heard of women warriors, and women chiefs along its course, called it the Amazon. When he returned to Spain he told amazing stories of the richness of the country he had explored and received from the crown the right to establish a Spanish colony near the mouth of the Amazon. In 1544 he left Cadiz with a party of colonists, but the expedition proved unsuccessful. He died in Brazilian Guiana about 1555. His chaplain, Gasper de Caroajai, wrote an account of his travels, which was published in Seville; and later translated into English W.M.C.

ORES. See MINING, Vol. XVI, pp. 460–462; and METALLURGY, Vol. XVI. pp. 62–68; see also articles on SILVER and GOLD, in these Supplements.

ORFA or URFAH, same as Edessa, Vol. VII, p. 566.

ORGANIC CHEMISTRY. See Chemistry, in these Supplements.

ORGAN MOUNTAINS. See Brazil, Vol. IV, p. 200; also New Mexico, Vol. XVII, p. 410.

ORGANOGENY. See Embryology, in these Supplements.

ORIBASIUS OF PERGAMUS, an early Byzantine physician. See Medicine, Vol. XV, p. 814.

ORIEL. See *Bay Window*, under Architecture, Vol. II, p. 404.

ORIENTAL RITE. See Roman Catholic Church, Vol. XX, pp. 646, 647.

ORIFLAMME, the battle-flag of France, adopted by Louis VI in 1124. See Flag, Vol. IX, p. 243.

ORIGINAL-PACKAGE LEGISLATION. See Liquor Laws, in these Supplements.

ORILLIA, a post village of Simcoe County, southern central Ontario, 86 miles N. of Toronto and about 25 miles N.E. of Barrie, the capital of the county, on Lake Couchiching near its junction with Lake Simcoe, and on the Grand Trunk railroad. It is situated in a district having large lumber and agricultural interests and producing large quantities of honey; has flour and saw mills, tanneries, foundries and carriage-shops, and is an important shipping-point for lumber and grain. It is popular as a summer resort, and is the seat of the Ontario Asylum for Idiots. Population 1901, 4,907.

ORKHAN, an early Turkish monarch. See Turkey, Vol. XXIII, p. 682.

ORLANDO, a city and the capital of Orange County, central eastern Florida, 35 miles W. of Titusville and 90 miles S. of Palatka, on the Florida Central and Peninsular and the Savannah, Florida and Western railroads; cultivates oranges, pineapples and vegetables; has large foundry and machine works and two state banks. Is a noted winter-resort. Population 1900, 2,481.

ORLEANS, Duc d'. See Paris, Comte de, in these Supplements.

ORLEANS, Maid of. See Joan of Arc, Vol. XIII, p. 706.

ORMEROD, Eleanor A., an English entomologist, the daughter of George Ormerod (1785–1873), the historian. She commenced her contributions to the science of entomology in 1868, in connection with the Bethnal Green Museum. In 1872 she represented Great Britain at the Moscow International Polytechnic Exhibition, and by her plaster models of plants and fruits, made by a process of her own, attracted general attention. She was elected a fellow of the Meteorological Society in 1878, the first woman elected to membership. She edited for the society the *Cobham Journals* (1880). In 1882 she was appointed consulting entomologist of the Royal Agricultural Society, and retained the post until 1892. She held a number of honorary positions. Her principal publications were *Manual of Injurious Insects* (1881); *Guide to Insect Life* (1884); and *Reports of Observations on Injurious Farm Insects* (1877–96). Died at St. Albans, July 19, 1901.

ORODUS, a genus of cestracionf sharks whose remains are found in carboniferous strata. The fossils consist largely of immense teeth, indicating a fish of great size.

ORONO, a town of Penobscot County, Maine, in the south-central part of the state. It lies on the Penobscot River, five miles north of Bangor, is reached by the Maine Central railroad, and has lumber and cotton mills and other industries, securing a superb water power from the river. It is the seat of the Maine State School (q. v.). Its population in 1900 was 3,257. W.F.J.

ORONSAY. See Colonsay, in these Supplements.

ORONTES, a river of Syria. See Syria, Vol. XXII, p. 860.

OROVILLE, a town and the capital of Butte County, northern central California, 28 miles N. of Marysville, and about 130 miles N.E. of San Francisco, on the Feather River, and on the Southern Pacific railroad. It is in a region producing oranges and other fruits, and has gold and silver mines in the vicinity. Pop. township (1900), 554.

ORRERY, an astronomical machine constructed for the purpose of representing the motions, and, approximately, the relative magnitudes and distances, of the planets. George Graham, about the year 1700, invented what is regarded as the first machine for this purpose. An instrument-maker named of Rowley obtained possession of Graham's machine, reproduced it, and sent it to the Earl of Orrery (see Charles Boyle, Vol. IV, p. 166), an amateur in mechanics. Sir Richard Steele, unacquainted with the name of the original inventor, called it in honor of the earl the *Orrery*, which name remained. A number of iron tubes, equal in number to the planets to be represented, of different dimensions, are arranged one within another. The innermost tube projects at each end beyond the one next to it, and that beyond the third, and so on. A rod is attached at right angles to one end of each tube. On the end of each of these rods there is a ball or lamp (to represent the planets). The lengths of these rods are also proportional, or supposedly so, to the radii of the orbits of the planets. The other ends of the tubes constitute axes for toothed wheels connected directly, or by combinations of other toothed wheels of the series, with a winch. The velocity of the revolutions of the rods, proportional to the times of the revolutions of the planets, is effected by a careful adjustment of the several combinations of wheels. On the top of the axis around which revolve the balls representing the planets when set in motion by turning the winch, is a large ball or lamp representing the sun, all the outer objects revolving around the central object at their proportional distances and velocities. The orrery superseded the planetarium constructed by Huyghens and Römer, which was popular in the seventeenth and eighteenth centuries, and was supplemented by the combined tellurian and lunarian, which showed the motion of

the moon around the earth, of the earth around the sun, with the several phenomena accompanying the progress of each. These devices are now regarded as toys and of no scientific value.

ORRVILLE, a village of Wayne County, Ohio, in the northeast-central part of the state. It is reached by the Cleveland, Akron and Columbus, Pittsburg, Fort Wayne and Chicago and Wheeling and Lake Erie railroads, and had in 1900 a population of 1,910. W.F.J.

ORSINI, a Roman faction. See ROME, Vol. XX, pp. 814–817.

ORSOVA, the name of two towns on the Danube, equidistant between the Iron Gates. OLD ORSOVA, a Hungarian place, is 478 miles S.E. of Vienna, and a short distance above the point where the river leaves the Hungarian territory. Population, 4,610.—NEW ORSOVA, on the Servian side, is situated on an island 3 miles below the former and 36 miles E. of Moldova. Population, 3,200.

ORTA, a town and small lake in the province of Novara, compartment of Piedmont, northwestern Italy, about 25 miles N.N.W. of Novara. The town is situated on a peninsula upon the east shore of Lake Orta, a small body of water having an elevation of 950 feet and draining through the Toce into Lake Maggiore. Population, 750.

ORTEGAL, CAPE, the most northerly point of land in Spain, in the province of Corunna, about 35 miles N.E. of the city of Corunna, extending into the Bay of Biscay.

ORTHAGORISCIDÆ. See SUN-FISH, Vol. XXII, p. 693; also OPAH, Vol. XVII, p. 798.

ORTHODOX. See QUAKERS, Vol. XX, p. 155; and FRIENDS, SOCIETY OF, in these Supplements.

ORTHOPÆDIC SURGERY. See *Deformities*, under SURGERY, Vol. XXII, pp. 727, 728.

ORTON, EDWARD, an American geologist; born in Deposit, N. Y., March 9, 1829. He graduated at Hamilton College in 1848. He was State geologist of Ohio from 1869 till his death; was president of Antioch College, Ohio, 1872–73, and of Ohio State University, 1873–81; and professor of geology in the same institution from 1873 till his death. He was president of the Geological Society of America in 1897, and of the American Association for the Advancement of Science, 1898–99. He died in Columbus, Ohio, Oct. 16, 1899. E.E.T.

ORTON, JAMES, naturalist, was born at Seneca Falls, N. Y., on April 21, 1830, and was graduated from Williams College in 1855 and from Andover Theological Seminary in 1858. He travelled in Europe, was a Congregational preacher from 1860 to 1866, became instructor in sciences at the University of Rochester, led an expedition of Williams College students across South America, became professor of natural history at Vassar College in 1869, led another South American expedition, and started on a third but was compelled to abandon it. He was the author of *The Andes and the Amazon*, *Underground Treasures*, and several other works. He died on September 25, 1877, on his third trip to South America, and was buried on an island in Lake Titicaca. W.F.J.

ORTONA, a town of eastern Italy, on the Adriatic Sea, and on the Western Adriatic railroad, 104 miles S.E. of Ancona and 12 miles E. of Chieti, in the compartment of Abruzzo and Molise. Population 1901 8,266.

ORTONVILLE, a city and the capital of Big Stone County, western Minnesota, at the southeastern extremity of Big Stone Lake, on the Chicago, Milwaukee and St. Paul railroad, 45 miles N.W. of Montevideo. It is situated in a fertile prairie country, producing wheat and live-stock. There are extensive granite quarries. Pop. 1900, 1,247.

ORTYGIA, an island. See SYRACUSE, Vol. XXII, pp. 852, 853.

OSAGE, a city and the county seat of Mitchell County, Iowa, in the eastern part of the northern tier. It is on the Red Cedar River, is reached by the Illinois Central railroad, and had in 1900 a population of 3,092. W.F.J.

OSAGE, a tribe of North American Indians who occupy a reservation of 1,500,000 acres in the northeastern portion of Indian Territory. They numbered in 1895, 1,657, of whom 758 were half-breeds. For tribal relations and descent, see INDIANS, Vol. XII, pp. 868, 871.

OSAGE CITY, a city of Osage County, Kansas, in the central-eastern part of that state. It lies on Salt Creek, thirty miles from Topeka, and is reached by the Atchison, Topeka and Santa Fé and Missouri Pacific railroads. Its population in 1900 was 2,792. W.F.J.

OSAGE MISSION, a village of southeastern Kansas, on the Neosho River, 35 miles S.W. of Fort Scott and about 15 miles W. of Girard, on the Missouri, Kansas and Texas railroad. Its postoffice designation is St. Paul. It is the seat of St. Ann's Academy for girls and St. Francis Institute for boys; is engaged in the shipping of grain, and has flour-mills and plow-works. Now St. Paul City. Pop. 1900, 1,047.

OSAGE ORANGE (*Maclura aurantiaca*), a tree of the family *Urticaceæ*, a native of North America. It attains a height varying from twenty to sixty feet. The wood, which is bright yellow, is fine-grained and very elastic, and takes a high polish. The tree is largely employed in America, especially in the West, as a hedge-plant.

OSAWATOMIE, a city of Miami Co., Kansas, on the Marais des Cygnes River, and on the Missouri Pacific railroad, seven miles S.W. of Paola and about fifty miles S.E. of Topeka. It is situated in a region producing grain, vegetables, butter and live-stock. One of the state insane asylums is located here. Pop. 1890, 2,662; 1900, 4,101.

OSBORNE, a city and the capital of Osborne Co., northwestern central Kansas, 34 miles W. of Beloit and about fifty miles N.E. of Hays City, on the South Fork of Solomon River, and on the Missouri Pacific railroad. It is situated in a rolling prairie country, producing grain, vegetables, broom-corn, sorghum, butter, wool, hay and live-stock. Pop. 1890, 1,174; 1900, 1,075.

OSCAR II, FREDERIC, King of Sweden and Norway; born in Stockholm, Jan. 21, 1829. After his education and foreign travels were completed, he succeeded to the throne on the death of his brother, Charles XV, Sept. 18, 1872. He reorganized the army and the railroads. In 1873 he visited Norwegian Lapland, and in 1875 the emperors of Germany and Russia. King Oscar published translations of Goethe's *Faust* and of *Tasso*, a sketch of Charles XII, and a volume of poems, published under the pseudonym of "Oscar Frederik." His collected writings appeared in four volumes, 1875–91; and a fifth volume, in 1894. He died Dec. 8, 1907.

OSCAR II.

OSCEOLA, a city and the capital of Clark Co., Iowa, about 45 miles S.S.W. of Des Moines, near the Chariton River, on the Chicago, Burlington and Quincy and the Des Moines and Kansas City railroads. The surrounding region is devoted to agriculture and stock-raising. The machine-shops of the Des Moines and Kansas City railroad are located here. Pop. 1890, 2,120; 1900, 2,505.

OSCEOLA, a post village and the capital of St. Clair Co., Missouri, on the right bank of the navigable Osage River, and on the Kansas City, Fort Scott and Memphis and the Kansas City, Osceola and Southern railroads, about 60 miles S.S.W. of Sedalia and about 85 miles S.E. of Kansas City. It is an important shipping-point for grain and live-stock, and large stone-quarries are in the vicinity. Pop. 1890, 995; 1900, 1,037.

OSCEOLA, a post village and the capital of Polk Co., Nebraska, about 100 miles W.S.W. of Omaha and about 56 miles N.W. of Lincoln, on the Union Pacific railroad. It is situated in a level prairie region, producing wheat, corn, oats, hay and live-stock. Pop. 1890, 947; 1900, 882.

OSCEOLA, a Seminole Indian chief; born in Florida about 1803. He was the son of an English trader named Powell, and of the daughter of a Seminole chief. His wife (the daughter of a fugitive slave woman) was claimed as a slave by the owner of her mother, and was carried off as such. Osceola protesting, he was arrested and ironed by Gen. Thompson, the Indian agent at Fort King, but was released after six days' imprisonment. He then lay in wait for Gen. Thompson, and on Dec. 28, 1835, he killed him and four other white men, thus commencing the second Seminole war. Osceola took command of a band of Indians and fugitive slaves who on the same day had massacred Major Dade and 110 soldiers. For upward of a year he conducted the struggle against superior forces with energy and skill; but on Oct. 23, 1837, while holding a conference under a flag of truce with Gen. Jesup near St. Augustine, he was treacherously seized and imprisoned at Fort Moultrie till his death, Jan. 1, 1838. E.E.T.

OSCEOLA MILLS, a borough of Clearfield Co., Penn., on Mushannon Creek, and on the Pennsylvania railroad and the Altoona and Phillipsburg connecting line, about 30 miles N. of Altoona and 21 miles S. of Clearfield. It is situated in a coal region, and contains foundries, a tannery, lumber-mills and a machine-shop. In 1875 the greater part of Osceola was destroyed by fire. Population 1900, 2,030.

OSCILLATOR, NIKOLA TESLA'S. The oscillating engine of Nikola Tesla occupies a position midway between the steam-engine and the electric dynamo. It is virtually a steam-chest set upright and disassociated from the usual mechanism that accompanies it in the steam-engine, but arranged to carry reciprocating armatures on its pistons. The steam-chest is run at a very high pressure, 350 pounds to the square inch, and no packing is used, the inventor having devised a means of operating without it. Opposite the steam-chest is an electro-magnetic coil, into whose field of force the piston is alternately thrust and withdrawn, thus setting up electric currents, as in an engine-driven dynamo. This is the form that was exhibited at the Columbian Exposition in Chicago, but Mr. Tesla built some six or eight other experimental forms previous to the destruction of his New York laboratory fire in 1895. The latest and best of these was a double machine, made horizontal, and arranged all on one base-plate. The steam-chest is single, but has two pistons, which reciprocate oppositely at a speed of eighty to one hundred times a second. The armatures on the pistons are plunged at every stroke into the fields of the two electro-magnetic generating systems, which constitute the dynamos of the machine. On top of the steam-chest, which is located centrally between the dynamos, is a miniature oscillator, arranged to serve as a governor, by controlling the admission of steam, and making the vibration of the engine independent of its load.

The advantages of the oscillator, as compared with a direct-connected steam-engine and dynamo, are a reduction in friction, consequent on the material reduction in the number of parts; a reduction in wear, due to few parts, and the absence of crank-motion; also the ease and simplicity with which it is regulated and maintained at an even speed. It accomplishes the end of converting the pressure of steam into electric energy in a much more direct manner than was before possible, and for this reason, and because of the eminent character of the inventor, engineers expect a great future for the oscillator. Its practical work, however, at this date has been confined to electric lighting, and that of a rather experimental character. It is primarily designed for use in electric-lighting plants, though it has a future of promise in steamboat navigation and railway locomotion.

C. H. COCHRANE.

OSCILLATORY DISCHARGE. See ELECTRICITY, § 92, in these Supplements.

OSCINES, a suborder of *Passeres*, including the birds with highly developed singing apparatus.

OSCODA, a village of Iosco County, in the northeastern part of the southern peninsula of Michigan, 70 miles N. of Bay City, on Lake Huron, at the mouth of Au Sable River, and on the Au Sable and Northwestern and the Detroit and Mackinac railroads. It has a large trade in lumber, and contains saw and planing mills, a foundry and extensive salt-works. Pop. 1890, 3,593; 1900, 1,109.

OSCOTT, a Roman Catholic College, in the village of that name in the parish of Handsworth, Staffordshire, four miles N. of Birmingham, England. The name is first met with toward the close of the seventeenth century as the seat of a Catholic mission, which continued to be served by different priests till, in 1752, it was formed into a college for the education of both laymen and ecclesiastics, and called St. Mary's College. In 1835 the present buildings were erected from the designs of Pugin, at a cost of $300,000. The buildings are arranged in the form of a cross. In 1889 the establishment became purely ecclesiastical, no longer admitting lay students. The college is presided over by a rector, has a vice-rector and a staff of eight professors, and is open to students from any British diocese.

OSCULATING CURVES. See INFINITESIMAL CALCULUS, Vol. XIII, p. 29.

OSCULATING PLANE. See MECHANICS, Vol. XV, p. 686.

OSGOOD, FRANCES SARGENT, an American poet; born in Boston, Mass., June 18, 1811. She contributed poems to Lydia M. Child's *Juvenile Miscellany;* in 1835 married S. S. Osgood, a painter; lived for five years in London, where she wrote for magazines and published *The Casket of Fate* and *A Wreath of Wild Flowers from New England;* and settled in New York, where she edited *The Poetry of Flowers, and Flowers of Poetry*, and *The Floral Offering*. She died in Hingham, Mass., May 12, 1850. E.E.T.

OSHAWA, Canada, a town of Ontario County, Ontario, 34 miles by rail N.E. of Toronto, a short distance inland, but with a good lake harbor and trade. Population, 1901, 4,394. C.L.S.

O'SHEA–PARNELL SCANDAL. See HOME RULE, in these Supplements.

OSHKOSH, a city of Wisconsin. In 1900 there were three railroads entering the city: the Chicago and North-Western, the Chicago, Milwaukee and St. Paul and the Wisconsin Central. The census returns for the year 1900 showed a total in the city of 285 manufacturing establishments, representing 31 chief industries, with a combined capital of $8,018,038, employing 4,587 persons, to whom was paid $1,762,410 in wages, and turning out products valued at $8,781,248. The principal industries are flour, saw and planing-mills, carriage and furniture factories, machine-shops, foundries, match factories, vinegar-works, breweries, slaughtering and meat-packing.

The banks of the city, state and national, had in 1900 a combined capital of $1,250,000, and in 1899 the assessed valuation of property in Oshkosh was $10,580,497. The city has a large shipping trade by lake and river, the chief articles of shipment being flour and lumber, and within recent years it has become popular as a summer-resort. Population 1890, 22,836; 1900, 28,284. See OSHKOSH, Vol. XVIII, p. 58.

OSKALOOSA, a city and the county seat of Mahaska County, Iowa, in the southeastern part of the state. It lies in an agricultural and mineral region, between the South Skunk and the Des Moines rivers, fifty miles east by south from Des Moines, and is the seat of several educational institutions and of numerous and varied industries. The latter include coal mines and breakers, rolling mills, brick and tile kilns, and machine shops. Among its schools and colleges is Penn College, one of the chief Quaker institutions of the west, which was founded in 1873, and in 1904 had 15 instructors, 366 students, and a library of 5,000 volumes. Oskaloosa is reached by the Iowa Central and the Chicago, Rock Island and Pacific railroads, and had in 1900 a population of 9,212. See also in Vol. XVIII, p. 59. W.F.J.

OSKALOOSA, a city and the capital of Jefferson County, northeastern Kansas, 25 miles N.E. of Topeka, and about 20 miles W.S.W of Leavenworth, on the Kansas City Northwestern and the Leavenworth, Topeka and Southwestern railroads. It is in a grain, stock and fruit-raising district. Population 1890, 773; 1900, 978.

OSMAN, NUBAR PASHA, a Turkish general; born in Tokat, in Asia Minor, in 1832. After his military education at Constantinople was finished, he entered the cavalry in 1854 and served under Omar Pasha. In 1876 he was commandant at Widdin during the Turko-Servian War, and for his valorous conduct at Saitschar was promoted from general to field-marshal. After the Russians had crossed the Danube in 1877, Osman Pasha repulsed their ninth corps with terrible slaughter at Plevna, July 24 and 31, and then thoroughly fortified that city. On September 14 he repulsed the Russian besiegers, with a loss of 2,000 men. On December 10 he made a gallant but unsuccessful attempt to break through the Russian lines. Being wounded, he was compelled to capitulate, surrendering 40,000 men and 400 cannon. His sword was returned to him by the Czar, and he was treated with the greatest courtesy by his conquerors. In 1878 he became commander-in-chief of the Imperial Guard, governor-general of Crete, and Minister of War. In 1894 he became Grand Marshal of the Palace. He died at Constantinople, April 4, 1900.

OSMAN ALI, commonly called OSMAN DIGNA, the leader of the Soudanese dervishes, was born at Suakim about 1836, his grandfather being a Turkish slave-dealer, who married a woman of the Hadendowa tribe. Osman followed the trade of his grandfather and father, dealt in slaves, having agents at Khartoum and Berber, the latter place latterly being his headquarters. He entered into communication with the Mahdi, Mohammed Ahmed, and brought the various tribes into a union for the purpose of raising the standard of revolt against the Khedive. He became the military head of the dervishes. The rebellion of "the false prophet" broke out on the White Nile in Decem-

ber, 1881. On Aug. 3, 1883, Osman was defeated before Suakim by Tewfik Bey. Again in September, 1885, an Abyssinian expedition under Ras Alula, which had been sent to the relief of Kassala, met Osman and utterly routed him. On Dec. 21, 1888, he was overcome at Suakim by Gen. Sir F. Grenfell; on Feb. 21, 1891, he was defeated and fled precipitately without having taken a direct or personal part in the fight, at Handoub. On March 7 the sheiks assembled at Suakim to hear the amnesty proclamation of the Khedive read by General Grenfell. In 1893 Osman Digna moved his headquarters to Amet, about 80 miles S.E. of Suakim. In April, 1894, he made another incursion towards Tokar, but was driven off by the Egyptian cavalry. In 1900 he was captured by treachery and kept a state prisoner at Rosette.

OSMIUM. See CHEMISTRY, Vol. V, pp. 465–466.

OSMOSE, the inter-diffusion of two liquids through a septum, usually of bladder or of parchment-paper. If a bottle, filled with one liquid, be closed by parchment-paper, and be completely immersed in a vessel containing another liquid, increase or decrease of the contents of the bottle will occur according as the liquid contained in the bottle passes out through the septum less quickly or more quickly than the other liquor passes inward. When the contents are increased the phenomenon has been called *endosmose*, when they decrease it has been termed *exosmose*.

OSSETES, LANGUAGE OF. See PERSIA, Vol. XVIII, p. 668.

OSSIPEE, a township and village, the capital of Carroll Co., N. H., 40 miles N.N.E. of Concord, in a mountainous district covered with heavy forests, whence its sawmills are supplied with logs. Pop. 1900, 1,479.

OSTEOBLASTS. See ANATOMY, Vol. I, p. 751.

OSTEOGLOSSIDÆ, a family of *Physostomi*. See ICHTHYOLOGY, Vol. XII, p. 732.

OSTEOLEPIS, a genus of fossil ganoid fish peculiar to the Old Red Sandstone. It is characterized by smooth rhomboidal scales, by numerous sharply-pointed teeth, and by having the two dorsal and anal fins alternating with each other.

OSTEOLOGY. See ANATOMY, Vol. I, p. 719.

OSTEOPATHY is a system of treating disease without drugs, by the use of the hands, to adjust all parts of the human mechanism to perfect mechanical relations. It is that science which finds in disturbed mechanical relations of the anatomical parts of the body the causes of disease, and which is employed to cure disease by applying technical knowledge and high manual skill to the correction of all disturbed relations occurring in the mechanical arrangement of the body. It is a science founded upon the principles of anatomy and physiology. The word does not mean the treatment of the bones, nor of bone diseases. It was used as a name because the founder discovered the importance of disturbances in the bony frame-work of the body in causing disease. He studied the skeleton as the foundation of anatomy, upon which science he grounded his system. The meaning of the word applies not only to derangements of bony parts, but as well to disturbed relations of ligaments, tendons, blood-vessels, muscles, nerves, and of any body-tissue.

The technical training of the Osteopath enables him to detect such mechanical faults in all parts of the body. He recognizes the disease by the symptoms manifested by it, but interprets these symptoms by tracing them to their real causes in the mechanical disturbances which produce them. Here lies one radical difference between Osteopathy and medicine. The diagnosis of the disease does not stop with naming the symptom group of a certain disease; it goes further, to diagnose the actual physical disturbances causing the disease.

Another radical difference is found in the method of treatment. The Osteopath rights what is radically wrong and leaves Nature free to act. It is clear that he thus reaches the specific cause. His remedy is applied, not to overcoming the symptoms, but to eradicating the cause. The human system is a perfect mechanism, and it must be in perfect mechanical order that it may perform its various functions aright.

The course of study embraces all the branches taught in Schools of Medicine, except that of drug-therapy.

The practice of Osteopathy rests upon the assumption that disturbed function is largely dependent upon disturbed structure and will be permanently corrected only by the adjustment of that disturbed structure. When that is accomplished the inherent recuperative powers of the organism manifest themselves in a rapid mechanic, chemic, and physiologic regeneration, sufficient to restore to every organ its normal function. It is assumed that so long as every organ receives its normal amount of blood, lymph, nerve force, or other vital fluid, and so long as it is properly drained of the waste products of metabolism, health must follow as a logical necessity; and that whenever an organ fails in the performance of its function, that fact is *prima facie* evidence of some obstruction to the incoming or outgoing forces. In the case of an organ whose arterial channels are obstructed, that organ must of necessity suffer from the effects of a local anemia; if an obstruction to its venous drainage be present, the ill-effects of a passive congestion are inevitable; if its channel for the propagation of nerve impulses is infringed upon, disturbance of the power of the organ must manifest itself. Hence, disease is looked upon as a condition of an organ or of the organism in which function or activity cannot properly obtain because of some interference with one or more of these various pathways. The structures which produce the obstruction may be any of the tissues of the body, but are found to be principally luxated bones, contractured muscles, and strained or overgrown ligamentous or connective tissue material. With this proposition in view the Osteopathic diagnostitian is not content with a diagnosis of the location and condition of the diseased organ, which he recognizes as important enough, but by methods pecu-

liar to his system he also attempts to locate the disordered structural condition which is at fault in the production of the perverted function. Having by these methods determined the abnormal structural condition present, he limits his field of operations to the reduction of such structural condition, as far as may be done, or attempts by his special manipulative measures to render to the organism such aid as will enable it to overcome or adapt itself to the changed structure. In his manipulation, he does not depend alone upon his ability to force a mechanically abnormal part back into place, but depends also upon the fundamental principle that as soon as structural parts are dislodged from their false positions and relations, the normal tension of immediately adjacent and related parts will tend to restore the conditions of mechanical integrity. Hence is formulated the foundation proposition that Nature constantly tends toward a normal condition, both of structure and function, and the province of the physician is not in seeking a healing power from without, but in assisting the organism to maintain its structural integrity, which animated by the vital principle is sufficient of itself to generate and distribute every element necessary to normal functioning. From an Osteopathic standpoint, disease is the result of physiological discord. With this fact established in the mind of the doctor of Osteopathy as a truth, he is warranted, then, in hunting the facts that would prove the position, that disease is the result of physiological discord in the functioning of the organs or parts of the physiological laboratory of life. Thus, as an explorer or seeker of the cause of disease, he would naturally reason that the variations from the physiological perfection would naturally be found in disordered nerve connections, to the degree of breaking or shutting off the normal circuit of nerve force from the brain to any part of the body that should be sustained by that force when normally conducted to any organ as the power necessary to its process of vital functioning. If this be true, there is nothing left in his procedure but to find the break or obstruction to the natural passage of blood or any other fluid that is necessary to a normal condition, which is health itself. Thus, the physician of any school of the healing art must know and act upon the philosophy that disease is the result of physiological discord. The cause of disease can be traced to bony variations, from the base of the skull to the sole of the foot, in the joints of the cervical, dorsal, and lumbar vertebræ, the articulations with the sacrum, also in the arms and lower limbs. Strains by lifting, jolts, jars, falls, or anything that would occasion any organ of the chest or abdomen to be moved from its normal to an abnormal position, are causes sufficient to confound the harmony of natural functioning of the whole viscera, both above and below the diaphragm, and be the cause of an unhealthy supply of nerve fluid and force for the limbs and the organs of the body, internal and external, the brain included. In the foregoing, we have given what we consider a short and philosophical definition of what is meant by the word Osteopathy. We use the bones as fulcrums and levers to adjust from the abnormal to the normal, that the harmonious functioning of the viscera of the whole body may show forth perfection, or that condition which is known as "good health."

The science was founded by Dr. Andrew Taylor Still at Baldwin, Kansas, in 1874. He is now the President of the American School of Osteopathy, at Kirksville, Mo., the original school of the science.

A. T. STILL.

OSTERODE, a town of Hanover, western Prussia, at the western base of the Harz Mountains, 30 miles N.W. of Nordhausen and 18 miles N.E. of Göttingen. Population, 7,472.

OSTHOFF, HERMANN, a German philologist; born in Billmerich, Westphalia, April 18, 1847; left the gymnasium of Una to enter the University of Bonn; continued his studies at Tübingen and Berlin; became teacher in the gymnasium of Cassel (1871–74); private docent in Leipsic (1875–77); professor of comparative philology in the University of Heidelberg (1877). He was one of the foremost students of Indo-European grammar and philology, etc.

OSTRACODA, an order of CRUSTACEA, Vol. VI, p. 587.

OSTREA. See OYSTER, Vol. XVIII, p. 110.

OSTROG, a town in Volhynia, Russia, about 170 miles W. of Kiev. It consists of an old and new town, and has an ancient castle. In the reign of Constantine of Ostrog the first Slavonic Bible was printed here, in 1558. Pop., 1897, 14,530.

OSTROLENKA OR OSTROLEKA, Russia, a town and railway junction in the Polish government of Lomza, near the Prussian boundary, on the Narew tributary of the Vistula, 20 miles west of Lomza, and 80 miles northeast of Warsaw. On the sandy plain and in the woods in the neighborhood was fought the battle of Feb. 16, 1807, when the French defeated the Russians. On May 26, 1831, it was again the scene of a sanguinary conflict, when the Russians under Diebitsch defeated the Poles under Skrzynecki, but were too exhausted to follow up their advantage. Population, 8,697.

C.L.S.

OSTROVSKY, ALEXANDER NIKOLAIEVICH, a Russian dramatist; born in Moscow, April 12, 1823. He first became known in 1849 by his successful comedy, *We Get on with Our Own Kind*. His subsequent works were *The Poor Bride* (1852); *Poverty Is Not a Fault* (1853); *A Profitable Place* (1857); *The Storm* (1859), and *A Warm Heart* (1869). He was the author of several translations, including one of *The Taming of the Shrew*. His complete works were published in St. Petersburg (1887). He died in Moscow, Russia, June 14, 1886.

W.M.C.

OSTROWSKI, COUNT ANTONIO JOANNES, a Russian soldier; born in Warsaw, May 27, 1782. He joined the French Body Guard in 1806 and was attached to Napoleon's army. He was a leader in the revolution of 1830 and wrote the manifesto issued by the Polish army to the European nations. He died in Tours, France, in 1846.

W.M.C.

OSTROWSKI, Count Tomasz Adam Rawich, a Russian nobleman; the last of the Polish nobles of the palatinate of Lublin; born in Ostrow, Lomza, December 21, 1739. The king of Poland appointed him minister of finance, after the establishment of the constitution of 1791, but in the following year he resigned and joined with the other nobles for the overthrow of the constitution. In 1795 he retired from public life to his estates in Ukraine, where he died February 5, 1817. W.M.C.

OSWALD, Felix Leopold, an American traveler and author; born in Namur, Belgium, in 1845; graduated at Liège in 1864; educated as a physician, but became attracted to natural history; removed to the United States, settling in Tennessee, and traveled in Mexico.

OSWEGATCHIE RIVER, 130 miles long; rises in Herkimer Co., N. Y., flows into Cranberry Lake, then westerly, then northeast, then northwest, and joins the St. Lawrence near Ogdensburg.

OSWEGO, the seat of Labette County, Kansas, in the southeastern part of the state, is reached by the Missouri, Kansas and Texas and the St. Louis and San Francisco railroads. Its population in 1900 was 2,208. W.F.J.

OSWEGO, a city and port of entry of New York. Pop. 1900, 22,199. See Oswego, XVIII, p. 67.

OSWEGO FALLS, a village of Oswego Co., N. Y., on the Oswego river and canal, opposite Fulton, with which it is connected by two iron bridges; has lumber, woolen, paper, and pulp mills. Pop. 1900, 2,925.

OSYMANDYAS, an ancient Egyptian king. See Libraries, Vol. XIV, p. 509.

OTAGO (Maori *Otakou*, "red earth"), the most southern provincial district of New Zealand, in South Island; colonized in 1848 by the Otago Association, connected with the Free Church of Scotland. It has a coast-line of 600 miles, and is 160 miles long by 195 broad. The eastern and central portions are partly forest and partly pasture and arable land; the western part is mountainous, and contains stone and slate. Gold was discovered here in 1861, and now the gold-fields comprise an area of 4,000 sq. miles, from which gold to the value of $90,000,000 had been exported up to 1888. Dunedin is the capital. Area, 25,487 sq. miles; population 1901, 173,145.

OTARIIDÆ. See Mammalia, Vol. XV, p. 449.

OTCHAKOF, a seaport in Kherson government, Russia, 38 miles N.E. of Odessa, on the site of the ancient *Alector*, and beside the ruins of the once important Greek colony of Olbia. In 1492 the Khan of the Crimea built here a strong fortress, which was taken by the Russians under Münnich in 1737, recovered in 1738, and again captured after a long siege by Potemkin in 1788, and annexed by Russia. After it had been bombarded by the allied fleet in 1855, the Russians demolished the fortifications. In 1887 a ship canal was opened here, which makes the estuary of the Bug and Dnieper much more accessible to large ships. The population, mostly Jews, engaged in the fishing-trade, is 10,784.

OTHMAN. See Osman, Vol. XVIII, p. 59.

OTHO OF BAVARIA, King of Greece. See Greece, Vol. XI. p. 112.

OTIS, Elwell Stephen, soldier, was born at Frederick City, Md., on March 25, 1838, and was graduated from the University of Rochester in 1858 and from the Harvard Law School in 1861. He entered the army in 1862 as a captain of volunteers, and was present in all the battles of the Army of the Potomac from Antietam until October, 1864, when he was seriously wounded. He served with distinction at Gettysburg, in the Wilderness, at Spottsylvania, and at Petersburg. After the war he was engaged on the frontier, and took a leading part in avenging the Custer massacre and reducing the Sioux to order and submission. At the outbreak of the Spanish War he was engaged as president of a court martial in trying an important case, and thus was unable to go to the front at once. Toward the end of the war, however, he was sent to Manila, and performed the duties of military governor of the Philippines for nearly two years. His labors there were of the most arduous description. He had to deal with the insurrection of Aguinaldo as well as to organize a governmental system for the archipelago. The government at Washington gave him a free hand, and the results were on the whole satisfactory. He was relieved of his duties in the Philippines on May 5, 1900, and on his return to the United States was put in command of the Department of the Lakes, at Chicago, and afterward, temporarily, of the Department of Dakota. On March 25, 1902, he was honorably retired with the rank of major-general. W.F.J.

ELWELL S. OTIS.

OTIS, Harrison Gray, soldier and journalist, was born in Ohio on February 10, 1837, served throughout the Civil War, was a brigadier-general in the Spanish War and in the Philippines, and was brevetted major-general. He has for many years been editor of the *Times* at Los Angeles, Cal. W.F.J.

OTOMIS or OTHOMIS, a tribe of Mexican Indians. See Indians, Vol. XII, p. 868.

OTRANTO. See Fouché, Vol. IX, p. 420.

OTSEGO, a village of Allegan Co., Mich., on the Kalamazoo river, 43 miles S. of Grand Rapids, in the celebrated fruit-growing region of Michigan; has good water-power, paper-mills, iron-works, corn-cutter, chair, and sash factories, and lumber and saw-mills. There are magnetic springs in the vicinity. Population 1890, 1,626; 1900, 2,073.

OTTAWA, one of the largest rivers of Canada, rises nearly 300 miles due N. of Ottawa City, in lat. 48° 30′ N., in the watershed on the opposite side of which rise the St. Maurice and Saguenay; flows west to Lake Temiscaming, some 300 miles, thence 400 miles southeast, and falls into the St. Lawrence by two mouths, which form the island of Montreal; drainage area 60,000 to 80,000 sq. miles; volume 90,000 cubic feet per second; sometimes contracts to forty or fifty yards, elsewhere widens into lakes of considerable size; chief affluents the Gatineau,

Lièvre, and Rouge. These with the Ottawa itself give transit for the largest lumber trade in the world. The river has several falls and rapids, the best known being the Carillon Falls, a series 12 miles in length above Rigaud; the Chaudière Falls, at the city of Ottawa; and, 30 miles further up the river, Les Chats, a striking series of rapids. The river is connected with Lake Ontario by a canal from Rideau to Kingston.

OTTAWA, capital of the Canadian Dominion, is situated 90 miles up the Ottawa River and from its confluence with the St. Lawrence, between the Chaudière and the Rideau Falls. Here are the parliament buildings, the governor-general's residence, a Roman Catholic cathedral, numerous schools and colleges, and the Parliamentary Library. The city was in 1856 selected by Queen Victoria as the capital of the Dominion, and in 1866 occurred the first assembling of the Dominion Parliament in the new buildings constructed for its use. The sawed lumber trade is the chief industry, the capacity of the mills of the city being over two hundred million feet for the season. There is also considerable flour milling. The city's assessed valuation was in 1895 over twenty million dollars. Branches of the principal chartered banks of the country, with a combined capital of nearly $40,000,000, are situated at Ottawa. Population (1901 census) was 59,928. The city and the adjacent village of Hull, across the Ottawa River, was, in April 26, 1900, visited by a most destructive and calamitous fire. Feeding largely on the lumber piles and wooden buildings in Hull, and fanned by a strong northerly wind, the devouring elements leapt across the suspension bridge and burned a large section of the capital. The estimated loss was $15,000,000. See OTTAWA, Vol. XVIII. p. 71.

OTTAWA, a city, capital of Lasalle Co., Ill., on the Illinois River, at the mouth of the Fox River, on the Illinois and Michigan canal, and on the Chicago, Burlington and Quincy, and Chicago, Rock Island and Pacific railroads; has a large number of structures of architectural excellence, including a county court-house, a high-school building, the Reddick Library, churches, and two national banks. Besides a fine system of public schools, the city is the seat of St. Francis Xavier Academy. Its manufacturing plants include cutlery, tile, and glass works, flouring and planing mills, starch, glass, agricultural-implement, and other industries of a substantial character. It is lighted by gas and electricity, has an electric street-railway, and has an abundant water-supply from artesian wells and other sources. Population 1890, 9,985; 1900, 10,588. See also OTTAWA, Vol. XVIII, p. 72.

OTTAWA, a city and the county seat of Franklin County, Kansas, in the central-eastern part of the state. It lies on the historic Marais des Cygnes River, 35 miles southeast of Topeka, and is reached by the Missouri Pacific and the Atchison, Topeka and Santa Fé railroads. It is the seat of Ottawa University, a co-educational Baptist institution founded in 1865, and has extensive coal, iron, timber and other industries. Its population in 1900 was 6,934. W.F.J.

OTTAWA, a village, the capital of Putnam Co., Ohio, on the Blanchard River, a tributary of the Auglaize, 20 miles N. of Lima, and on the Cincinnati, Hamilton and Dayton, and the Findlay, Fort Wayne and Western railroads; has factories of spokes, hubs, sashes, and blinds, and is the centre of a grazing and agricultural district producing corn and small grains, pork, and live-stock. Population 1890, 1,717; 1900, 2,322.

OTTAWAS. See INDIANS, Vol. XII, p. 871.

OTTENDORFER, OSWALD, an American journalist; born in Zwittau, Moravia, Feb. 26, 1826. He was educated in the universities of Vienna and of Prague, and studied law. He was active in several revolutions in 1848 and 1849; served in the Schleswig-Holstein war against Denmark; and came to America in 1850. He secured employment in the office of the New York *Staats Zeitung*, and in 1859 married the widow of his former employer. He was an alderman in New York in 1872–74; and was an anti-Tammany reform Democrat. He founded the Ottendorfer Free Library in New York, in which city he died. Dec. 15, 1900. E.E.T.

OTTERBEIN UNIVERSITY, situated in Westerville, Ohio, was organized in 1847, named in honor of Bishop Philip William Otterbein, founder of the Church of the United Brethren in Christ, and opened under the presidency of W. R. Griffith, with 81 students of both sexes. It was chartered in 1849, with university privileges. The main college building was erected in 1871, to replace the former, destroyed by fire the previous year. The other buildings are Saum Hall, a Conservatory of Music, and a new Christian Association building. The courses include the classical and the philosophical; the faculty consists of 24 instructors, and the number of students in 1907 was 477. There is a preparatory course of three years, post-graduate courses, and normal, art, and music departments. The productive funds amount to $100,000, and the total income to $56,378 annually. The library has 11,000 volumes.

OTTER CREEK, rises in the northern part of Bennington Co., Vt., and after flowing in a generally northerly direction through Rutland and Addison counties, empties into Lake Champlain at Ferrisburg. It is about 90 miles long, is navigable for eight miles from its mouth, and furnishes water-power for the towns situated on it, including Rutland, Middlebury, and Vergennes.

OTTERY ST. MARY, a town of England, on the river Otter, and on the London and Southwestern railroad, 11 miles E. of Exeter, and 5 miles S.W. of Honiton. Twice the scene of a great conflagration, in 1767 and 1866, it retains its magnificent collegiate church, a reduced copy of the cathedral of Exeter, with the only other transeptal towers in England. The town has factories of silk, shoe-laces, handkerchiefs, and Honiton lace, and is celebrated as the birthplace of the poet Coleridge. Population 1901, 5,000.

OTTO, KING OF BAVARIA. See BAVARIA, in these Supplements.

OTTUMWA, a city, capital of Wapello Co., Iowa. Since 1880 its growth has been rapid. There are 6 rail-

roads entering a general passenger depot, erected at a cost of $125,000. The water-power has been developed until it is claimed to be the finest in the state. The various industries include iron-works and ruffler company, employing 500 men, machine, cutlery and stove works, linseed-oil, starch and flour mills, cigar factories, and a pork-packing establishment with a capacity of 5,000 hogs daily. These industries employ 3,000 men and have a capital of $1,500,000. The city has many fine buildings, paved and graded streets, water-works, a good sewerage system, a fire department, gas and electric lights, several miles of electric street-railways, good public schools, 15 churches, normal school, business college and Roman Catholic Academy, state and national banks, with a combined capital of $670,000, 3 daily and 8 weekly papers and a monthly periodical. Population 1890, 14,001; 1900, 18,197. See also OTTUMWA, Vol. XVIII, 73.

OUDE. See OUDH, Vol. XVIII, pp. 74–76.

OUIDA, novelist. **See DE LA RAMÉE, LOUISA,** in these Supplements.

OULACHAN OR EULACHON, a fish of the smelt family found along the northern Pacific coast of North America. Its scientific name is *Thaleichthys pacificus.* The flesh is very oily, and from it large quantities of oil are extracted. It is called the candle-fish because it burns easily when dried. It is a finely flavored food-fish.

OULESS, WALTER WILLIAM, an English artist; born in Jersey, September 21, 1848. He received an academic education at Victoria College; studied painting at the Royal Academy School and for many years exhibited at Burlington House. He began his career as a painter of genre and historical pictures, but it is as a portrait painter that he has chiefly distinguished himself. He was elected an associate of the academy in 1877, and a full academician four years later. He has painted portraits of Charles Darwin, John Morley, Lord Selborne, Cardinal Newman and other celebrated persons. His only historical pieces of note are *Home Again* and *An Incident in the French Revolution.* Ouless is best known by his portrait of *Charles Darwin*, an etching by Rajon, having had wide circulation in the United States and Europe. W.M.C.

OURAY, a city and the capital of Ouray County, southwestern Colorado, about 15 miles N. of Silverton, at the base of Mount Hayden, on the Denver and Rio Grande railroad. It is situated in a rich mineral region, producing gold and silver abundantly, also copper and galena, and containing iron and sulphur springs. The surrounding scenery is noted for its grandeur and beauty. The city has lumber-mills and smelting-works. Population 1890, 2,534; 1900, 2,196. This section of the state was explored by the Georgians under Baker, who was killed by the Indians, on the Colorado River.

OURO PRETO, a Brazilian city. Population in 1890, 59,249. See OURO PRETO, Vol. XVIII, p. 78.

OUSE, a river of Yorkshire, England, formed near Boroughbridge by the union of the Ure and Swale; flows in a southeasterly direction, and after a course of about fifty-seven miles it joins with the Trent to form the estuary of the Humber. Among the larger tributaries of the Ouse are the Wharfe, the Aire and the Don. The river is navigable for vessels of the largest size to Goole, eight miles up, and for vessels of moderate size to York, a distance of 43 miles. The navigation is improved by an extensive weir and large lock at Naburn, a few miles above which the stream skirts the well-wooded grounds of Bishopthorpe, the official residence or palace of the Archbishops of York.

OUSELEY, SIR FREDERICK ARTHUR GORE, an English composer and musician; born in London, August 12, 1825. He was educated at Christ Church, Oxford, took the degree of doctor of music in 1854 and in the following year was appointed professor of music in his university. He then became incumbent of St. Michael's, Tenbury, and warden of St. Michael's College, an institution in which the teaching of choral singing is combined with a good classical education, and which owes its establishment chiefly to his efforts. In 1866 he was made a canon residentiary of Hereford Cathedral. His published compositions include two oratorios, *The Martyrdom of St. Polycarp* (1855) and *Hagar* (1873); a large number of anthems; many church services; numerous chants, hymn tunes and carols; a sacred cantata; besides overtures, glees, solos and quartettes. He also wrote *A Treatise on Harmony* (1868); *A Treatise on Counterpoint, Canon and Fugue* (1869), and *A Treatise on Musical Form and General Composition* (1875). He died in Oxford, England, April 6, 1889. W.M.C.

OVAMPOS, OVAMBO OR OTJIHERERO, an industrious and peaceable Bantu people of the west coast of Africa, inhabiting Ovampoland, a country extending south of Cunene, in German West Africa, to Damaraland. Some fifty miles from the coast the country rises into a lofty tableland, which is moderately fertile, then declines to the south and east into the deserts of the Kalihari and the region of Lake Ngami. Indications of copper ore appear in various places. Ivory is still an article of trade. An attempt to establish a republic here in 1885, under the name of Appengtonia, failed. See also AFRICA, in these Supplements.

OVARIES, reproductive organs. See REPRODUCTION, Vol. XX, pp. 420–421. For those in plants, see BOTANY, Vol. IV, p. 130.

OVEN-BIRD, a name given to South American birds of the genus *Furnarius.* These birds build hemispherical nests, which resemble an oven or beehive. The name is also sometimes applied to the North American golden-crowned thrush (*Sciurus aurocapillus*).

OVERBECK, JOHANNES A., a Belgian archæologist; born in Antwerp, March 27, 1826; a nephew of F. J. Overbeck (q.v., Vol. XVIII, p. 80); educated at Bonn; privatdocent (1850); professor of archæology at Leipsic (1853). His works include *Kunstarchäologische Vorlesungen* (1853); *Pompeji* (1855; 4th ed. 1884); *Geschichte der Griechischen Plastik* (1857; 4th ed. 1892); *Die Antiken Schriftquellen zur Geschichte der Bildenden Künste bei den Griechen* (1868); *Griechische Kunstmythologie* (1871–87) D , 1895.

OVERSTONE (Samuel Jones-Lloyd), Baron, an English economist and financier; born in London, Sept. 25, 1796; educated at Trinity College, Cambridge; entered his father's banking-house on leaving college; was elected to Parliament in 1819 for Hythe, and in 1850 was raised to the peerage as Baron Overstone and Fotheringhay. The first of Lord Overstone's famous tracts on the Bank of England and the state of the currency was published in 1837, and was followed by others between that period and 1857. The proposal for making a complete separation between the banking and issue departments of the Bank of England, introduced by Peel into the act of 1844, was first brought forward in these tracts. He died Nov. 17, 1883.

OVERSKOV, Thomas, dramatist; was born in Copenhagen, Denmark, on October 11, 1798. He wrote several highly successful dramas, the best known of them being *Ostergade og Vestergade* and *Capriciosa*, both of which retain their places in the theatrical repertory. He was also the author of an important *History of the Danish Theater*, which was published at Copenhagen in seven volumes in 1854–76, and did much for the promotion of dramatic act. He died at Copenhagen in 1873. W.F.J.

OVID, a village of Clinton County, central part of the southern peninsula of Michigan, on Maple River, 10 miles E. of St. John and 65 miles E. of Grand Rapids, and on the Detroit, Grand Haven and Milwaukee railroad. It contains several machine-shops and manufactures of flour, lumber and carriages, and is the center of a district producing wheat and wool. Population 1890, 1,423; 1900, 1,293.

OVID, a village and one of the capitals of Seneca County, southwestern New York, situated on a ridge between Seneca and Cayuga Lakes, about 25 miles S. of Waterloo, the other capital, and about 40 miles N. of Elmira. It is the center of a thriving local trade. About two miles from here, at the village of Willard, is the Willard Lunatic Asylum. Population 1900, 624.

OVUM. See Reproduction, Vol. XX, pp. 425–428; and Embryology, in these Supplements.

OWATONNA, a city and the capital of Steele County, southeastern Minnesota, on Straight River, and on the Chicago, Milwaukee and St. Paul and the Chicago and North-Western railroads, 15 miles S. of Faribault and 71 miles S. of St. Paul. It is the seat of the State School for Dependent Children, contains a valuable mineral spring, has manufactures of flour, carriages and agricultural implements, and a good shipping trade for a region producing immense quantities of wheat and raising live-stock. Population 1890, 3,849; 1900, 5,561.

OWEGO, a town of New York. Population 1900, 5,039. See Owego, Vol. XVIII, p. 88.

OWEN, David Dale, an American geologist, son of Robert Owen; born in New Lanark, Scotland, June 24, 1807. He accompanied his father to the United States in 1823, took a degree from the Ohio Medical College and for some years studied in Europe. In 1833 he was appointed state geologist of Indiana and under the direction of the legislature made a geographical survey of the state. In 1839 he was appointed by the United States government to make a survey of the mineral lands of Iowa. He then made a government geological survey of Wisconsin and Minnesota, and in 1852 was engaged in a geological survey of Kentucky. He became state geologist of Kansas in 1857. Among his publications are reports of his various surveys. He died in New Harmony, Ind., Nov. 13, 1860. W.M.C.

OWEN, Sir Philip Cunliffe, a British promoter of industrial art; born June 8, 1828; entered the navy in 1840, but retired on account of ill health; in 1854 became clerk, in 1860 assistant director, of the South Kensington Museum, and in 1873 succeeded Sir Henry Cole as director. In 1876 he was executive commissioner at the Centennial Exhibition at Philadelphia, and in 1878 he served as secretary of the royal commission for the Paris Exposition. He took an active part in the International Fisheries Exhibition at London in 1883, the health and education exhibitions in 1884, the Music Exhibition in 1885, and the Colonial and Indian Exhibition in 1887. In all these cases he displayed great executive ability, and promoted the objects of the industrial arts materially. In 1873 he was knighted. He retired in 1893, and died in Lowestoft, March 23, 1894.

OWEN, Sir Richard, an English anatomist and zoölogist; born in Lancaster, England, July 20, 1804. He became assistant curator of the Hunterian Museum; in 1834 he was appointed professor of comparative anatomy at Saint Bartholomew's Hospital; Hunterian professor on the same subject at the Royal College of Surgeons in 1836; superintendent of the natural history department in the British Museum in 1856. From a femur sent to him from New Zealand in 1839, he reconstructed the skeleton of the Diornis bird, and four years later, from fresh examples of subfossil bones, he distinguished five species of this genus. He was a master in the fields of animal fossils and of anatomy, a great collector and classifier of anatomical and palæontological remains, and profoundly versed in morphology. In these departments of science his name is linked with Cuvier, whom, in many respects, he resembled, both as to his anatomical insight and enthusiasm for palæontology. Toward the modern theories of the evolutionists Sir Ricard Owen maintained a conservative, though by no means hostile, attitude. Besides his numerous contributions to the *Transactions* of the Royal, Linnæan, Geological and Zoölogical societies, he published descriptive catalogues of the specimens of physiology and comparative anatomy in the museum of the Royal College of Surgeons, together with a catalogue of the natural history, the osteology and the fossil organic remains preserved in that institution. In 1879 he

SIR RICHARD OWEN.

was knighted. He received distinguished honors from foreign states, and was a member of all the principal scientific societies of Europe and America. Died in Richmond Park, Dec. 18, 1892.

OWEN, Robert Dale, publicist, son of Robert Owen, the founder of the "Chartist" movement in England, was born near Glasgow, Scotland, probably on November 6, 1801, though other dates are given, and was educated chiefly in Switzerland. He came to America with his father in 1823, and settled in Indiana. He was a representative in Congress from that state in 1843–47 and was chargé d'affaires at Naples in 1853–58. He was one of the organizers and one of the first regents of the Smithsonian Institution. During the Civil War he was an earnest advocate of the emancipation of the slaves, and a strong supporter of the national government. He also interested himself in other political and social questions, and had a memorable debate in print with Horace Greeley on the subject of divorce. Spiritualism commanded his earnest attention, and he was for years one of its foremost champions in America. He was the author of many books, the chief of them being *Education at New Lanark*, *Moral Physiology*, *Popular Tracts*, *Personality of God and Authority of the Bible*, *Pocahontas* (a drama), *Hints on Public Architecture*, *Footprints on the Boundary of Another World*, *Beyond the Breakers*, *The Debatable Land Between This World and the Next*, and *Threading My Way* (autobiography). He was also a prolific contributor to periodical literature. For many years he made his summer home at Lake George, N. Y., and he died there on June 17, 1877. W.F.J.

OWENS, John Edward, an American actor; born in Liverpool, England, May 4, 1824. He removed with his parents to the United States in 1828, and was educated in Philadelphia. He made his first appearance as an actor there in 1841. In 1849 he became manager of the Baltimore Museum and in 1852 opened Brougham's Lyceum in New York. After a tour of Europe, during which he played comedy rôles, he was manager of the Charles Street theater in Baltimore. He starred successfully for several seasons, playing in the leading cities of the United States and Canada. In 1864 he made a nine months' run at Wallack's theater, New York, in *Solon Shingle*, afterward playing the same part in London. After his return he starred in various stock companies He died near Towson, Maryland, December 7, 1886. W.M.C.

OWENSBORO, a city and the capital of Daviess County, northwestern Kentucky, on the Ohio River, about 40 miles above Evansville, Indiana, and about 75 miles S.W. of Louisville, on the Louisville and Nashville, the Louisville, St. Louis and Texas and the Owensboro, Falls of Rough and Green River railroads. The city is the center of a region rich in agricultural and mineral products, and in timber. The leading industry is connected with the tobacco interests, the annual shipments reaching 18,000,000 pounds. There are numerous distilleries, lumber-mills, railroad machine-shops and manufactures of furniture. There are a number of fine public buildings, including the United States Government Building, the Woman's College and a large theater; public schools for both white and colored children; state savings and national banks, with a combined capital of $1,500,000; 18 churches of 7 denominations, and 2 daily and 4 weekly papers. The principal streets of the city are macadamized; there are gas and electric lights, and water is supplied by the Holly system. The population increased from 6,231 in 1880 to 9,837 in 1890, and to 13,189 in 1900.

OWENS COLLEGE. See Manchester, Vol. XV, p. 470.

OWEN SOUND, a town and port of entry and capital of Grey County, northwestern Ontario, at the outlet of Sydenham River, on Owen Sound, an arm of Georgian Bay, 130 miles N.W. of Toronto, and on the Canadian Pacific and the Grand Trunk railroads. It possesses a deep sheltered harbor, and has a large trade in lumber and grain, besides manufactories of furniture and woodenwares, machinery and woolen goods and ships. The Canadian Pacific steamers leave here for Port Arthur. Population 1891, 7,497; 1901, 8,776.

OWENS RIVER and LAKE. See California, Vol. IV, p. 618.

OWL-PARROT or GROUND-PARROT. See Kakapo, Vol. XIII, p. 834.

OWOSSO or OWASSO, a city of Shiawassee County, southeastern central southern peninsula of Michigan, on the Shiawassee River, and on the Ann Arbor, the Michigan Central and the Detroit and Grand Haven railroads, 78 miles N.W. of Detroit and 28 miles N.E. of Lansing. The river supplies abundant water-power, and the city has flour and planing mills, coffin, furniture and sash and blind factories, besides foundries and railway shops. Population 1890, 6,564; 1900, 8,696.

OX. See Cattle, Vol. V, p. 213.

OX-BIRD. See Sand-piper, Vol. XXI, p. 273.

OXENFORD, John, an English dramatist and critic; born in Camberwell in 1812; was called to the bar in 1833, but preferred a literary life; made himself familiar with French, German and Spanish literature, and became known by his admirable translations of such books as Goethe's *Dichtung und Wahrheit* and Eckermann's *Conversations with Goethe*. During the last thirty years of his life he was dramatic critic for the London *Times*, his criticisms being characteristic of the genial kindliness of his nature. His *Book of French Songs* showed as a translator a mastery of the lighter forms of verse. He wrote many plays; among them, the *Dance of Death;* the *Reigning Favorite;* the *Two Orphans;* as well as the libretto for *The Lily of Killarney*, and a farce, *Twice Killed*, that became widely popular. He died in London, Feb. 22, 1877.

OXENHAM, Henry Nutcombe, theologian; was born at Harrow, England, on November 15, 1829, and was educated at Harrow school and at Balliol College, Oxford. He was a minister of

the English Church until 1857, when he joined the Roman Catholic Church and became a professor at St. Edmund's College and master at the oratory school, Birmingham. He was a prolific writer, his works including poetry and prose, theology and fiction. Among his books were *The Sentence of Kaires and Other Poems* (1854); *Manual of Devotion for the Blessed Sacrament* (1854); *Church Parties* (1857); *Philip Paternoster* (1865); *The Catholic Doctrine of Atonement* (1865); *Dr. Pusey's Eirenicon Considered* (1866); *Recollections of Ober-Ammergau* (1871); *Catholic Eschatology and Universalism* (1876); *Short Studies in Ecclesiastical History and Biography* (1884); *Short Stories: Ethical and Religious* (1885); *Memoirs of Lieutenant Rudolph de Lisle, R.N.* (1886); *Thoughts for Holy Week* (1886), and a number of translations of the writings of Dr. Döllinger and others. He died in March, 1888. W.F.J.

OXFORD, a town of Calhoun County, northeastern Alabama, 20 miles N.E. ot Talladega, on the Southern railroad. It is situated in a region whose staple product is cotton, and is an important shipping-point for that product. Population 1890, 1,473; 1900, 1,372.

OXFORD, a town of Newton County, north-central Georgia, about 38 miles E.S.E. of Atlanta, and 2 miles N. of Covington, the nearest railroad station, on the Georgia railroad. It contains the Palmer Institute, and is the seat of Emory College (Methodist Episcopal South), a co-educational institution established in 1837, having, in 1904, 16 instructors, 258 students and an equipment comprising 6 buildings and a library of 30,000 volumes. Population 1890, 791; 1900, 800.

OXFORD, a town of Talbot County, eastern Maryland, and a popular summer resort, situated on the eastern shore of Chesapeake Bay, on a navigable arm known as Three Haven or Tred Avon River, 10 miles S.W. of Easton, on the Philadelphia, Wilmington and Baltimore R. R. Pop. 1900, 1,243.

OXFORD, a township of Worcester County, central Massachusetts, on French River, 10 miles S. of Worcester and about 48 miles W.S.W. of Boston, and on the New England and the Boston and Albany railroads. It contains the villages of Texas, North Oxford, North Oxford Mills, West Oxford and Oxford, of which the last named is the largest and most important, having several churches, a public library, large boot and shoe factories, and cotton and woolen mills. The other villages are devoted to manufacturing. Population of the town in 1890, 2,616; 1900, 2,677.

OXFORD, Mississippi, is a city and the county seat of Lafayette County, in the central-northern part of the state. It is a center of the cotton-growing and manufacturing industry, and has also some trade in lumber, canned fruits and vegetables, etc. It is the seat of the University of Mississippi (q. v.), and of several other educational institutions, and is a favorite place of residence. It is reached by the Illinois Central railroad, and had in 1900 a population of 1,825. W.F.J.

OXFORD, a village of Chenango County, southern central New York, beautifully situated in the fertile valley of the Chenango River, eight miles S.S.W. of Norwich, on the Delaware, Lackawanna and Western and the New York, Ontario and Western railroads. The surrounding country is rich in dairy products, and has quarries of bluestone. The village contains Oxford Academy, and has manufactures of flour, sleds and baskets. Population 1890, 1,477; 1900, 1,931.

OXFORD, a town and the capital of Granville County, northern North Carolina, 42 miles N. of Raleigh, on a northern affluent of the Tar River, and on the Southern railroad. It contains an orphan asylum, and is extensively engaged in the tobacco trade, having several manufactories and large warehouses. Tobacco is the staple product of the surrounding country. Population 1890, 2,907; 1900, 2,059.

OXFORD, a village of Butler County, southwestern Ohio, 39 miles N.W. of Cincinnati, on the Cincinnati, Hamilton and Dayton railroad. It contains important manufactories of agricultural implements. It is the seat of Oxford College (Non-Sect.), an institution established in 1849 for the education of women, which had, in 1901, 19 instructors, 150 students, and a library of 3,000 volumes. Western Female Seminary, a non-sectarian institution of learning, and Miami University (q.v., in these Supplements) are also located here. Population 1890, 1,922; 1900, 2,009.

OXFORD, Pennsylvania, is an important borough of Chester County, in the southeastern part of the state, forty-five miles southwest of Philadelphia. It contains flour mills, factories of vehicles, and other industries, and is the seat of several institutions of higher learning. One of the latter, Oxford Academy, is a large secondary school founded by the Presbyterian Church. Lincoln University was also founded by Presbyterians, near Oxford, for the education of negroes, and has been a successful and valuable institution. Oxford is in a rich agricultural and fruit-growing region, is reached by the Philadelphia, Wilmington and Baltimore and Lancaster, Oxford and Southern railroads, and had in 1900 a population of 2,032. W.F.J.

OXFORD FURNACE OR OXFORD, a town of Warren County, northwestern New Jersey, 15 miles N.E. of Phillipsburg and 30 miles W. of Morristown, on the Delaware, Lackawanna and Western railroad. It contains many extensive foundries, furnaces, factories, machine-shops and mills. Population of township (1900), 3,095.

OXFORD MOVEMENT, OR TRACTARIAN MOVEMENT, originated during the second quarter of the nineteenth century, and was a High Church reaction toward mediæval Roman Catholicism, as well as against rationalism and formalism. The first sign of the movement may be traced to the publication, in 1827, of John Keble's *Christian Year*. John Henry Newman was brought under the influence of this brilliant scholar, who preached a sermon, July 14, 1833, on *National Apostasy*, regarded by Newman as the real starting-point of the agita-

tion. The famous *Tracts for the Times* began to appear September 9th, the authors including such writers as Hugh James Rose, John Keble, John Henry (afterward Cardinal) Newman, Edward Bouverie Pusey, and other divines. These tracts extend to a series of ninety, and advocated apostolic succession, baptismal regeneration, confession, the real presence and the authority of the church and of tradition. The movement culminated in the neo-Catholic schism headed by Newman. See PUSEY, Vol. XX, p. 122.

OX-GALL, the bile of the ox as found in the gall-bladder. In composition it contains, in 100 parts, water, 90.44; biliary and fatty bodies, including resinoid acids, 8; mucus, .30; watery extract, chlorides, phosphates and lactates, .85; soda, .41 The union of the resinoid acids and the soda results in the soapy constitution of the bile. In medical practice it was formerly common to administer it to patients deficient in bile, to aid in the digestion of fats; in clysters, for the purpose of dissolving hardened masses of feces; and as a liniment, its properties being considered to be discutient. Artists use gall, refined from its coloring and coagulable matter, in mixing colors, improving their tint while also fixing them and making them flow easier. It is a constituent of some varnishes, and is used in cleaning ivory tablets for artists' use. See ABATTOIRS, in these Supplements.

OXLEY, JAMES MACDONALD, a Canadian author and lawyer; born in Halifax, Nova Scotia, October, 22, 1855. He was graduated from Dalhousie University, Halifax, in 1874, and studied at Harvard in 1876. He was admitted to the bar in 1878 and practiced law in Halifax. In 1883 he was appointed legal adviser in the Dominion department of marine and fisheries. He resigned from office in 1891 and engaged in the life insurance business in Ottawa and Montreal. He has written a large number of books for boys, including *Donald Grant's Development* (1892); *Archie of Athabaska* (1893); *In the Swing of the Sea* (1897); *Fife and Drum at Louisbury* (1899), and *Lhasa at Last*, a journey to the Forbidden City of Tibet (1900). He has also written two legal works, *Nova Scotia Decisions* (1880), and *Admiralty Decisions* (1882). W.M.C.

OXYCALCIUM LIGHT OR LIME-LIGHT. See MAGIC LANTERN, Vol. XV, p. 213.

OXYGEN AND OXIDES. See CHEMISTRY, Vol. V, pp. 413–417; and in these Supplements.

OXYHÆMOGLOBIN. See RESPIRATION, Vol. XX, p. 497.

OXYHYDROGEN BLOWPIPE. See OXYHYDROGEN FLAME, Vol. XVIII, pp. 108, 109; and BLOWPIPE, Vol. III, p. 730.

OYAMA, MARQUIS, a Japanese general and statesman; born 1842, famous for his military skill and valor. He won distinction in the civil war in southern Japan, and at the outbreak of the Russo-Japanese War was placed in command of an army mobilized at Hiroshima, Sept. 26, 1894, and in January, 1895, was given command of the third Japanese army. Field-Marshal Oyama was wisely made commander-in-chief of the Japanese land forces in the Russo-Japanese War of 1904–05, as his brilliant success in the field proved. A.R.R.

OYSTER. The oyster-fishery is by far the most important of the fishing industries of the United States. The American oyster (*Ostrea virginiana*) is found along the Atlantic coast from Florida to the Gulf of St. Lawrence. In some portions of this range it occurs in natural beds of large extent, that of Long Island Sound being 115 miles in length. Chesapeake Bay, with its many inlets and river mouths, is the best-adapted home for the American oyster. It attains here its highest excellence. The bottom of this bay is almost covered with beds of the finest oysters in the world. Baltimore is the most important mart in the oyster trade. It cans and pickles vast quantities of oysters for shipment to the West and to foreign countries. Farther south the coast oysters occur plentifully, but are only gathered for local use. On the coast of Georgia they occur, in some places, in such abundance as to form natural breakwaters firm enough to resist the billows of the ocean. The coast region here is made up of salt marshes from 12 to 18 miles wide, through which slow-flowing rivers make their way to the sea. These rivers flow between banks of living oysters so closely compacted that a vessel might, in some places, obtain a cargo in a space only three or four times its own length. Oysters abound, also, in the inlets and small bays of the Gulf of Mexico. In the Bay of Mobile they are plentiful and of excellent quality, and are cultivated on a large scale. In Louisiana are beds of oysters unsurpassed in size and flavor. On the Pacific coast, oysters exist abundantly, in the Strait of Fuca and in Puget Sound. These oysters are, however, quite small, but of fine flavor. The Eastern oyster has lately been introduced on the Pacific coast, and seems to be susceptible of easy cultivation there. In like manner oysters of the Chesapeake are brought to Long Island and planted there to supply the beds that have become exhausted by over-dredging.

Oysters are said to be fatter in winter than in summer. What is called "fat" in the oyster is, however, no fat at all, but a deposit of protoplasm, which forms a very digestible and highly nutritious food for man. It is laid down in the mantle or fleshy portion of the animal during the winter season, and again exhausted during the reproductive period in summer, when the oyster becomes poor and non-nutritious. The so-called "fattening," by removing the oysters for a few days to water fresher than that in which they grew, is a dealer's trick. The oyster absorbs more fresh water than sea-water. By this means it becomes plumper, and at the same time loses part of its saltness. Some dealers even warm the water by means of steam, in order to induce the oyster to take in more water, and thereby become plumper.

The principal food of the oyster consists of microscopic beings and fragments of organic matter, which are carried by the currents of water to the mouth of the animal at the hinge end of the shell. When this material is examined through the microscope, it is seen that the animal subsists largely upon what scientists call "diatoms"—one of the lowest

types of moving plants which swim in the water, encased in minute sandstone cases or boxes of delicate workmanship. When these have been found in the intestines of the oyster, they have usually had their living contents already dissolved out by the action of the gastric juice.

Some American oyster-lovers reject green oysters, under the impression that they are poisonous, or at least unhealthy. In France and England green oysters are looked upon as a special delicacy. They bring higher prices than the ordinary varieties. Investigation has demonstrated that their green color is due to the eating of green vegetable food, as the young grass growing on the bottom of shallow oyster-beds. The chlorophyll of the green food is absorbed in such quantities as to tint the blood-cells of the animals greenish. Green oysters are, in reality, more palatable and nutritious than white ones.

As to the statistics of the oyster-fishery in the United States we take from the census report of 1890 the following data, giving the value produced by molluscan fishery (oysters, clams and scallops), in the maritime states during that year: Alabama, $107,812; California, $782,627; Connecticut, $1,476,435; Delaware, $75,910; Florida, $109,649; Georgia, $40,820; Louisiana, $299,896; Maine, $165,478; Maryland, $5,304,092; Massachusetts, $343,171; Mississippi, $166,672; New Hampshire, $975; New Jersey, $2,142,444; New York, $3,570,211; North Carolina, $188,457; Oregon, $3,887; Pennsylvania, $101,850; Rhode Island, $359,216; South Carolina, $23,204; Texas, $127,990; Virginia, $2,556,098; Washington, $153,695. The total value of the product of the United States molluscan fisheries, as sold for the year preceding the census enumeration of 1890, was $18,100,598. In 1900, the value of canned oyster products was $1,535,693.

Baltimore packs 7,000,000 bushels per annum. The industry in Maryland is now protected by legislation, and directed by a state commission. An oyster three months old is the size of a quarter-dollar, six months old, a half-dollar, but is not fit to eat before four years old. The oyster-beds established by advice of Abbé Bonnetard in France produced 97,000,000 oysters in 1831. (See Vol. XVIII, pp. 110–114.)

Country.	Bushels.	Value.
United States	29,796,387	$16,638,805
Great Britain	2,760,000	6,200,000
France	2,000,000	5,000,000
Holland	70,000	444,000
Italy	65,000	200,000
Canada	152,580	183,846
Germany	13,000	75,000
Miscellaneous	400,000	600,000
Totals	35,256,967	$29,341,651

A comparison of the oyster-product of the world is shown in the preceding table, given in *The Oyster Industry of Maryland* (1894):

The comparative consumption of the bivalve in three of the principal cities is seen by the following figures (*Mulhall's Statistics*):

	Consumption. Millions.	Per Inhabitant.
London	220	60
Paris	57	26
New York	810	660

OYSTER–DRILL, a name which the oyster-fishermen apply to a small gasteropod mollusk (*Vrozalpinx cinerea*) of the family *Muricidæ*. It is said to drill holes in the shell of the oyster with its lingual ribbon, in order to reach the soft parts.

OYSTER–PLANT. See *Salsify*, under Horticulture, Vol. XII, p. 300.

OZARK, a village and the capital of Dale County, southeastern Alabama, about 45 miles S.W. of Eufaula and about 75 miles S.S.E. of Montgomery, on the Alabama Midland railroad and the Central Railroad of Georgia. It is in an agricultural and pine forest region, and has a tannery, a cotton-gin factory, and flour, cotton, saw and grist mills. Population 1890, 1,195; 1900, 1,570.

OZARK, a town and the capital of Franklin County, northwestern Arkansas, on the Arkansas River, 43 miles below Fort Smith, and on the St. Louis, Iron Mountain and Southern railroad. The surrounding country is hilly, coal is found, and cotton, corn, sweet and white potatoes, hogs and livestock are produced. The town has a cotton-gin. Population 1890, 862; 1900, 848.

OZARK MOUNTAINS, a series of mountains, or more properly hills or ridges, as they nowhere exceed two thousand feet in elevation, steep and heavily timbered, extending from southeastern Missouri throughout eastern Arkansas into Indian Territory. In their mineral structure these mountains resemble the Alleghanies. Coal, iron and lead have been found in them, and deposits of the precious metals are believed to exist. The Ozark region of Missouri was for many years noted for the deeds of lawlessness which were committed there.

OZONE. See Chemistry, Vol. V, pp. 417, 418; and in these Supplements.

P

PABNA—PACIFIC RAILWAYS

PABNA, a town of Bengal, India, and capital of the district of Pabna, on an arm of the Ganges, 115 miles N. of Calcutta. It has government buildings, a hospital and indigo-works. Population, 16,500, composed of Hindus and Mohammedans. The district has an area of 1,847 square miles and a population of 1,311,728. It is a fertile plain, traversed by numerous watercourses. Pop. of city, 16,500.

PACA OR CÆLOGENYS PACA. See *Dasyproctidæ*, under MAMMALIA, Vol. XV, p. 426.

PACA, WILLIAM, an American statesman; born in Harford County, Md., Oct. 31, 1740. He graduated at Philadelphia College in 1759; studied law, and began practice in Annapolis, Md. He was a member of the Provincial House of Representatives, 1771–74; delegate to the Continental Congress, 1774–79; state senator, 1777–79; chief justice of the supreme court of Maryland, 1778–80, and of the court of appeals, 1780–82; governor of Maryland, 1782–86; United States district judge from 1789 till his death, which occurred at Wye Hall, Md., in 1799. E.E.T.

PACCHIONIAN BODIES. See ANATOMY, Vol. I, pp. 759–760.

PACHUCA, a mining town and the capital of the state of Hidalgo, southeastern central Mexico, 56 miles N.N.E. of Mexico, on the Hidalgo and North-Eastern, Mexican, and Mexican Central railroads. It is situated in a valley surrounded by lofty mountains, and is celebrated for its silver-mines, which were worked before the Spanish conquest, and, with the neighboring mines of Real del Monte, produce one sixth of all the silver mined annually in Mexico, the yearly reduction of ore being from 70,000 to 90,000 tons. Here, in 1557, Bartolomeo Medina discovered and first used the *patio* process for extracting ore by the help of sulphide of copper, salt and mercury. Population 1900, 37,487.

PACIFIC, a town of Franklin County, eastern Missouri, on the Maromee River, and on the Missouri Pacific and the St. Louis and San Francisco railroads, 37 miles W.S.W. of St. Louis. It has rich beds of white-glass sand and fire-clay, deposits of iron, copper and lead, and a flour-mill, sand-crusher and tripoli factory. Population 1890, 1,184; 1900, 1,213.

PACIFIC RAILWAYS. In 1856 both the Democratic and Republican national conventions adopted resolutions in favor of granting government aid to the construction of a railroad to the Pacific Coast. Similar resolutions were adopted at the conventions of 1860, and the breaking out of the Civil War, with the unfriendly attitude of Great Britain and France toward the Federal government, established the need of such a road as a war measure, if for no other purpose. Accordingly, a bill, providing for the construction of a railroad connecting the eastern system with the one which had begun to come into existence on the Pacific Coast, passed the Congress June 24, 1862, and was approved July 1, 1862, by President Lincoln.

By this act the Union Pacific Railroad Company was chartered to construct a railroad and telegraph line from the Missouri River, at Omaha, Nebraska, to the western boundary of Nevada, in the general direction of San Francisco. The Central Pacific Railroad Company, a corporation organized under the laws of the state of California, was recognized by this act, and authorized to extend its line to the eastern boundary of California, and, if necessary, to continue the construction beyond that point to a connection with the Union Pacific. The Leavenworth, Pawnee and Western Railroad Company, a Kansas corporation, chartered to build a railroad from Leavenworth to Lawrence, was authorized to construct a line from Kansas City, along the valley of the Republican River, and to a junction with the Union Pacific at the 100th meridian, and to receive the regular subsidy in bonds and land for this mileage. The name of the company was thereupon changed to the Union Pacific Railway Company, Eastern Division. Another branch line was authorized to extend due west from Atchison, Kansas, to connect with the line from Kansas City, an estimated length of one hundred miles, and the Atchison and Pike's Peak Railroad Company proposed and was authorized to build that road; whereupon the name of that company was changed to the Central Branch Union Pacific Railroad Company. It was further provided that upon the completion of a railroad from Chicago or St. Paul to Sioux City, a line might be constructed from Sioux City to a connection with the Union Pacific or its Sioux City extension, and authority to construct such a road was granted to the Sioux City and Pacific Railroad Company, organized for that purpose on Aug. 1, 1864.

Government aid was granted for the construction of these lines, in the shape of a land grant of 6,400 acres per mile, together with United States subsidy six-per-cent thirty-year bonds of $16,000 per mile for the branch lines and the portion of the main line from Omaha to the base of the Rocky Mountains, and from San Francisco to the base of the Sierra Nevadas—that is to say, for the level and easily constructed mileage; for the sections where the road climbed the two mountain ranges, the subsidy was increased to $48,000 per mile; and for the plateau region between the Rocky Mountains and the Sierra Nevadas, the subsidy was to be $32,000 per mile.

In consideration of these grants, the companies

were to complete their roads by July 1, 1876; to transport troops, munitions of war, postal matter, etc., for the United States at rates as favorable as those charged to private parties; to allow the use of their telegraph on similar terms; to pay into the Treasury of the United States five per cent of the net earnings of their respective roads, and allow the government to retain the whole of the charges for transportation on its account—the two sums so provided to be applied to the payment of interest on the government bonds as it matured, the companies also being required to pay the principal of the bonds at their maturity, together with any balance of interest that might then be due.

The act incorporating the Union Pacific authorized an issue of stock to the amount of $100,000,000, the total issue, however, being limited in amount to the total cost of the road, and it was provided that, as conditions precedent to a permanent organization and the election of a board of directors, at least $2,000,000 stock should be subscribed and ten per cent paid in thereon.

The Central Pacific Company formally accepted the terms offered by Congress on Oct. 7, 1862, and the work of construction was begun at Sacramento on Jan. 8, 1863.

The Union Pacific effected a temporary organization, and subscription-books were opened in the leading cities of the country. On Oct. 29, 1863, $2,177,000 of the stock had been subscribed and $217,700 (ten per cent) paid in thereon, and accordingly the company was permanently organized. The amount of paid-up stock subscriptions was soon used up, and as no further subscriptions could be secured, the company became pecuniarily embarrassed. The capitalists of the country did not consider the Union Pacific a promising investment as matters stood, the prices of both labor and materials being abnormally high at the time, and for these and similar reasons they held aloof from the enterprise. At the request of the Union Pacific, therefore, Congress, in 1864, amended the former act by making terms more favorable to the companies, the chief of these being preference to an amount of bonds to be issued by the companies equal to the subsidy bonds of the government, and a provision that the government should pay over to them one half of the charges for services on its account. Also, the land grant was increased to 12,800 acres per mile, making the total grant to all the companies about 39,000,000 acres. The transcontinental line was completed May 10, 1869, the Union Pacific having constructed 1,034 miles from Omaha, Nebraska, to Ogden, Utah, and the Central Pacific, beginning at Sacramento, 743 miles. Meanwhile, the Central Pacific Company had assigned to the Western Pacific Railroad Company the right to construct the road from Sacramento to San José, together with the benefits and responsibilities attaching to the work, and on Sept. 1, 1869, the road was completed and put in operation.

In 1869 the Sioux City and Pacific railroad was completed from Sioux City to Fremont, Nebraska, 102 miles, and in 1870 the Union Pacific Railroad Company, Eastern Division, completed its line from Kansas City to Denver, 638 miles.

By the act of 1862 the line from Sioux City was intended to run to the 100th meridian, but the amendment of 1864 allowed a junction either with the Union Pacific's Sioux City branch (proposed) or with the main line of that road. To cross the Missouri River immediately at Sioux City and proceed in a southwesterly direction, according to the intention of the act, would have placed the whole land grant in Nebraska. There were more valuable lands in western Iowa, so the projectors chose a course slightly east of south from Sioux City, and crossed the river at a point only a little way above Omaha. The junction with the Union Pacific was at Fremont, a short distance west of Omaha.

The projectors of the Union Pacific, Eastern Division, doubting that the Union Pacific would ever build its road as originally planned, procured the insertion into the act of July 2, 1864, of a section providing that if the line from Omaha had not been constructed when the Eastern Division reached the 100th meridian, the latter might proceed to build westward on the proposed route of the Union Pacific, and receive the subsidy, for such work. In 1866, however, the Eastern Division was released from the necessity of joining the Union Pacific at the 100th meridian. Under the authority granted by this act, the old route by way of the Republican fork of the Kaw River was abandoned, and a new one, following the Smoky Hill branch of that stream, was adopted, the point of divergence from the original route being Fort Riley. It was the intention of the company to build its road southwest from Denver through New Mexico and Arizona, and on to the southern part of California; but this plan was frustrated by the act of 1866, which required the Eastern Division to join the Union Pacific at a point not more than fifty miles west of Denver. The act extended the company's land grant to cover the additional mileage to its junction with the Union Pacific, but the issue of subsidy bonds was confined to the length of line (394 miles) originally provided for. In March 1869, authority was obtained from Congress to transfer to the Denver Pacific Railway and Telegraph Company, a Colorado corporation, all the rights and privileges to which the company was entitled for the construction of a railroad between Denver and the junction with the Union Pacific at Cheyenne; and in the same month, by special act of Congress, the company was authorized to assume the title of Kansas Pacific Railway Company. The Denver Pacific line was opened June 23, 1870.

The Central Branch Union Pacific, the last of the branch lines provided for, was completed from Atchison to Waterville, Kansas, one hundred miles, and opened Jan. 20, 1868. Subsidy bonds for the first completed section of twenty miles

were issued Aug. 2, 1866, those for the fifth and last section Jan. 24, 1868.

Meanwhile, rumors had begun to be circulated impugning the reports of the commissioners who had accepted the several sections of the Pacific railroads, and hinting at unlawful means employed by the companies to secure these reports. In consequence, Congress, in April, 1869, appointed a committee to investigate the affairs of the Union Pacific Company, and inquire whether its charter had not been forfeited. At the same time provision was made for the appointment of a commission to examine the roads and ascertain whether they fulfilled the requirements of law, and also what further expenditures were needed to make them first-class roads. Its report was handed in Oct. 30, 1869, and it specified the improvements needed.

When the matter came up in Congress in 1876, the Judiciary Committee of the House reported that "the railroad companies concede that one half of the compensation for services, and perhaps five per cent of the net earnings, of the roads should be applied, so far as they will go, in reducing the interest account, but they claim that they are not required in any other manner to pay any of the interest until the maturity of the subsidy bonds, *and not even then.*

"The following table shows the principal of the subsidy bonds issued to each company, the amount which each company would owe the government at the maturity of the subsidy bonds for interest paid by the government, with interest compounded thereon, and the amount of interest paid to maturity of subsidy bonds without any interest computed thereon."

Name of Companies.	Date of Maturity of Subsidy Bonds.	Principal of Subsidy Bonds.	Compound Interest to Maturity.	Simple Interest to Maturity.
Central Pacific	Nov. 18, 1897	$25,885,120	$126,619,733 30	$46,593,216 00
Kansas Pacific	Nov. 17, 1896	6,303,000	30,831,774 36	11,345,400 00
Union Pacific	Sept. 3, 1897	27,236,512	133,230,206 60	49,025,721 60
Central Branch Union Pacific	Oct. 20, 1896	1,600,000	7,826,564 96	2,880,000 00
Western Pacific	Sept. 5, 1898	1,970,560	9,639,197 41	3,547,008 00
Sioux City and Pacific	Jan. 1, 1898	1,628,320	7,965,095 16	2,930,976 00
Totals		$64,623,512	$316,112,571 79	$116,322,321 60

In January, 1872, another Congressional committee was appointed "to make inquiries in relation to the affairs of the Union Pacific Railroad Company and the Crédit Mobilier of America." The outcome of this investigation was the law of March 3, 1873, which, among other things, repealed the requirement that the government should pay over to subsidized railroad companies one half of the charges for transportation on government account, thus restoring the text of the act of 1862. The Union Pacific tested the right of the government to retain full transportation charges in the courts, which decided that the government could only retain one half of the charges on its account, and that no interest on the subsidy bonds was payable until their maturity, except the five per cent of net earnings and one half of charges on government transportation. The supreme court decision to this effect was handed down some time in 1876.

A proposition was now made to the government that the company should pay into the United States Treasury $500,000 per annum for ten years commencing July 1, 1875, $750,000 per annum for ten years commencing July 1, 1885, and $1,000,000 annually thereafter until the maturity of the bonds; the money so paid in, together with the sum of $800,000 claimed by the company as due it for government transportation at the time of making the proposition (February, 1875), to be held by the Secretary of the Treasury as a sinking-fund, devoted to the extinction of the government mortgage, compound interest to be allowed on the money so held at the rate of 6 per cent per annum.

Notwithstanding this enormous equitable obligation, the railroad companies were able to defeat all measures to bring them to terms. They were content with the position in which the courts had placed them.

Alarmed at the rapid rate with which the balances against the companies on account of interest was increasing, Congress passed, in 1878, what is known as the Thurman Bill for the establishment of a sinking-fund for both Union Pacific and Central Pacific. This act provided that there should be carried to the credit of the sinking-fund, on the 1st of February in each year, the one half of the compensation for government service, and also the sum of $850,000, or so much thereof as would be necessary to make the five per cent of the net earnings of the road payable to the United States under the law of 1862, and the whole sum earned as compensation for government service; also, a sum amounting to 25 per cent of the whole net earnings of the road, the net earnings to be ascertained by deducting from the gross earnings the expenses of operation, together with interest on first-mortgage bonds.

This measure materially increased the yearly amounts to be paid to the government, but even then they were not sufficient to pay the interest and meet the requirements of the sinking-fund. Consequently, the debt due to the government increased steadily, and, as the dates of maturity of the several issues of bonds drew nigh, alarm began to be felt for the security of the government's claim. Measures looking to the settlement of the vexed question were introduced in Congress, but were passed on from session to session with-

out any satisfactory solution of the problem being reached. Meanwhile, the Union Pacific had become financially embarrassed and its property placed in the hands of receivers. To sell the property under foreclosure of its first mortgage the government recognized would put its claim in imminent jeopardy, and therefore renewed efforts were made to bring about a settlement. Several projects were urged, agreeing, however, in principle. They proposed funding the government claim in very long-time bonds, even to eighty years, at low rates of interest, and making these obligations a first lien on all the property of the defaulted companies. But at the close of 1896 the hard problem had not been solved and no settlement had been reached.

The debt matures rapidly; indeed, several blocks of it, running into the millions, have already been paid by the government and larger amounts will shortly fall due. The plan of the Reorganization Committee of the Union Pacific proposes to set aside $35,755,280 in new four per cent bonds to pay the debt of the United States, or meet other "extraordinary requirements," and $20,864,400 of the new preferred stock for the same purposes. See also RAILROADS, in these Supplements.

JOHN P. MEANY.

PACINIAN CORPUSCLES. See ANATOMY, Vol. I, p. 757; and TOUCH, Vol. XXIII, pp. 508–510.

PACING. See TROTTING AND PACING, in these Supplements.

PACKARD, ALPHEUS SPRING, scientist and educator, was born at Brunswick, Maine, on February 19, 1839, and was graduated from Bowdoin College in 1861, and from the Maine Medical School in 1864. He also studied under Louis Agassiz at the Lawrence Scientific School of Harvard University for three years. He was an assistant surgeon in the army in 1864–65, librarian and custodian of the Boston Society of Natural History in 1865–66, curator of the Essex Institute in 1866, curator and director of the Peabody Academy of Science in 1867–78, State entomologist of Massachusetts in 1871–73, and a member of the U. S. Entomological Commission in 1877–82. He was the founder and for twenty years the editor of *The American Naturalist*. Since 1872 he was a member of the National Academy of Sciences, and a member of a dozen or more learned societies in Europe. He became professor of zoölogy and geology in Brown University in 1878, and held that place until his death. He wrote many books, including *Guide to the Study of Insects; The Mammoth Cave and Its Inhabitants; Our Common Insects; Life History of Animals; Zoölogy for High Schools and Colleges; First Lessons in Geology; First Lessons in Zoölogy; A Text-Book of Entomology; Observations on the Glacial Phenomena of Labrador and Maine*, and *A Naturalist on the Labrador Coast*. He also wrote hundreds of papers, addresses, etc. Died Feb. 14, 1905. W.F.J.

PACKER, ASA, an American public man and philanthropist; born in Groton, Conn., Dec. 29, 1806. He received a public-school education and removed to Springfield, Pa., in 1820, where he became a carpenter. He settled in Mauch Chunk in 1832, and became largely interested in the production of coal and the construction of railroads. He served in the Pennsylvania House of Representatives, and sat as a Democrat in the national House of Representatives from Dec. 5, 1853, to March 3, 1857. In 1865 he founded Lehigh University at South Bethlehem, Pa., and liberally endowed it. He was a delegate to the National Democratic Convention in 1868, and died in Philadelphia, Pa., May 17, 1879.

E.E.T.

PACKING now includes the whole processes connected with the "manufacture" of the products from cattle, sheep and hogs for the various demands of the market. The term was formerly applied solely to the curing and packing of hog-products, but around this industry arose the no less profitable and indispensable ones for preparing the products of cattle and sheep. Associated, also, with these, many new industries sprang up as a result of scientific methods of utilizing the waste products, which secured in themselves a handsome profit.

The origin of packing is obscure. It has been stated, though the authority is doubtful, that pork was cured and packed in barrels in Salem, Massachusetts, as far back as 1640. In 1690 Boston had a large trade in packing. In 1818 Elisha Mills established a packing-house at Cincinnati. In 1832 Cincinnati slaughtered 85,000 hogs. No attempt at packing in Chicago seems to have been made until about 1832. It has been claimed that 9,600 hogs were packed in Chicago in 1834; but it was not until 1850 that the city figured in the statistics. In 1845 Cincinnati boasted of the title of Porkopolis, when its business even exceeded that of Cork or Belfast, Ireland. About that time the number of regular packing-houses in that city were 26, ten years later the number was 41, after which time the number remained about stationary. In 1843–44 the total number of hogs packed in the West reached a total of over 1,000,000. Cincinnati held her own until 1861–62; then Chicago passed her and has since maintained the lead, this center handling about 35 per cent of the total number of hogs marketed in the West. Writing in 1895 on the packing industry in *One Hundred Years of American Commerce*, Philip D. Armour said: "During the past ten years Western packers have paid out $1,429,000,000 for hogs, or an annual average of about $143,000,000, reaching $172,679,000 for the year ending March 1, 1895." The aggregate value, in 1844, of 623,000 animals (cattle, sheep and hogs) marketed in Boston, New York, Philadelphia and Baltimore was $7,500,000. In 1894 the value of the 9,445,782 animals marketed in the same cities was, approximately, $140,000,000.

Of the total number of 21,619,645 hogs packed and marketed in the United States for the year

ending March 1, 1895, the largest numbers were credited to the following cities: Chicago, 5,293,202; Kansas City, 2,105,333; Omaha, 1,550,821; Boston, 1,748,000. The number of cattle killed in the four Western cities (Chicago, St. Louis, Kansas City and Omaha) was, in 1894, 3,958,000; and on the seaboard, 1,079,000. The number of sheep killed in the West for the same year was 3,564,000; and for the East, 4,079,000.

The capital invested in the United States in the packing industry, as estimated for the year 1890, was $116,887,504.

The following figures represent the total amounts exported, and the values thereof, of beef and pork products and mutton, for the year ending June 30, 1895:

	Pounds.	Value.
BEEF-PRODUCTS.		
Beef, canned	64,102,263	$5,720,933
Beef, fresh	191,338,487	16,832,860
Beef, salted	62,473,325	3,558,230
Beef, other cured	821,673	73,569
PORK-PRODUCTS.		
Bacon	452,549,976	$37,776,293
Hams	105,494,123	10,960,567
Pork, fresh	818,581	60,660
Pork, pickled	58,266,893	4,138,400
Mutton	591,449	$47,832.

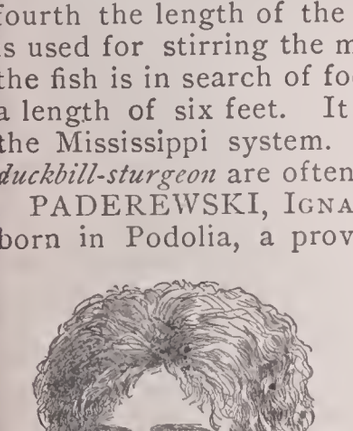
For utilization of products and methods of killing and dressing, see ABATTOIRS, in these Supplements.

PACTOLUS, Turkey in Asia, the ancient name of the Sarabat or Gediz-Cha, a river flowing into the Gulf of Smyrna. Its golden sands are said to have enriched Crœsus. C.L.S.

PADANG. See SUMATRA, Vol. XXII, pp. 672–674.

PADDLE-FISH (*Polyodon spatula*), a ganoid fish in which the nose is greatly prolonged into a paddle-like structure, which is sometimes one fourth the length of the fish itself. This paddle is used for stirring the mud of the bottom when the fish is in search of food. The fish may reach a length of six feet. It is common in rivers of the Mississippi system. The names *spoonbill* and *duckbill-sturgeon* are often applied to this fish.

PADEREWSKI, IGNACE JAN, a Polish pianist; born in Podolia, a province of Russian Poland, Nov. 6, 1860. He began to play on the piano at the age of three years. At the age of seven he was placed under the instruction of Pierre Sovinski, a local master. In 1872 he went to Warsaw, where the foundation of his knowledge of harmony and counterpoint was laid by Roguski. Later he pursued his musical studies under Frederick Kiel, in Berlin. His first musical tour was made through Russia, Siberia and Roumania, during which he played his own compositions. At eighteen years of age he became professor of music in the Conservatory of Warsaw. In 1884 he was promoted to a professorship in the Conservatory of Strasburg; but in less than a year he determined to abandon teaching and enter upon the career of a piano virtuoso. After three additional years' study with Teschitzki, in Vienna, he began his professional tours, appearing in Germany; in 1889 at Paris, and in 1890 at London. He married at the age of nineteen. Later, his wife died, but a son survived her. In the autumn of 1891 he visited New York and began a tour of extraordinary success in the chief American cities. His American tour in 1893, when he visited the World's Fair at Chicago, brought him $150,000. He repeated the visit in 1896, realizing $187,000. He donated the sum of $10,000, the interest to be devoted to the encouragement of American composers by the award of three triennial prizes. He also dedicated to his American admirers a *Menuet Moderne*, in contradistinction to his *Menuet à l'Antique* (1883). He has also composed about 80 vocal works; a *Polish Phantasie*, produced at the Norwich festival in 1893; and an opera, *Stanislaus* (1898).



I. J. PADEREWSKI.

PADUCAH, a city of Kentucky. Paducah in 1890 was a center for three railroads, the Chesapeake and Ohio Southwestern, the Paducah, Tennessee and Alabama and the St. Louis, Alton and Terre Haute. Its tobacco trade has reached large proportions, there being numerous factories and warehouses, making this city one of the most important tobacco-markets in the United States. Other industries include saw and flour mills, foundries and machine-shops, carriage factories and ship-yards. Paducah makes extensive shipments of corn, pork and iron. The city has parks, gas and electric lights, electric street-railways, water-works and fire department, good public schools, a young ladies' seminary, 19 churches, two daily and four weekly newspapers. Population 1890, 12,797; 1900, 19,446. See also PADUCAH, Vol. XVIII, p. 136.

PAGANISM. See CHRISTIANITY, Vol. V, p. 605.

PAGE, THOMAS NELSON, an American author; born on Oakland Plantation, Hanover County, Va., April 23, 1853. He was educated at Washington and Lee University, Va., and graduated from the Law Department of the University of Virginia. He practised law in Richmond from 1875 to 1893, and has frequently appeared in the lecture field. His works deal principally with Southern scenes, and those largely of the period before and during the Civil war. Among his published books are: *In Ole Virginia* (1887); *Two Little Confederates* (1888); *On Newfound River* (1891); *The Old South* (1891); *Among the Camps* (1891); *Elsket, and Other Stories* (1892); *The Burial of the Guns* (1894); *Marse Chan* (1896); *The Old Gentleman of the Black Stock* (1896); *Two Prisoners* (1897); *Red Rock* (1898); *Gordon Keith* (1903). E.E.T.

PAGE, WILLIAM, an American painter; born in Albany N. Y., Jan. 23, 1811. He received

his education in New York. He forsook an incipient study of law for art, and became a pupil of S. F. B. Morse, first president of the National Academy, where he gained a silver medal. At the age of 17 he embraced Presbyterianism, and, determining to devote himself to the ministry, went to Andover, and later to Amherst, Mass. A short experience in these seminaries led him to return to New York and take up painting again. He spent a year in Albany, painting portraits, and then settled in New York, where he was admitted a member of the National Academy. Later he went to Boston, and afterward to Florence and Rome, in which cities he lived 11 years. He painted portraits of Gov. Marcy and J. Q. Adams, and among his other works are: *The Infancy of Henri Quatre*, *The Flight into Egypt*, etc. He died in Tottenville, N. Y., Oct. 1, 1885. E.E.T.

PAGET, Sir Augustus Berkeley, a British diplomatist; born in 1823; became précis writer to the late Earl of Aberdeen in 1846; attaché to the embassy of Paris the same year; and secretary of legation at Athens in 1852. After filling diplomatic offices in Egypt, Holland and other countries, he was on several occasions *chargé d'affaires* at Lisbon; minister to Saxony in 1858; to Sweden and Norway in 1859; to Portugal in 1866; and to Italy in 1867. In March, 1876, he was nominated ambassador to Italy, and shortly afterward was sworn of the privy council. Sir A. Paget succeeded Sir Henry Elliott as British ambassador at Vienna, Jan. 1, 1884, and retired on a pension, July 1, 1893. He edited *The Paget Papers* of his father, Sir Arthur Paget. He died July 11, 1896.

PAGET, Sir George Edward, a British physician; born in Yarmouth, England, in 1809; educated at the Charterhouse and at Cambridge; took his B.A. degree in 1831; became Fellow of Caius in 1832; M.D. in 1838. In 1872 he was appointed regius professor of physic in Cambridge, and was knighted in 1885. He may well be regarded as a public benefactor, as having taken the principal part in the great advance that has been made in medical education. He died Jan. 29, 1892.—His brother, Sir James Paget, Bt., was born in Yarmouth, Jan. 11, 1814; studied at St. Bartholomew's Hospital, London; became a member of the Royal College of Surgeons in 1836; honorary fellow in 1843; member of the council in 1865; president of the college in 1875; Croonian lecturer (heart) in 1857; delivered the Hunterian oration in 1877; Bradshawe lecturer in 1882; Morton lecturer (cancer) in 1887; sergeant-surgeon to the queen, surgeon to the Prince of Wales and consulting surgeon to St. Bartholomew's Hospital. He was created a baronet in 1871, and in the same year received the degree of LL. D. from the University of Edinburgh. His two standard works are *Lectures on Surgical Pathology* and *Clinical Lectures*. He was vice-chancellor of the University of London and a member of the Institute of France (Academy of Sciences). Died in London, January 3, 1900.

PAGET, Violet, author; best known by her pen-name of Vernon Lee; was born in Normandy, of English parents, in 1856, and has spent most of her life in Italy. She has written novels, philosophical essays and dialogues, fairy tales, and historical and art treatises on Italy. Her works include *Studies of the Eighteenth Century in Italy* (1880); *Belcaro* (1881); *Ottilie* (1883); *The Prince of the Hundred Soups* (1883); *Euphorion* (1884); *Miss Brown* (1884); *Baldwin* (1886); *A Phantom Lover* (1886); *Juvenilia* (1887); *Hauntings* (1890); *Vanitas* (1892); *Althea* (1893); *Renaissance Fancies and Studies* (1895); *Limbo* (1897), and *Genius Loci* (1900). W.F.J.

PAGO PAGO HARBOR or PANGO PANGO, a seaport on the southeast coast of Tutuila, one of the Samoan Islands, in lat. 14° 19′ S., long. 170° 31′ W. It has an excellent natural harbor; was formerly used as a coaling-station by the United States, and later by Great Britain for the same purpose, but in 1892 was formally ceded to the United States. There is communication by steamer with Sydney and San Francisco.

PAH-UTES. See Piutes, in these Supplements.

PAILLERON, Edouard Jules Henri, a French dramatist; born in Paris, Sept. 17, 1834; began life as a clerk in a notary's office, and published in 1860 a volume of satirical poetry, *Les Parasites*, and a one-act play, *Le Parasite*. Among his most successful productions were *Le Mur Mitoyen* (1862); *Le Dernier Quartier* (1863); *Le Second Mouvement* (1863); *Le Monde où l'on s'amuse* (1868); *Les Faux Ménages* (1869); *Hélène; L'Autre Motif* (1872); *Petite Pluie* (1875); *L'Âge Ingrat* (1878); *L'Etincelle* (1879); *Pendant le Bal* (1881); *Le Monde où l'on s'ennuie* (1881). To the last piece of contemporary satire — for it is rather that than a play — M. Pailleron owed his election to the Academy in 1882. He wrote also *Le Départ; Prière pour la France; La Poupée* (1884); *Théâtre chez Madame; Discours Académiques* (1886); *La Souris* (1887); *Amours et Haines* (1888); *Études sur Émile Augier;* etc. He was made officer of the Legion of Honor in 1889. Died in Paris, April 20, 1899.

PAIN, See Touch, Vol. XXIII, p. 513.

PAINE, John Alsop, an American archæologist; born in Newark, N. J., Jan. 14, 1840. He graduated at Hamilton College in 1859, and at Andover Theological Seminary in 1862. He was ordained in 1867; was engaged by the Board of Regents to enlarge the flora of the State of New York, 1862–67; professor of natural science at Robert College, Constantinople, 1867–69; professor of natural history and German at Lake Forest University, Ill., 1870; associate editor of the *Independent*, 1871–72; archæologist for the first expedition of the Palestine Exploration Society, 1872–73; edited and published the *Journal of Christian Philosophy*, 1882–84; and since 1889 has been curator of the Metropolitan Museum of Art, New York. He has published many archæological reports and magazine articles. E.E.T.

PAINE, John Knowles, an American com-

poser; born in Portland, Me., Jan. 9, 1839. He studied music under Kotzschmar in that city, and made his first appearance as organist in 1857. He studied in Germany under Haupt and others from 1858 to 1861, and made an artistic tour of that country in 1866–67. He was instructor of music at Harvard in 1862–73, and was professor of music there after 1875. He composed the music for the *Œdipus Tyrannus*, as performed at Cambridge, Mass., in 1881; the cantatas *Nativity; Song of Promise; Realm of Fancy; Phœbus, Arise!;* the choruses for *The Birds*, of Aristophanes. He died April 25, 1906. E.E.T.

PAINE, Robert, clergyman, was born in North Carolina on November 12, 1799, and was licensed to preach in 1818. He became a "circuit rider" of the Methodist Episcopal Church, with a circuit 325 miles in circumference, In 1824 he was a delegate to the first of fifteen general conferences which he thus attended, from 1829 to 1846 he was president of LaGrange College, Alabama, he participated in the division of the M. E. Church, and in 1846 was chosen a bishop of the M. E. Church, South. He died on October 19, 1882. W.F.J.

PAINE, Robert Treat, an American statesman; born in Boston, Mass., March 11, 1731. He graduated at Harvard in 1749 and became a lawyer in Taunton, Mass. In 1770 he conducted the prosecution of Capt. Preston and others concerned in the Boston "massacre." He was a Representative from Taunton to the General Court in 1773–74, and a delegate from Massachusetts to the Continental Congress in 1774–78. In 1777 he was Speaker of the Massachusetts House of Representatives, and attorney-general of the State, and in 1779 a member of the Executive Council and of the committee which framed the State constitution. He was attorney-general again in 1779–90, and a judge of the supreme judicial court, 1790–1804. He died in Boston, May 11, 1814. E.E.T.

PAINE, Robert Treat, 2d, an American author; born in Taunton, Mass., Dec. 9, 1773. He was originally christened Thomas, but had this name changed to that of his father. He graduated at Harvard in 1792, and displayed considerable literary ability, especially in poetry. He entered mercantile life, but soon quitted the counting-house for the editorial desk. It is said that "he made entries in his day-book in poetry, and once made out a charter-party in the same style." In October, 1794, he started a semi-weekly newspaper called the *Federal Orrery*, and at the same time contributed verses to the *Massachusetts Magazine*. Subsequently he wrote dramatic criticisms, and in February, 1795, married Miss Baker, an actress, a proceeding which resulted in family estrangement and social ostracism. A poem on *The Invention of Letters* produced a sum of $1,500, or over $5 a line, and another, on *The Ruling Passion*, yielded him $1,200. For the song of *Adams and Liberty*, he received $750, or $11 a line. He practised law for a short time, but dissolute habits caused his death in Boston, Nov. 13, 1811. E.E.T.

PAINE, William Henry, an American soldier and civil engineer; born in Chester, New Hampshire, May 27, 1828. He received a common school education, then took up the study of civil engineering and removed to Wisconsin, where he began his career as a land surveyor. In the Civil War he was appointed captain of engineers on the staff of General McDowell. After the war he removed to New York where he assisted in the construction of the Brooklyn bridge. For a time he exercised entire supervision of the work and from the date of its completion until 1889. was consulting engineer. The construction of cable railways in various cities and the building of the Port Huron tunnel occupied him during his latter years. He died in Cleveland, Ohio, December 31, 1890. W.M.C.

PAINESVILLE, a village and the capital of Lake County, northeastern Ohio, on Grand River, three miles from Lake Erie, about 30 miles E. of Cleveland, and on the Lake Shore and Michigan Southern, New York, Chicago and St. Louis and the Pittsburg and Western railways. It is the center of an agricultural and fruit-growing section, and has an extensive nursery and manufactories of steam-engines, machinery, metallic oilcloth bindings, sash and blinds, flour and leather. The village is the seat of Lake Erie Female Seminary, a non-sectarian institution chartered in 1856; has a bank with a capital of $200,000, two libraries, one daily and three weekly papers. Population 1890, 4,755; 1900, 5,024.

PAINT. See Pigments, Vol. XIX, pp. 94–97.

PAINTED GOOSE or EMPEROR-GOOSE. See Goose, Vol. X, p. 692.

PAKENHAM, Sir Edward, a British soldier; born at Pakenham Hall, Westmeath, Ireland, March 19, 1778; the second son of the Earl of Longford and a brother-in-law of the Duke of Wellington. He entered the British army in 1794, fought with distinction in Spain, and particularly at Salamanca, where he carried off the honors of the day. In 1814 he was given command of the large force of British regulars which operated against New Orleans. Here he was opposed by General Andrew Jackson with a number of Mississippi and Tennessee militia. In the brief campaign which followed, Pakenham was entirely out-maneuvered and was killed in the battle, Jan. 8, 1815.

PAKTONG or PACKFONG. See German Silver, Vol. X, p. 401.

PALÆOTHERIUM (Gr., "ancient wild beast"), a genus of pachydermatous mammalia whose remains occur in the Eocene beds of England and the Continent. See *Paleotheriidæ*, under Mammalia, Vol. XV, pp. 434, 435.

PALÆOZOIC AGE. See Geology, Vol. X, pp. 291–312.

PALAGONITE-TUFF, usually associated with basalt-lavas; is fine-grained, red, brown and sometimes greenish or yellowish in color. Under the microscope it is seen to be composed of minute fragments of volcanic glass, crowded among which are granules and crystals of augite, olivine, plagio-

clase and magnetite. It occurs in Sicily, the Canary Islands, the Faroe Islands, Iceland and Scotland.

PALAMEDEIDÆ, a family of birds with characters intermediate between the rails and ducks. Huxley included them with the ducks (*Anatidæ*) in the group *Chenomorphæ*. The family includes two genera with three species—all South American. The horned-screamer (*Palamedea*) is the typical genus. See SCREAMER, Vol. XXI, p. 578.

PALANQUIN, an Indian vehicle corresponding somewhat to the Roman litter and the modern European sedan-chair, but, unlike the latter, used for long distances by travelers where railways or good carriage-roads do not exist. It is a wooden box about eight feet long, four feet wide and four feet high, with wooden shutters which can be opened or closed at pleasure, constructed like Venetian blinds. At each end of the palanquin, on the outside, two rings are fixed, and the *hammals*, or palanquin-bearers, of whom there are four, two at each end, support the palanquin by poles passing through these rings.

PALAPTERYX, a genus of fossil birds whose remains are found in the river-silt deposits of New Zealand, associated with the gigantic dinornis, and which, like the dinornis, resembled in the form of the sternum and the structure of the pelvis and legs the living wingless apteryx. Palapteryx, however, seems to have possessed rudimentary wings. See DINORNIS, Vol. VII, p. 212.

PALATAL LETTERS. See HIEROGLYPHICS, Vol XI, p. 712.

PALATE. See DIGESTIVE ORGANS, Vol. VII, p. 193; also ANATOMY, Vol. I, pp. 734, 735.

PALATINE. See COUNTY, Vol. VI, p. 455; also DURHAM, Vol. VII, pp. 483–485.

PALATINE, a village of Cook County, northeastern Illinois, 26 miles N.W. of Chicago, on the Chicago and North-Western railroad. It is in a dairying and farming district, and has manufactories of sash, blinds and doors, besides flour, planing and flax mills. Population 1890, 891; 1900, 1,020.

PALATINE HILL. See ROME, Vol. XX, p. 840.

PALATKA, a city and the capital of Putnam County, eastern Florida, 35 miles E. of Gainesville, on the St. John's River, and on the Florida East Coast, the Florida Southern, the Gainesville and Gulf and the Jacksonville, Tampa and Key West railroads; has a lumber-mill and a moss factory; cotton, sugar and oranges are shipped here in steamboats, which ply daily between Jacksonville and this place. Population 1890, 3,039; 1900, 3,301.

PALE, IRISH. See IRELAND, Vol. XIII, p. 268.

PALEMBANG, a Dutch residency in SUMATRA, Vol. XXII, p. 673.

PALESTINE, a city and the capital of Anderson County, eastern Texas, about 150 miles N. of Houston, and 181 miles N.E. of Austin, on the International and Great Northern railroad, 10 miles E. of Trinity River. The surrounding country produces cotton, grapes, live-stock and lumber. The city has electric lights, water-works, one daily, one semiweekly and two weekly newspapers; is the headquarters of the railway company; contains a cottonseed-oil mill and compress, a manufactory of brass and iron, brickyards and saw and grist-mills, and has a good trade in hides. Population 1900, 8,297.

PALEY, FREDERICK APTHROP, an English author; born in Easingwold, June 14, 1816. He was educated at Shrewsbury, and St. John's College, Cambridge. He acquired celebrity as an archæologist and classical scholar, having edited Æschylus, Euripides, Hesiod, the "Fasti" of Ovid, Propertius, Theocritus, and the works of other classical writers for the *Bibliotheca Græca* and written a *Manual of Gothic Architecture; Manual of Gothic Mouldings*, and other works and papers on archæology. Having resided in Cambridge from 1860 to 1874, he was appointed professor of classical languages in the Roman Catholic College in London. His books are now almost universally employed in schools and colleges throughout England. He died in Cambridge, September 9, 1888. W.M.C.

PALFREY, JOHN GORHAM, an American author; born in Boston, Mass., May 2, 1796. He graduated at Harvard in 1815, studied theology, and was ordained minister of the Brattle Street church, Boston, in 1818. He was Dexter professor of sacred literature at Harvard, 1831–39; editor of the *North American Review*, 1835–42; member of the Massachusetts House of Representatives, 1842–43; Secretary of the Commonwealth, 1844–48; and Representative in Congress from Massachusetts, 1847–49. He was an acknowledged leader of the Free Soil party. In 1831 he published a *Harmony of the Gospels;* in 1843, *Evidences of Christianity;* and in 1858–64, a *History of New England*. He was postmaster of Boston, 1861–66. He died in Cambridge, Mass., April 26, 1881. E.E.T.

PALGRAVE, FRANCIS TURNER, an English poet, eldest son of Sir Francis Palgrave; born Sept. 28, 1824; was educated at the Charterhouse and at Balliol College, Oxford, where he took his degree of M.A., and was elected to a fellowship at Exeter College. Mr. Palgrave was created an honorary LL.D. of Edinburgh in 1878. On the death of Principal Shairp in 1886, Mr. Palgrave was elected professor of poetry at Oxford. Among his works are *Lyrical Poems* (1871); *Idyls and Songs* (1854); *Essays on Art* (1866); and a *Life of Sir Walter Scott*. He is, however, best known as the editor of *The Golden Treasury of English Songs and Lyrics* (1861), one of the best collections, in compact form, of English verse; of the *Children's Treasury of English Song* (1864); and of the *Treasury of Sacred Song* (1884); of *Shakespeare's Lyrics* (1879); *Tennyson's Lyrical Poems* (1885); *Selections from Wordsworth* (1865); and a *Selection from the Lyrical Poems of Robert Herrick* (1877). He died in London, Oct. 24, 1897.

PALGRAVE, WILLIAM GIFFORD, an English missionary and diplomatist, brother of Francis Turner Palgrave; was born in London, Jan. 24, 1826. He graduated from Trinity College, Oxford, in 1846, taking first-class honors in literature and second-class in mathematics. Soon after completing his university course, he obtained a lieutenant's commission in the Eighth Bombay regiment of native infantry, and went to India.

Becoming converted to Roman Catholicism, he resigned from the army, and was ordained a priest in the Jesuit order, with which he remained connected for fifteen years. He was engaged as a missionary in southern India until 1853, and afterward continued the work for several years in Syria. After the massacre at Damascus, in June, 1861, he returned to France and England and delivered lectures on his experiences in the East, some of which were afterward published under the title, *Four Lectures on the Massacres of the Christians in Syria.* In 1862–63 he made a journey across central Arabia, partly in the interest of the French government, and an account of his adventures was published in his *Narrative of a Year's Journey through Central and Eastern Arabia.* In 1865 he was sent on a special mission to Abyssinia, and later, he filled several consulships —at Soukhoum Kalé, in 1866; Trebizond, 1867; St. Thomas, West Indies, 1873; Manila, 1876, and Bangkok, 1879. In 1884 he was made minister to Uruguay. One of his most important works, is *Essays on Eastern Questions* (1872). He died at Montevideo, Uruguay, Sept. 30, 1888. R.W.C.

PALIKAO, a place on the canal between Pekin and its port, Tientsin, on the Peiho. Here, Sept. 21, 1860, a victory was gained by the Anglo-French troops over the Chinese, and hence the French general, Cousin-Montauban (1796–1878), who was Minister of War in August and September, 1870, received his title of Count Palikao.

PALISADES OF THE HUDSON, a name applied to an escarpment of roughly columnar basaltic trap forming the western wall of the Hudson River for a distance of nearly twenty miles, extending through Rockland County, New York, and Bergen and Hudson counties, New Jersey. This ridge is formed of trap-rock, which in a molten condition, in the Triassic period, gushed forth from between the layers of sandstone and shale belonging to the Newark system. The palisades vary in height from 350 feet, half a mile above Fort Lee, to 550 near their northern end at Indian Head, directly opposite Hastings. The front of the cliff is everywhere precipitous, there being but three breaks sufficiently large to admit of wagon-roads reaching the river. A road runs along the top of the ridge for some distance, and on the inner, or side away from the river, the descent is very rapid into a valley dividing the Palisades from Bergen Ridge.

PALISSOT, DE MONTENOYE, CHARLES, a French author; born in Nancy, January 3, 1730. He was educated at the Congregation of the Oratory, and first attracted notice by his violent hostility to the French philosophers. He wrote the comedy *Le Corde* (1755) in which he satirized Rousseau, and in the following year published a satire on Diderot. This was followed by his famous comedy *Les Philosophes* in 1760. Morellet who wrote an answer to this play was sued for libel by Palissot, and served a term in the Bastile. Palissot's complete works include six octavo volumes. Among them are, *The Dunciad; Little Letters against Great Philosophers; Memoirs for a History of French Literature,* and a *History of the Early Ages of Rome.* He died in Paris, June 15, 1814. W.M.C.

PALIURUS, a genus of trees and shrubs of the family *Rhamnaceæ*, nearly allied to the genus *Zizyphus* but very different in the fruit, which is dry, orbicular and with a broad, membranous wing. *P. aculeatus* is often called Christ's Thorn, from the fancy that it supplied the crown of thorns with which our Saviour was crowned. It is a deciduous shrub or low tree, with slender, pliant branches and ovate three-nerved leaves, each of which has two sharp spines at the base, one straight and the other recurved. It is a native of the countries around the Mediterranean, of India and many parts of Asia. It is often used for hedges in Italy and other countries.

PALK STRAIT, a channel between India and northern Ceylon, connecting Palk Gulf and the Sea of Bengal. At its narrowest point it is 40 miles across. It was named by the Dutch after a governor of Ceylon.

PALLADIUM, a metal. See PLATINUM, Vol. XIX, p. 204; also CHEMISTRY, Vol. V, pp. 465, 466.

PALLICE, LA, a harbor opened in 1889 to receive large Transatlantic and other ocean-going vessels bound for La Rochelle in France, whence it is less than three miles distant. It consists of an inner basin, 28½ acres in extent, and an outer harbor protected by two moles, each 1,380 feet long.

PALLISER, SIR WILLIAM, a British soldier and inventor; born in Dublin, June 18, 1830; entered the army as a cavalry officer, and in 1863 invented the chilled shot that bears his name, and a system of strengthening cast-iron ordnance by the insertion of a steel tube. He retired in 1871; sat in Parliament for Taunton, and was knighted Jan. 21, 1873. He died Feb. 4, 1882.

PALMA, one of the CANARY ISLANDS, Vol. IV, pp. 702, 706.

PALMA RICARDO, a Peruvian author, born in 1833. See PERU, Vol. XVIII, p. 689.

PALMA, TOMAS ESTRADA, educator and statesman, was born at Bayamo, Cuba, and was educated for the bar at the University of Seville, Spain. He was a leader of the Cuban patriots in the Ten Years' War, 1868–78, and became president of the revolutionary republic, but was captured in 1877 and imprisoned. In 1878 he was released, went to Honduras and became postmaster-general. Later he settled in New York state and taught a school for many years. He was Cuban minister to the United States in 1898, and from 1902 to 1906, has been president of the Republic of Cuba. W.F.J.

PALMAS, CAPE, West Africa, at the mouth of the Cavally River forming the southwestern boundary of Liberia, is a low promontory projecting into the Atlantic, and marking the division between the Grain Coast and Ivory Coast with their trading settlements. C.L.S.

PALMER, a township in Hampden County, southwestern Massachusetts, 15 miles N.E. of Springfield, on the Chicopee, Swift and Ware rivers, and on the Boston and Albany and the Vermont Central railroads. It comprises the villages of Palmer,

Three Rivers, Thorndike, Bondsville and Duckville, of which the first two are the largest and most important. The township is noted for its manufacturing establishments, there being at Palmer a woolen-mill, yarn-mill, carpet factory, wire-mill and foundry; at Three Rivers a cotton-mill employing over 600 hands and producing annually 9,000,000 yards of cloth; at Thorndike, two mills making plain and fancy tickings and employing 600 hands; and at Bondsville, a mill producing annually 5,000,000 yards of duck and flannel. The village of Palmer has five churches, a weekly newspaper, two banks—national and savings—waterworks, electric lights and fire department. Population 1890, 6,520; 1900, 7,801.

PALMER, Alice Freeman, an American educator; born in Colesville, Broome County, New York, Feb. 21, 1855. She was educated at the University of Michigan, graduating in 1876, and received the appointment of instructor in Latin, Greek and mathematics at Geneva Lake, Wisconsin. In 1877 she became principal of the High School at East Saginaw, Michigan, remaining there until, in 1879, she received the appointment of professor of history in Wellesley College. In 1881 she became acting president of that institution, and in 1882, president. The University of Michigan conferred the degree of Ph.D. upon her in 1882, and she received that of doctor of letters from Columbia in 1887. She resigned in 1887, and was married to Professor George H. Palmer of Harvard in December of that year.

ALICE FREEMAN PALMER.

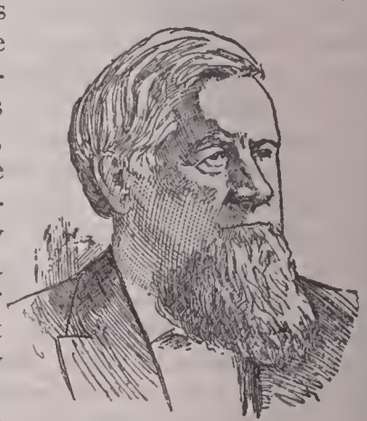
PALMER, Benjamin Morgan, an American clergyman; born in Charleston, South Carolina, Jan. 25, 1818; educated at the University of Georgia, and the Columbus (Georgia) Theological School. After 1841 he occupied successively pulpits of the First Presbyterian Churches at Savannah, Georgia; Columbia, South Carolina; and New Orleans, Louisiana. The latter place he filled after 1856. Dr. Palmer was commissioner to ten General Assemblies; from 1853 to 1856 he was professor of church history in the Columbia (South Carolina) Theological Seminary; and in 1861 was moderator of the first Southern Assembly, at Augusta, Georgia. He was a founder and editor of *The Southern Presbyterian Review*, and published several theological works. D., 1902.

PALMER, Sir Charles Mark, an English shipbuilder and coal-miner; born in South Shields, in 1822, and educated at a private school. After preparing for a commercial career he entered into partnership with his father, who was a merchant of Newcastle, and others in coal-mining and coke-making, extending the business from small beginnings until the production amounted to 1,750,000 tons per annum. Mr. Palmer introduced the use of steam collier-vessels for the transportation of coal, which have entirely superseded the old sailing-vessels. He also established the ship-yard at Jarrow, where, in 1852, was launched the first screw collier, the *John Bowes*. After that he developed the works into what is now Palmer's Shipbuilding and Iron Company, Limited, where ocean vessels are built from the ore of its own mines, and carried through all stages, from the raw material to the finished vessel. The modern town of Jarrow sprang from these works. Mr. Palmer held many public positions of honor and trust; was elected in 1874 a Liberal member of Parliament, and was three times returned. He was made a baronet in 1886.

PALMER, Erastus Dow, an American sculptor; born in Pompey, N. Y., April 2, 1817. He was a carpenter in Utica, N. Y., until 29 years old, when he occupied his spare time in cameo-cutting, for which he had acquired a taste. He took up his residence in Albany, and at 35 years of age attempted sculpture, to which he thenceforth devoted himself exclusively. His work was almost entirely of original conception, as, at the time of the production of his earlier works, at least, he had never been abroad or studied from the antique. In fact, his first effort at cameo-cutting was a head of his wife, and his first work in marble—a bust of the Infant Ceres—was modelled from one of his own children, and idealized with a strict regard to nature. He died in Albany, N. Y., March 9, 1904. E.E.T.

PALMER, James Croxall, navy surgeon, was born in Baltimore, Md., on June 29, 1811, and was graduated from Dickinson College in 1829 and from the medical department of the University of Maryland in 1834. He was a member of the Wilkes exploring expedition, served in the Mexican War, and in 1857 was on the *Niagara* which laid the first Atlantic cable. At the outbreak of the Civil War he was the head of the Naval Academy upon its transfer to Newport. In 1863–64 he was fleet surgeon with Farragut, and at the great battle of Mobile Bay went aboard the captured Confederate ram *Tennessee* and set the broken leg of its commander, Admiral Franklin Buchanan. He was in active service until 1877, and died on April 24, 1883. W.F.J.

PALMER, John McCauley, statesman, was born at Eagle Creek, Ky., on September 13, 1817, removed to Illinois in order to live in a free state, and became a lawyer. In 1843 he was elected a probate judge, in 1847 a member of the state constitutional convention, in 1849 a county judge, and in 1852 a State Senator. Thus far he had been a Democrat but he left that party because of the Kansas-Nebraska bill and was one of the organizers of the Republican party. In the Civil War he was a major-general of volunteers. From 1868 to 1872 he was governor of Illinois, as a Republican,



GEN. J. M. PALMER.

but in 1872 became a Democrat again. He was U. S. Senator from 1891 to 1897, being the first Democratic Senator from Illinois since Douglas. In 1896 he was the Presidential candidate of the "Gold Democrats." He died on Sept. 25, 1900. W.F.J.

PALMER, JOHN WILLIAMSON, an American author; born in Baltimore, Md., April 4, 1825. He graduated in medicine at the University of Maryland in 1847. He travelled extensively in Hawaii, China, and the East Indies, and was naval surgeon during the second Burmese war, 1851–52. During the Civil war was Confederate war correspondent of *New York Tribune*. He was later a member of the editorial staffs of the Century and the Standard dictionaries, and a magazine contributor. Is author of *The New and the Old* (1859); *Up and Down the Irrawaddi* (1860). Died Feb. 26, 1906. E. E. T.

PALMER, RAY, clergyman and author, was born at Little Compton, R. I., on November 12, 1808, and was graduated from Yale College in 1830. He was licensed to preach in 1832, from 1835 to 1850 was pastor of a Congregational Church at Bath, Maine, and then for sixteen years of a church at Albany, N. Y. Thereafter for twelve years he was secretary of the Congregational Union. At the end of that service he gave his attention to literary work, and became the author of many books in prose and poetry. As a hymn writer he was one of the most gifted men of his time, some of his hymns, such as *My Faith Looks Up to Thee*, being sung the world around. He suffered a stroke of paralysis in 1885, and died on March 29, 1887. W.F.J.

PALMER, SIR ROUNDELL. See SELBORNE, in these Supplements.

PALMER, THOMAS WITHERELL, an American merchant and statesman; born in Detroit, Michigan, Jan. 25, 1830; was educated at the University of Michigan, and engaged in the real-estate and lumber trade. He served in the state senate in 1878; was defeated for Congress in 1876, and in 1883 became United States Senator. Afterward he served as minister to Spain. In June, 1890, Mr. Palmer was elected president of the national commission having charge of the World's Fair in 1893.

PALMETTO, a common name given to certain palms of the southern United States, notably *Sabal Palmetto*, the cabbage palmetto; *S. serrulata*, the saw palmetto, with spiny-margined petioles; *S. Andansonii*, the dwarf palmetto; and *Chamærops hystrix*, the blue palmetto. The first is a tree, and the southern palmetto of ordinary reference; the others are low forms.

PALMIERI, LUIGI, an Italian meteorologist; born in Faicchio, Benevento, April 22, 1807. He was educated at Cajarro and Naples. He then filled the post of professor of mathematics at the University of Salerno, then at Campabosso and later at Avellino. In 1845 he became professor of physics at the Royal Marine School at Naples, and in 1847 at the University of Naples. In 1854 he was appointed head of the Meteorological Observatory at Vesuvius. He invented several new instruments, notably an electrical seismograph. He wrote various monographs, papers and reports, of great value to astronomical science. The most important of these is an account of the eruption of Vesuvius in 1872. He died in Naples, Italy, September 10, 1896. W.M.C.

PALMIERI, MATTHEW, an Italian historian and philosopher; born in Florence, in 1405. He published a poem *Citta Divina* in which he advanced the theory that the souls of human beings are those angels which in the revolt of Lucifer neither preserved their allegiance to God, nor joined with that apostate, and in consequence were sent hither to pass through a probationary state. This poem was condemned to be burned. He also wrote *Cronoca Generale* (1449), and *A Treatise on Civil Life* (1453). He died in Florence in 1475. W.M.C.

PALMISTRY OR CHIROMANCY, the pretended art of discovering human character and divining personal history by a fanciful interpretation of certain varying lines and irregularities found upon the palm of the hand, usually the left. Aristotle regarded it as a science worthy of approbation; the Emperor Augustus practiced it, and the art was sanctioned by the early and mediæval Church; while its great antiquity is proven by the records of Brahmans in India. The important features of the palm upon the character of which divination is founded are: (1) *The line of life*, curving from the basal joint of the forefinger round the ball of the thumb as far as the wrist-joint. When regular and deeply colored, this line indicates a long and "happy" life, subject to such modifications as are foretold by cross-markings and connected furrows; (2) *the line of health*, running across the hand; (3) *the line of fortune*, from the forefinger to the little finger, it being important that these markings should be clear and unbroken; (4) the fleshy projection at the base of the thumb, technically called the *mountain of Venus*; (5) that at the base of the forefinger, the *mountain of Jupiter*; (6) of the middle finger, the *mountain of Saturn*; (7) of the ring finger, *mountain of the Sun;* and (8) of the little finger, *mountain of Mercury*—all indicating various dispositions and traits of character according to their respective prominence. Even the markings of the finger-nails are supposed to possess an occult significance, and certain minute lines above the finger-joints are made to augur the most fantastic destinies. The votaries of the art have sought to elevate it to the rank of an exact science; but, save among the gypsies and their dupes, this method of divination is now properly relegated to the obscurity to which other vagaries of mediævalism have been consigned.

PALMITIC ACID, occurs as a glyceryl compound in a large number of fats and oils. Is a solid at ordinary temperatures, insoluble in water, but may be dissolved in boiling alcohol or ether. Along with stearic acid it forms the bulk of the so-called "stearine" candles.

PALM-OIL, a heavy oil, mostly obtained for commerce from certain African species, and exten-

sively used in the arts for soap, candles, glycerine, etc.

PALM-SUGAR OR JAGGERY. See SUGAR, Vol. XXII, p. 661.

PALM WINE, the sap of several palms. *Caryota ureus* of India will yield a gallon a day for a month. When fresh it is known as "toddy," but it soon ferments and becomes intoxicating; when distilled it becomes arrack—the gin of India. Palm wine is also made in South America. W.R.B.

PALMYRA, a city and the county seat of Marion County, Missouri, in the northeastern part of the state, 105 miles northwest of St. Louis and near the Mississippi River. It is reached by the Hannibal and St. Joseph railroad and is the center of a rich agricultural region. It has also considerable industries, including packing houses, flour mills, brick and tile yards, carriage factories, etc., and is the seat of a number of academies and colleges, including a Methodist preparatory school, a Roman Catholic College, a college for women, and a Protestant Episcopal College. Its population in 1890 was 2,515, and in 1900 was 2,323. W.F.J.

PALMYRA, a village of Wayne County, New York, in the northwestern part of the state. It is twenty-two miles east of Rochester, and is reached by the New York Central and Hudson River and the West Shore railroads, and by the Erie canal. It is an agricultural center, but has also some manufacturing industries and commerce, and had in 1900 a population of 1,937. W.F.J.

PALMYRA PALM, a name given to *Borassus flabelliformis*, an Asiatic palm, whose sugar-containing sap is one of the palm-wines from which *arrack* is distilled.

PALO ALTO, a town of Santa Clara County, California, in the western part of the state. It is pleasantly situated at the southern end of San Francisco Bay, 28 miles south by east from San Francisco, on the line of the Southern Pacific railroad. It is best known as the seat of the Leland Stanford, Junior, University (q. v., in these Supplements), which was founded in 1891 and which in 1904 had 130 instructors, 1,400 students, and 80,000 volumes in its library. The town of Palo Alto, apart from the university, had in 1900 a population of 1,658. W.F.J.

PALO ALTO, near Matamoros, in Hidalgo County, Texas, in the extreme southern part of that state, was the scene of one of the early battles of the Mexican War, in which, on May 8, 1846, the Americans under General Taylor were victors over a much larger force of Mexicans under General Aristas. W.F.J.

PALOLO, an annelid. See POLYNESIA, Vol. XIX, p. 433.

PALPITATION OF THE HEART. See HEART, Vol. XI, p. 494.

PAMIR PLATEAU. See TURKESTAN, Vol. XXIII, p. 673; also ASIA, Vol. II, p. 599.

PAMLICO SOUND, North Carolina, a shallow body of salt water extending along the low shores of the counties of Carteret, Pamlico, Hyde and Dare, and separated from the Atlantic by a chain of narrow sandy islets scarcely one mile in width, the westernmost point of the central one forming Cape Hatteras, and the southernmost point being Cape Lookout. The sound, entered through Ocracoke and Hatteras inlets, is 80 miles long, from 8 to 30 miles wide, and connects on the north with Albemarle Sound. C.L.S.

PAMPAS. See AMERICA, Vol. I, p. 625.

PAMPAS-GRASS. See *Gynerium*, under HORTICULTURE, Vol. XII, p. 258.

PANA, a city of Christian County, southern central Illinois, 42 miles S.E. of Springfield and 35 miles S.W. of Decatur, on the Illinois Central, the Baltimore and Ohio Southwestern and the Cleveland, Cincinnati, Chicago and St. Louis railways. It is situated in a mining region, is an important center of trade, and has railroad car-shops, planing and flour mills, grain-elevators, several churches, banks, two daily and two weekly newspapers. Population 1890, 5,077; 1900, 5,530.

PANAMA, known as the Isthmus of Panama and up to its declaration of independence, November 3, 1903, a state or department of the Republic of Colombia, after which time it became a self-governing republic. On its separation from Colombia, the revolutionary junta issued a manifesto reviewing the little consideration the Colombian government had given the industrial and intellectual development of the inhabitants of Panama, the latter's large fiscal remittances, the grievances they had borne for the sake of harmony and the union, and their forbearance as long as there was any hope of improvement or effective progress under Colombian rule; but, it says in effect, when it became evident that this unjust policy of disregarding Panama's interests was to continue, as demonstrated by the rejection of the Hay-Herran Canal Treaty, — which action was due largely to the alleged fact that Panama would be the only part of the country to receive direct benefit from an inter-oceanic canal — they felt justified in asserting their independence and self-sovereignty, in order that they might work out their own destiny and improve their natural opportunities by negotiating for themselves.

The newly-formed republic has an area of about 33,800 square miles and an estimated population of 400,000, including an independent tribe of Indians numbering about 8,000. Panama City, the capital and chief town, contains (1903) 30,000. President of the republic is Don Jose Domingo de Obaldia, succeeding President Amador on July 12, 1908.

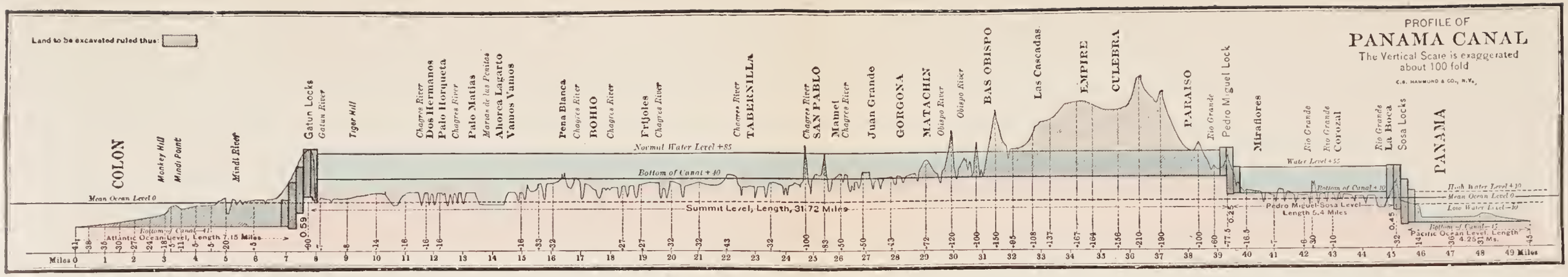
The constitution provides for a Chamber of 32 Deputies, which meets every two years, on Sept. 1, and for a president, elected every four years. There are two vice-presidents and a cabinet of five ministers. The republic is divided into seven provinces, each under a governor. The budget for 1907–08 puts the revenue and the expenditure at $4,867,700. The imports into the Republic in 1906 amounted to $7,353,000, of which the value of $3,648,000 came from the United States. The soil of Panama, of which area about $\frac{5}{8}$ are unoccupied is of great fertility. The most important product is the banana. The United States Fruit Company ex-

ports from Bocas del Toro annually about 2½ million bunches of bananas. Other products are cocoa, coffee and cautchouc. Cattle-raising is also carried on successfully in the provinces of Chiriqui, Los Santos, Coclé and Varágas. Every common mineral except coal is found in the Republic. The Panama Railroad, 47 miles long and connecting the ports of Colon and Panama, was completed in 1855 at a cost of $7,500,000. It is owned by the United States Government.

PANAMA CANAL. In May, 1879, an international congress was convened in Paris by M. Ferdinand de Lesseps, to discuss the plan of cutting a canal through the Isthmus of Panama. A plan previously prepared by M. de Lesseps was adopted, the necessary franchise from the United States of Columbia was secured and work on the canal was begun Feb. 28, 1881. Money from stocks and bonds was expended in the enterprise until the Company was forced into liquidation Jan. 1, 1889, when its indebtedness approximated $350,000,000, and perhaps a fifth of the real work done. It was found that only about half the money had been legitimately used for excavation and construction. De Lesseps and others were confronted with serious charges of fraud, creating a general financial scandal throughout France. A reorganization of the Canal Company followed and in 1894 a new issue of stock numbering 300,000 shares was made but after a few years work practically ceased. On Jan. 4, 1902, The Panama Canal Company offered to sell its abandoned works on the Isthmus of Panama, together with all its rights and titles to lands and harbor privileges to the United States for $40,000,000, the valuation put upon the property by the American Canal Commission appointed in 1901. The Isthmian Canal Act passed at first session of the 57th U. S. Congress and approved June 28, 1902, authorized the President of the United States to accept for and on behalf of the United States said offer of Panama Canal Co. on verification of a "good, valid and unencumbered title" to the property, but contingent on proper concessions from Colombia. Otherwise the Nicaragua route was to be considered. The title being found satisfactory, a treaty was drawn up by Secretary of State Hay, acting for the United states, and Dr. Herran, representing Colombia, Jan. 22, 1903, which provided that the United States should pay Colombia a bonus of $10,000,000 and a perpetual annuity of $250,000 in lieu of the rights and territories granted for the construction and operation of the Canal; Colombia to retain her sovereignty over the Canal strip, about six miles wide. The treaty was duly ratified by the American Congress but was rejected by the Colombians. Thus the matter rested until after the Isthmians declared their independence of the Colombian government, Nov. 3, 1903, and negotiations for the Canal were concluded with the new republic, on November 18, and signed by Secretary of State Hay, and Minister Bunean–Varilla. This treaty provides in 25 articles: That the United States guarantees and will maintain the independence of the Republic of Panama; that Panama cedes to the United States in perpetuity a strip of land ten miles wide along the canal and across the Isthmus, and all lands necessary to the construction and maintenance of the canal, including the islands in the Bay of Panama. The Republic of Panama grants to the United States in perpetuity a monopoly for the construction, maintenance and operation of any means of communication by means of a canal or railroad across the Isthmus between the Caribbean Sea and Pacific Ocean, and for a period of 50 years the sanitary control of the cities of Panama and Colon and, in case of necessity, of the entire Republic of Panama. It also authorizes the new Panama Canal Company to sell all its rights and property to the United States. The ports of Panama and Colon are to be declared free for all time, so that the United States may import at any time, free of customs duty, into said zone all the materials necessary for the construction of the canal. The Republic is to enjoy free transportation over the canal of its vessels, troops and munitions at time of war, also free transportation of Government employees and police in the Republic. The canal when constructed and the entrance thereto shall be neutral in perpetuity, and the United States is given the right to employ its armed forces or to build fortifications for the safety or the protection of the canal. For these privileges the United States agrees to pay to the Republic of Panama the sum of $10,000,000 in gold and an annual rental of $250,000 during the life of the convention, beginning 9 years from the date thereof. In case of change in the government of Panama, the rights of the United States are to be respected and in no way waived and all the differences between the Republic and the United States shall be settled by arbitration by a commission of four members, to be composed of 2 members of each government. In case of disagreement an umpire shall be chosen whose decision shall be final. After the failure of the Colombian envoys to bring Panama back into the Colombian Federation, Nov. 16, on the information given by the United States minister of Bogota on Nov. 27, that the Republic of Panama had been recognized by the United States of North America, the government of Panama ratified the canal treaty on Dec. 2, 1903, and marines from the United States cruiser *Dixie* were landed on Dec. 8, who occupied the town of Empire on the Panama Railroad. On Jan. 15, 1904, delegates were elected for a convention to form a constitution of the Republic of Panama, which was enacted on Feb. 14, and on Feb. 20, Manuel Amador was inaugurated President of the Republic, and Pablo Arosemana appointed minister to the United States. The canal treaty was ratified by the United States Congress on Feb. 23, 1904, and went into effect on Feb. 26. After Congress had, on April 28, 1904, passed an act to provide for a temporary government of the Canal Zone, President Roosevelt appointed the following Isth-

mian Canal Commission to take charge of the construction of the canal and the administration of the Canal Zone: Rear-admiral J. G. Walker, chairman; Major-general Geo. W. Davis, Wm. B. Parsons, Wm. Burr, B. M. Harrod, C. E. Crunsky, F. J. Hecker, J. F. Wallace was appointed chief engineer. On April 22, 1904, the Panama Canal Company transferred its rights to the United States for the sum of $40,000,000, the Republic of Panama received $10,000,000.

General Geo. Davis was appointed Governor of the Canal Zone, to report to the War Department, and issued his first proclamation to the inhabitants on May 19, 1904. The first Isthmian Canal Commission resigned on April 3, 1903, and a new commission was appointed by the President consisting of Theodore Shonts, chairman; salary, $30,000; Chas. Magoon, $17,500; John Wallace, chief engineer, $25,000; Rear-admiral, M. Endicott; Brigadier-general, P. Hains; Colonel O. Ernst; Benj. Harrod, with each a salary of $7,500, and F. B. Bishop, commissioner and secretary to the Commission with a salary of $10,000. Magoon was made governor of the Canal Zone in July, 1905. A board of consulting engineers consisting of 13 members, of which 4 were foreigners, was also appointed to report on the plan of a canal to be recommended to the President. After protracted sittings at Washington, 8 members, including all the foreign representatives, declared for a sea-level canal, while 5—all Americans—favored a lock canal. President Roosevelt expressed himself in favor of a lock canal which was adopted by the Senate on June 26, 1905, the House of Representatives having voted for a lock canal already on June 15. The engineers then estimated the cost of a lock canal at $140,000,000, to be finished in 8 years. In November, 1906, President Roosevelt spent 4 days on the Isthmus thoroughly inspecting the entire route of the canal. He was well satisfied with the work done and sent a message to Congress on Dec. 17, in which he expressed his views regarding the canal construction. In January, 1907, Theodore Shonts, president of the Canal Commission resigned to be succeeded by John F. Stevens, chief engineer of the Commission, who, however, likewise resigned on March 4. On April 1, 1907, the President appointed the following Isthmian Commission: Lieutenant-Colonel George W. Goethals, chairman and chief engineer, in charge of construction and engineering, salary, $15,000; Major D. Gaillard in charge of the department of excavation and dredging, salary, $14,000; Major Wm. Sibert, in charge of the department of locks and dam construction, salary, $14,000; H. H. Rosseau, in charge of municipal engineering, motive power, machinery and building construction, salary, $14,000; Jos. Blackburn, in charge of civil administration, salary, $14,000; Colonel W. Gorgas, chief of department of sanitation, salary, $14,000; Jackson Smith, in charge of labor quarters and subsistence, salary $14,000; Jos. B. Bishop, secretary, salary $10,000. The Government decided to continue the work of construction by itself and not by contract, also to abolish Chinese coolie labor. The total length of the canal which will connect Colon on the Caribbean Sea with Panama on the Pacific ocean is 46 miles. The route chosen follows practically the one laid out by Lesseps. The depth will vary from 34 to 45 feet and the surface width from 200 feet in the Culebra cut to 1,000 feet from Gatun Locks to San Pablo, for a distance of 15 miles. It has been definitely decided to construct the canal at an 85 feet level. At Gatun there will be a duplicate flight of locks 110 feet wide with a lift and a descent for vessels to and from a lake to be formed by a dam 7,000 feet long and containing 118 square miles, and at places 8 miles wide with a steamer channel 23 miles long. On the Pacific there will be a lock at Pedro Miguel with a lift and descent of 30 feet, from which point there will be lake navigation at 55 feet level for 5 miles, to Sosa Hill, in which 2 locks will carry the vessel down to the level of the Pacific Ocean. Sosa Lake is to be formed by two dams on the Pacific shore. The heaviest portion of the canal work is at the Culebra cut section from La Cascades to Paraiso, a distance of 4.7 miles. At Culebra cut there is 94 feet left to dig to reach the 85 level canal. The department of construction embraces: 1. The Culebra division, extending from the Chagres River to Pedro Miguel; 2. The Chagres division, embraced between deep water in Lake Gatun and the Chagres River; 3. The Colon dredging division, extending from Gatun to deep water in the Atlantic; 4. The La Boca dredging division taking in all excavation between the La Boca locks and deep water on the Pacific, and 5, the locks and dams embracing the Gatun locks and dam, the locks and dam at Pedro Miguel, and the locks and dams at Lake Boca. 140,000,000 cubic yards is the estimated entire yardage to be excavated and removed from the canal proper. Of these, 18,699,080 yards were excavated at the end of October, 1907. At the end of September, 1907 29,845 men were at work, 23,607 for the Commission and 6,238 for the Panama Railroad. Up to June 30, 1907, $110,489,816 have been expended, while about $40,000,000 have been spent from 1907-08. In January 1908, Colonel Geo. Goethals stated to the Senate Committee on Interoceanic Canals, that the canal would certainly be completed by July 1, 1914, and that its cost would not exceed $250,000,000. On March 1, 1908, the excavation for the Panama Canal aggregated 28,414,934 cubic yards, or one-fifth of the total estimate. The sanitation of the Canal Zone alone costs $2,000,000 per annum. During 1906–7, 16,000,000 square yards of brush were cut, 1,000,000 square yards of swamps filled and drained; 30,000,000 square yards of grass burned, 217,000 linear feet of ditches dug, 50,000 feet of tile ditches laid, and 150,000 linear feet of ditches cemented. The protection of the em-


Land to be excavated ruled thus:
PROFILE OF
PANAMA CANAL
The Vertical Scale is exaggerated about 100 fold
C.S. HAMMOND & CO., N.Y.
COLON
Monkey Hill
Mindi Point
Mindi River
Gatun Locks
Gatun River
Tiger Hill
Chagres River
Dos Hermanos
Palo Horqueta
Palo Matias
Marias de las Penitas
Ahorca Lagarto
Vanos Vanos
Pena Blanca
ROHIO
Frijoles
TABERNILLA
SAN PABLO
Mamei
Juan Grande
GORGONA
MATACHIN
BAS OBISPO
Las Cascadas
EMPIRE
CULEBRA
PARAISO
Pedro Miguel Lock
Miraflores
Rio Grande
Corozal
La Boca
Sosa Locks
PANAMA
Normal Water Level +85
Bottom of Canal +40
Summit Level, Length, 31.72 Miles
Mean Ocean Level 0
Bottom of Canal -41
Atlantic Ocean Level, Length 7.15 Miles
Water Level +55
Bottom of Canal +10
Pedro Miguel-Sosa Level, Length 5.4 Miles
High Water Level +10
Mean Ocean Level 0
Low Water Level -10
Bottom of Canal -15
Pacific Ocean Level, Length 4.25 Ms.
Miles 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 Miles

CARIBBEAN SEA
MOSQUITO GULF
GULF OF PANAMA
PACIFIC OCEAN
GULF OF DARIEN
CHIRIQUI
VERAGUA
PANAMA
COLOMBIA
Colon
Panama
Chagres
Porto Bello
Limon or Navy B.
Salud
Buenavista
Farallon Sucio
Manzanilla Pt.
Pt. Pescador
Palenque
Pt. San Blas
Gulf of San Blas
Mulatas Archipelago
Playon Chico
P. Escondido
Mosquitos Pt.
Caledonia Harbor
Escocs Pt.
P. Carreto
Escondido Pt.
C. Tiburon
Acanti
Arenas Pt.
Caribana Pt.
Savanilla Pt.
S. Juan Pt.
S. Pedro
S. Geronimo
Arboletes Pt
Broqueles Pt.
Tortuguilla I.
S. Bernardo
Fuerte I.
Zapote
Lorica
Tolu
Morrosquillo Gulf
Meztizos Pt.
San Bernardo Is.
Rosario Is.
Barbacoas Bay
Cartagena
Canoas Pt.
Cano-loro
Baru I.
Sabanilla
Guaragua
Turbo
Rio Carepa
S. Jorge R.
Gulf of Uraba
Darien Harbor
Chepigana
Yaviza
Tucuti
Garachine
Garachine B.
Garachine Pt.
C. Escarpado
Brava Pt.
S. Miguel Bay
Pt. Caracoles
Pinas B.
Pt. Pinas
Humboldt B.
C. Marzo
Octavia Rocks
Cupica
Cupica B.
Cruces Pt.
Pearl Islands
S. Miguel
Pedro Gonzales I.
Rey I.
Saboga I.
Chapera I.
Bayoneta I.
Taboga I.
Panama Bay
Cheppillo I.
Chepo
Mirflores
Pacora
Chorrera
Sa. Capiro
Chame B.
Chame Pt.
Chame
Pueblo Nuevo or S. Carlos
Penonome
Anton
Aguadulce
Parita Bay
Los Santos
Las Tablas
Pt. Liso
Montijo
Montijo B.
Iguana I.
Pedasi
C. Mala
Los Frailes
Guanico Pt.
Puercos Pt.
Mariata Pt.
Cebaco I.
Coiba I.
Montuosa I.
Hermosa Pt.
Negrada Pt.
Icaron I.
Secas Is.
Ladrones Is.
Contreras Is.
Medidor I.
Baltasar Hd.
Bahia Honda
Sona
Santiago
Atalaya
Canazas
Palmas
Tole
Remedios
S. Felix
Espartal I.
Pto. Nuevo
G. Parada I.
Sevillin I.
Boca I.
Bay of David
David
Boqueron
Caldera
Burica Pt.
Gulf of Dulce R.
Pavon R.
Rigato
Canas Gordas
Chiriqui Vol.
Mt. Pando
Mt. Horqueta
Chiriqui Bay
Chiriqui
Alanje
R. Chiriqui
Escudo de Veragua
Pt. Rincon
Pt. Paliseado
Bocas del Toro
Columbus I.
Boca del Toro
Provision I.
Boca del Drago
Almirante B.
Rondi I.
Ropa I.
Boca del Tigre
C. Valiente
Vieja Isabel Pt.
Sipurio
Mt. Blanco
Coaita Pt.
Carreta Pt.
Sissola
Blanca Pt.
Limon
Mt. Chiriqui
Mt. Santiago
Catalina Mts.
Mt. Chiriqui
Mt. Chico
Aguadulce
Calobre
Canazas
Santiago
Atalaya
Parita
Montijo
Los Santos
Las Tablas
Pedasi
Iguana I.
C. Mala
Los Frailes
Guanico Pt.
Puercos Pt.
Mariata Pt.
Cebaco I.
Coiba I.
Montuosa I.
Hermosa Pt.
Negrada Pt.
Icaron I.
Secas Is.
Ladrones Is.
Contreras Is.
Medidor I.
Baltasar Hd.
Bahia Honda
Sona
Montijo B.
Leones
Macaracas
Mt. Grande
Peninsula de Azuero
Parita Bay
Pt. Liso
Submarine Cable to Buenaventura
Submarine Cable to San Juan del Sur
Jamaica
Cable to Kingston
North
Longitude 79 West from Greenwich
PANAMA
SCALE OF MILES
0 10 20 40 60 80
Proposed Panama Canal
Panama Railroad

ployees against the malarial mosquito were so successful that not one case of yellow fever originated on the Isthmus during the season of 1906–07. The average daily sick in quarters and hospitals, of which five new ones were constructed, amounted to 916 for the year 1906–7.

Much attention has been given to the subject of schools in the Zone for the benefit of the children, especially of Americans employed by the Commission. Twenty-four schools with an average enrollment of 1,643 pupils and 31 teachers were opened during the year. On June 30, 1907, the effective force of police consisted of 181 officers and men.

PAN-AMERICAN CONGRESS. The idea of a congress or conference of representatives of the American republics originated in a plan of Henry Clay for a Panama congress, but no steps were taken to bring it about. The convening of such a congress in 1889 was owing to the efforts of James G. Blaine. This conference was meant to include representatives of the republics of the United States, Mexico, Central and South America, Haiti and Santo Domingo, and the Empire of Brazil. It was planned for the purpose of discussing and recommending means of enlarging and regulating business relations, better facilities for communication, and closer relations in matters of international exchange and reciprocity. In conformity with the provisions of an act of the United States Congress of May 24, 1888, the representatives met in Washington, Oct. 2, 1889, but adjourned to November 19th of the same year for the purpose of visiting various portions of the United States before commencing their work. The congress continued without final adjournment for five months, and voted to recommend to the various governments for adoption, among other measures, a uniform commercial coinage, a general plan of legalizing documents, a uniform system of weights and measures, and that all the represented states adopt treaties of reciprocity.

The various American republics, constituting this International Union, held a second conference in the city of Mexico, meeting Oct. 22, 1901, and adjourning Jan. 31, 1902. Seventeen republics, including the United States, were represented by delegates. A number of important treaties were negotiated and among other transactions was the adoption of a protocol declaring that the principle of voluntary arbitration established by the International Peace Conference at the Hague, in 1899, should be considered as American public law. Before adjourning a resolution was passed to the effect that not more than five years should elapse before a third congress be held.

The third Pan-American Congress was held at Rio Janeiro, Brazil, from July 23 to August 27, 1906. It was attended by delegates from the United States of North America and from the 21 different republics of the Western Hemisphere. Secretary Root of the United States who arrived on July 27, at Rio Janeiro, was also present at several sessions and delivered a speech. The subjects of arbitrating all disputes between the South American states, of sanitation, commercial relations, patents and copyright, the Pan-American Railway and the codification of international laws were disposed of. Mr. Buchanan, chairman of the American delegation, presented a resolution, requesting the different countries to prepare tables showing the monetary fluctuation during the past 20 years and to submit them to the next Congress. It was adopted. The Drago Doctrine opposing the use of force by foreign powers for the collection debts, which had caused a heated discussion on August 6, was referred to the Hague Tribunal.

PAN-AMERICAN EXPOSITION. In Jan. 1899, the Legislature of the state of New York passed a special Act incorporating the Pan-American Exposition Company, the design of which was to hold an exhibition in the city of Buffalo, N. Y., from May 1 to Nov. 1, 1901, which should fittingly illustrate the development of the Western Hemisphere during the 19th century by a display of the arts industries, manufactures, and the products of the soil, mine, and sea. The project had the cordial endorsement of Congress, which appropriated the sum of $500,000 to be expended on national buildings and exhibits, including among the latter those not only native to the country, but such interesting displays as could be procured from the colonial possessions of the Nation. Exhibits from the chief departments at Washington, and from the National Museum and the Smithsonian Institution, were among the attractions of the Exposition as well as an array of exhibits from Canada, the West Indies, and the republics of South America. National and State Boards also co-operated in giving practical effect to the project, and a large capital stock was raised in Buffalo (to the amount of two and a half million dollars, exclusive of the National and State appropriations), to carry out effectively the designs of the incorporators. The grounds of the Exposition (350 acres in extent), were beautifully situated in the suburbs of Buffalo, and most attractive were the array of artistic structures in which to house the exhibits, in a landscape setting of great beauty.

The Pan-American Exposition, it was confidently claimed, surpassed former enterprises of the kind in six important features: First, in the electrical effects; second, in the hydraulic and fountain effects; third, in the horticultural, floral, and garden effects; fourth, in the original sculptural ornamentation; fifth, in the color decorations; and sixth, in the court settings. The general style of architecture of the exposition buildings was a free treatment of the Spanish Renaissance, a compliment to the Latin-American republics, that aided the enterprise by varied exhibits. Some idea of the extent and attractions of the Exposition may be gathered from the following scheme of arrangements: The principal buildings surrounded a broad and beautiful court in the form of an inverted letter T. The transverse section of this court, known as the Esplanade, ran east and west, and was over 1,700 feet

between the two extremes. The Court of Fountains, which lay to the north, was 500 feet wide and 2,000 feet from north to south. Arriving at the Exposition grounds, the visitor passed through the beautiful entrance on Lincoln Parkway. Following the broad drive, he would reach the Albright Gallery; to the right he would see the new park shelter and boat house, and crossing the great bridge over the neck of water connecting the lake with North Bay he would get the first glimpse of the New York State building. Continuing north he would come to the Approach and to the Fire Court, and crossing the Triumphal Bridge, which spaned the canal between the east and west of the mirror lakes, he would be within the Esplanade. The buildings here seen upon the extreme right were the Government group, consisting of three large structures. On the far left was a similar group, consisting of the Horticulture, Graphic Arts, and Forestry and Mines Buildings. Crossing the Esplanade one approached the Ethnology building on the right and the Temple of Music on the left. These marked the junction of the Court of Fountains with the Esplanade. On the right and left again were two subordinate courts, known as the Court of Cypresses and the Court of Lilies. The aquatic basin, some two thousand acres in extent, contained numerous fountains, and constituted one of the prettiest scenic features of the grounds. On the east and west sides of the Court of Fountains were the Manufactures and Liberal Arts Halls, and the Machinery and Transportation Buildings. The Electric Tower, 375 feet in height and built of steel, stood in another broad basin, brightened with fountains. This tower was off the main plaza; east of the tower was the Agricultural Hall and west of it was the Electricity building. In planning the Exposition, the management early decided upon paying special homage to electricity. The progress of electrical science, they properly thought, had been so marked in recent years as to excite the wonder of the scientific world. Buffalo was, perhaps, more than any other city interested in this science, owing to the nearness of Niagara Falls, where the greatest electric power plants were installed. The electrical displays, it was designed therefore, should be a chief feature of the Exposition. On the eastern side of the Plaza was the Stadium, with a sitting accommodation for 10,000 people. On the west was the largest restaurant erected on the grounds. Here was the entrance to the Midway, which occupied a space of 30 acres and had about 3,000 lineal feet of streets. North of the Park were the State and foreign buildings and in the neighborhood were the music gardens. The plans for the Exposition buildings, together with the general landscape work, were made by a board of skilful architects. The officers of the Pan-American Exposition, marshalled by the President, John G. Milburn, and the Hon. W. I. Buchanan, director-general, included besides a body of influential directors, many executive committeemen having the oversight of the buildings and grounds, the exhibits, the department of works, the bureau of transportation, etc., etc. Other gentlemen formed standing committees of the Exposition, while a separate board of management was entrusted with the supervision of the United States Government exhibit. The total cost of the Exposition was $8,860,757, and the total receipts were $5,534,643, leaving a deficit of $3,326,114. As a great object lesson in modern progress and development in the two continents of North and South America, the Pan-American Exposition was an interesting and instructive attraction marred in its closing days unhappily by the tragic assault on and death of President McKinley. G.M. A.

Revised by A.R.R.

PANAS, Photinos, a French surgeon; born in the Ionian Islands, January 30, 1832. He took up his residence in Paris in 1848, became a subject of France and began the study of medicine. In 1860 he was graduated from the Paris School of Medicine and two years later was appointed associate professor and surgeon to the Central Bureau. He was then surgeon at the Bicetre Hospital and later at the St. Antoine Hospital. In 1873 he was decorated by the Legion of Honor. In 1875 he was appointed ophthalmic surgeon at the St. Louis Hospital. He has written a large number of surgical works and numerous papers on medical subjects. W.M.C.

PANCHATANTRA, a collection of very ancient Sanskrit fables, which, having been translated into other languages, have been adopted by modern fabulists. See Sanskrit, Vol. XXI, p. 301.

PANCOAST, Joseph, surgeon, was born in Burlington County, N. J., on November 23, 1805, and was graduated from the medical department of the University of Pennsylvania in 1828. He settled in practice in Philadelphia, in 1831 began to teach classes in anatomy and surgery, and from 1838 to 1874 was a professor in the Jefferson Medical College. He was one of the most eminent surgeons of his day, and was the author of several important operations. One of these was for soft and mixed cataracts, another was the plow and groove or plastic suture for rhinoplasty, a third was for empyema, and others were for strabismus and for the restoration of the voice. He was a voluminous and authoritative writer on surgical topics. He died on March 7, 1882.

W.F.J.

PANCOAST, William Henry, surgeon, son of Joseph Pancoast (q. v.), was born in Philadelphia on October 16, 1835, and was graduated from Haverford College in 1853, and from Jefferson Medical College in 1855. He also studied in London, Paris, Vienna, and Berlin. He settled in Philadelphia, and soon became known as a skilful operating surgeon. During the Civil War he was surgeon-in-chief of the great military hospital in Philadelphia; from 1862 to 1874 he was a demonstrator of anatomy in Jefferson Medical College, in 1867, 1873, and 1874 adjunct professor, and in 1874 he succeeded his father as professor there, and filled the place for many years. He became professor of surgery in the Medico-Chirugical College of Philadelphia in 1886. He died on January 5, 1897. W.F.J.

PANCREAS. See NUTRITION, Vol. XVII, pp. 693–697.

PANCREATINE. See FERMENTATION, Vol: IX, p. 85.

PANDA. See *Ailurus*, under MAMMALIA, Vol. XV, p. 448.

PANDECTS OF JUSTINIAN, a digest of Roman law. See JUSTINIAN, Vol. XIII, 802–803.

PANDORA, a Grecian myth. See ADAM, Vol. I, p. 126.

PANEL SYSTEM. See COAL-MINING, in these Supplements.

PANGENESIS, a theory of reproduction. See BIOLOGY, Vol. III, p. 597.

PANGUITCH, a post precinct and the capital of Garfield County, south southwestern Utah, on Panguitch Creek, a west branch of the Sevier River, about 130 miles S. of Nephi. It is situated in a mountainous region, with fertile valleys. Coal and an abundance of timber are found. Agricultural and dairy products are plentiful. The village has a tannery. Population 1900, 883.

PANICALE, an Italian painter. See MASOLINO DA PANICALE, Vol. XV, p. 616.

PANICS. (For a general understanding of financial crises throughout the world, see BANKING, Vol. III, pp. 274. et seq.). In the United States there have been two or more panics within recent years which were remarkable, not less for certain points of similarity in some of the causes which produced them and in their widespread effects, than for certain other deep-seated elements which mark them as distinctly different in kind.

The panic of Sept. 18, 1873, known as "Black Friday," was mainly a financial one, being a logical outcome of a long period of overtrading, excessive speculation and unwarranted expansion in certain lines of development. The conditions were, moreover, strongly influenced by a depreciated and fluctuating paper currency, concerning which there had been no authoritative assurance of ultimate redemption in coin. The crisis was immediately precipitated by the failure of Jay Cooke and Company, and within a brief period a great proportion of the banks suspended, premium rates for loans advanced enormously, and there was a disruption of the conditions of exchange between different sections, which was long continued. The Redemption Act of Jan. 7, 1875, restored confidence in monetary conditions, and the commercial prosperity during the ensuing 15 years was unexampled. In 1893 a panic came on, which was marked by peculiar features. The state of productive industry seemed at its highest; crops were bountiful; nature had withheld all such disasters as pestilence, famine and fire, nor was the country threatened with war or internal dissensions. The conditions changed within the space of a few weeks; and the monetary stringency and industrial depression which spread over the land were characterized by more disastrous and lasting effects than any hitherto known. In July the decrease in the volume of trade in New York was 15 per cent. In August and September it was nearly thirty per cent; and bank failures and the suspension of commercial houses were of almost daily occurrence. The shortage of payments, as shown by the clearing-houses, was nearly three billion dollars in excess of that for the same quarter in 1892. Before the end of September upward of fifty per cent of the mills and factories in the production of cotton, woolen, leather and knit-goods, pig-iron and other products were closed; and these conditions had undergone little relaxation—if, indeed, they were not intensified—up to the beginning of November, 1896. In the matter of money scarcity, however, the conditions during this period were variable. During July and August of 1893 fully one tenth of the deposits of all banks was withdrawn in the form of bills and hidden away, and the result was a currency-panic. Premiums as high as $25 per thousand were offered by money-brokers in exchange for small bills, and even the Chemical National Bank of New York was unable to furnish the New York Central railroad with the money for its monthly pay-roll. This incident was only one among thousands of a similar nature. In a short time, however, the high premium on currency brought it from its hiding-places, so that early in September it had dropped to one per cent, and soon disappeared entirely. Subsequently there was no real scarcity of money, but in view of the fact that industrial conditions exhibited no tendency toward a healthy improvement, the conservative banks restricted the amount of their loans and made the conditions of security so much more exacting that cash continued to be difficult to obtain.

The cause, or causes, of this period of depression were disputed. But among the more thoughtful students of the situation, there was little difficulty in forming a decided opinion. Similar to the conditions of 1873, speculation had gone to unwarranted lengths; and investments in improvements such as new railroads, Western town and land schemes, and unremunerative projects of all sorts, served to create timidity in many centers.

The people were going at too rapid a pace; and a check sooner or later was inevitable. Added to this was the growing doubt and uncertainty as to what would be the policy of the government in relation to the questions of coinage and the standard of value. Public attention became focused upon the matter in 1893, during the long fight in Congress over the repeal of the silver-purchase clause of the Sherman Bill. The agitation continued, however, and culminated in 1896 in the transformation of the Democratic party into a party whose principal aim was the free coinage of silver at the ratio of 16 to 1. Public credit was at its lowest ebb, and resulted in unparalleled commercial and industrial depression, which condition prevailed until after the election on November 3d. When it was known that the Presidential candidate of the Republican party had been elected, the alteration in the situation was surprising. Not only the nature of the change, but the degree and emphasis of it were marked features. Mills and factories which had been closed down for months, through sheer timidity as to the outcome, started up within a day after the election, with increased numbers of operatives, and prepared to run night and day, that they might complete extensive orders for goods which had been contingent upon

the turn of the election. Money came from its hiding-places, and a much better feeling of confidence pervaded nearly all industrial and financial centers.

THE PANIC OF 1907–08. During the years 1907–08, the United States passed through a financial panic of great severity, the effects of which will be felt for a long time to come. As reasons for it given by finance experts is the loss of over two and one-half billion dollars of liquid capital caused by the Boer War, the Russian-Japanese War and the earthquake of San Francisco; the over-supply of gold (in 1907–08, $425,000,000) by which the price of commodities and the rate of interest were raised; over-speculation in stocks and staples and metal; an unprecedented activity and expansion in industries and manufactures; the inadequacy of our currency system, and the rapid expansion of the banking industry under the guise of trust companies without proper legal reserves. The financial crisis began when the common stock of the Union Pacific was put on a ten per cent dividend basis in 1906. In March, 1907, a severe slump in the stock market took place, when the Union Pacific coterie lost $500,000,000. The next step to bring about the panic was the break in the copper market. In March, 1907, the price of copper fell, and millions and millions were lost by speculators and investors. In October, 1907, August Heinze, a western millionaire, tried to corner United States copper, but finding no money, he had to suspend payment. Mr. Heinze and his friends resigned from their positions as presidents and vice-presidents of several banks, amongst them the Knickerbocker Trust Company of New York. The determination of the Bank of Commerce of New York to eliminate Heinze and his associates by no longer clearing to the above institution caused the suspension of payment by the Knickerbocker Trust Company after paying out $8,000,000. The run on this bank, holding $62,000,000 of deposits, was the signal for runs on other institutions, like the Trust Company of America, New York, from which $13,000,000 was withdrawn, and on the Lincoln Trust Company of New York. Bank suspensions in Brooklyn included the First National, Williamsburg, Trust Company, Jenkins Trust Company, Burrough Bank, Brooklyn Bank, and in New York the Guardian Savings Bank and the U S. Exchange Bank. All over the country banks closed their doors. The public, becoming distrustful, withdrew their deposits and hoarded money to the amount of $100,000,000.

On October 28, the Clearing House Association in all large cities decided to issue clearing house certificates and to require from depositors the legal notice of from thirty to sixty days before making withdrawals. At the height of the crisis, when call money was at 100 per cent on the New York Exchange and a stock market panic imminent (October 24), J. P. Morgan came to the rescue by lending $25,000,000 at 10 per cent, to which the New York Trust Companies added another $10,000,000. The panic was further checked by the timely action of President Roosevelt and Finance Secretary, Mr. Cortelyou. On November 17, the President announced that the government would issue $50,000,000, Panama bonds and interest-bearing certificates of indebtedness to the amount of $150,000,000. The measures, and likewise the arrival of $40,000,000 of foreign gold and the sale of $40,000,000 of corporate stocks and bonds by the City of New York allayed the crisis to such an extent that public confidence was restored and the sale of only a fraction of the bonds offered became necessary.

PANTELEGRAPH, a telegraphic apparatus for reproducing a writing or drawing at a distance. It makes use of a pendulum which carries an iron point over a picture or writing done in an insulating ink on metallic paper. The circuit is broken every time the pendulum passes over the points that are inked. This action is duplicated by a pendulum at the other end of the line, which swings over a paper prepared with a solution of yellow cyanide of potassium, and leaves blue marks corresponding to the original writing.

PAOLA, a city and the capital of Miami Co., eastern Kansas, 43 miles S.S.W. of Kansas City, Mo., about 70 miles E N.E. of Emporia, on Bull Creek. In the vicinity are found coal, lime, natural gas and oil. The city has carriage-shops, flour-mills, grain-elevators, several banks, two libraries and three weekly newspapers. Population 1900, 3,144.

PAPAINE OR PAPAYOTIN, a digestive agent, derived from the juice of the papaw tree (*Carica papaya*). The milky juice is slightly bitter and styptic, and free from tartness. It flows from incisions made in the bark and the green fruits, and is bottled and sent to market, either pure or with the addition of 10 to 12 per cent of alcohol to prevent fermentation. Papaine is used in many pharmaceutical preparations.

PAPAVERACEÆ, the name of the poppy family, which are herbs with milky or colored narcotic or acrid juice, a calyx which falls off when the flower opens, four to ten petals, numerous stamens and a many-seeded pod. The prominent genera are: *Papaver*, one of whose species (*P. somniferum*) yields opium; *Sanguinaria*, the common blood-root; *Argemone*, the prickly poppy of the southwestern United States and Mexico; *Eschscholtzia*, the Californian poppy, a showy plant common in cultivation; *Chelidonium*, the celandine, and *Bocconia*, an ornamental plant cultivated from China.

PAPAW, the common name (Creole origin) of species of *Asimina*, well-known shrubs of the central and southern United States, which bear dull-purple flowers preceding the leaves, and large, oblong, sweetish, pulpy fruits. They belong to the family *Anonaceæ* or custard apples.

PAPUA, a Malayan word signifying frizzled and sometimes applied as a title to New Guinea.

PARA, a small Turkish coin, equivalent, approximately, to one-ninth of a cent in United States money. R.W.C.

PARAÇATU, a town and a river of the same

name, a western affluent of the São Francisco, in western Minas Geraes, Brazil, about 450 miles N.N.W. of Rio de Janiero. It is the center of a region devoted to grazing and to growing coffee and sugar-cane. A considerable trade is carried on with Goyaz and Bahia. Paraçatu was formerly noted for its gold-washings, now almost exhausted. Some diamonds have also been found in the vicinity. Population (communal) in 1896, 46,621.

PARACHUTE. See AËRONAUTICS, Vol. I, pp. 181–183.

PARACLETE OR HOLY GHOST. See GOSPELS, Vol. X, pp. 745, 746.

PARADISE-FISH, a Chinese species of Macropod, the genus *Polyacanthus*, of the acanthopterygian family *Labyrinthici*, often kept in aquaria for its beauty of form and coloring. In the male the colors increase in brilliancy at the pairing-season, and he swims around his wished-for mate, fluttering the long, delicate filaments of the ventral fins, or erecting those of the tail fin like a peacock's train in miniature.

PARADISEIDÆ. See BIRDS OF PARADISE, Vol. III, p. 675.

PARADOX, HYDROSTATIC. See HYDRO-MECHANICS, Vol. XII, p. 457.

PARADOXURUS OR PALM-CIVETS. See MAMMALIA, Vol. XV, p. 442.

PARAGOULD, a town, the capital of Greene Co., Ark, 160 miles N.E. of Little Rock and 10 miles W. of the St. Francis river, on the Paragould and Southeastern, St. Louis, Iron Mountain and Southern and the St. Louis Southwestern railways, in a region producing cotton, corn, the cereals, white and sweet potatoes, fruit, live-stock, and timber; is an important shipping-point, and has large stave factories. Pop. 1890, 1,666; 1900, 3,324.

PARAGUAY, REPUBLIC OF. (For general article, see PARAGUAY, Vol. XVIII, pp. 247–49.) In 1905 the area and population were estimated as follows: Area, about 98,000 square miles; white population, about 631,340, including abput 18,180 foreigners of all nationalities. There were besides about 100,000 Indians. The population of the capital, Asuncion, was about 60,259; other towns are Villa Rica, 25,000; Concepcion, 15,000; San Pedro, 8,000; Luque, 8,000, including their districts.

Education is free and compulsory. In 1887 only 20 per cent of the Paraguayans and 60 per cent of adult foreigners could read and write. There were, in 1900, 400 public and private elementary schools, with 25,000 pupils and 700 teachers. In 1887 there were only 138 schools, with 15,180 pupils. There are, besides, over 100 schools subsidized by the Council of Education; and at Asuncion there is a national college, with 15 professors and 205 students.

In Asuncion there is also a public library, and five newspapers are published in that city.

A high court of justice and various inferior tribunals, with local magistrates, exercise judicial functions.

FINANCE. The revenue of Paraguay in 1900 amounted to a total of $6,866,000. Of this sum about $5,080,622 was derived from customs, $500,000 from sales of land and yerbales, and $12,653 from the rent of government lands. The expenditure amounted to $8,122,139. The foreign debt on Jan. 1, 1901, was about $4,827,500. The internal debt at the same time was $12,454,660.

In 1898 gold was at about 660 per cent premium.

PRODUCTION AND INDUSTRY. The number of horned cattle in Paraguay in 1899 was 2,283,000; horses, 182,790; mules and asses, 7,626; sheep, 214,060; goats, 32,324; pigs, 23,900. Only 158,100 acres were under cultivation in 1887; viz., maize, 58,800 acres; manioca, 41,400 acres; sundries, 8,800 acres. There were about 1,200 factories, tanneries, mills, and houses of business, with an aggregate working capital of $4,550,000, giving employment to 2,600 persons. The chief industry is the growing of *yerba maté*, or Paraguay tea.

COMMERCE. The total value of imports from all directions in 1905 was $4,678,500 (in gold); exports, $5,232,970 (in gold); in 1888, imports $3,198,168, exports $2,183,381; in 1890, imports $2,725,611, exports $2,901,589. The chief imports are textiles.

The imports pass entirely through Brazil and Argentina, and there is no direct intercourse between Paraguay and the United States or Europe.

COMMUNICATION. In 1905, 460 vessels, of 109,930 tons, entered the port of Asuncion.

There is a railway of 157 miles, now in English hands. In 1900 the receipts were 1,568,037 paper pesos; 624,741 passengers were carried, and 50,774 tons of goods. A concession was granted in 1887 for the extension of the railway. There is a line of telegraph at the side of the railway. The national telegraph connects Asuncion with Corrientes, in Argentina, and thus with the outside world. There are 1,130 miles of telgraph line; and in 1905 103,820 messages were sent. The telephone is in operation at Asuncion. Paraguay joined the postal union in 1881. In 1899 there were 139 post offices; letters sent and received, 1,254,800.

PARAGUAY RIVER. See BRAZIL, Vol. IV, pp. 200, 210.

PARAGUAY TEA. See MATÉ, Vol. XV, p. 633; and AQUIFOLIACEÆ, in these Supplements.

PARAHYBA-DO-SUL. See BRAZIL, Vol. IV, p. 200.

PARALEPIDIDÆ, a family of small fishes found in the deep waters of northern seas. There are few species. They are of no economic importance.

PARALLELOGRAM. See MENSURATION, Vol. XVI, p. 19.

PARALLELOGRAM OF FORCES. See MECHANICS, Vol. XV, p. 709.

PARALLELOPIPED, a solid figure having six faces, the faces being invariably parallelograms, and any two opposite faces equal, similar, and parallel. If the faces are all squares, and consequently equal, the parallelopiped becomes a cube.

PARALLELS OF LATITUDE. See GEOGRAPHY, Vol. X, p. 176.

PARAMAGNETIC SUBSTANCES. See ELECTRICITY, § 60, in these Supplements.

PARAMATTA. See PARRAMATTA, Vol. XVIII, p. 326.

PARAMECIUM OR SLIPPER ANIMALCULE, an infusorian common in pond-water or in vegetable infusions. In shape it is an asymmetrical oval, in length about one hundredth of an inch. Each paramecium is covered with rows of cilia, which lash it through the water and drive food-particles into an aperture which serves as a mouth. A paramecium often divides transversely into two; these two repeat the process, and rapid multiplication may thus proceed for a while. It has its limits, however, and then two individual infusorians conjugate, exchange some of the material of their micronuclei and separate, when division again ensues. Illustrations of the various stages in the life-history are given under *Ciliata*, in PROTOZOA, Vol. XIX, pp. 886–889.

PARAMETER. See CONIC SECTIONS, Vol. VI, p. 242.

PARAMITAS. See LAMAISM, Vol. XIV, 227.

PARANÁ, a town and the capital of the province of Entre Rios, eastern central Argentine Republic. It stands on a high bluff, forming the east bank of the Paraná, overlooking the Paraná, nearly opposite Santa Fé, 245 miles N.W. of Buenos Ayres. The town was the capital of the Confederation from 1852 to 1861; afterward it sank rapidly, but within recent years has had a marked increase in growth, and in 1906 had a population of 27,000.

PARANA, a river. See PLATE, Vol. XIX, 199.

PARAPET. See ARCHITECTURE, Vol. II, p. 412; and FORTIFICATION, Vol. IX, pp. 371–379.

PARAPLEGIA. See PARALYSIS, Vol. XVIII, p. 260.

PARA RIO. See BRAZIL, Vol. IV, p. 198.

PARASALENÆ OR MOCK MOONS. See HALO, Vol. XI, pp. 355–357.

PARASANG. See *Persia*, in WEIGHTS AND MEASURES, Vol. XXIV, p. 518.

PARASITES. See PARASITISM, Vol. XVIII, pp. 262–276; and ECOLOGY, in these Supplements.

PARCÆ. See FATES, Vol. IX, p. 44.

PARDESSUS, JEAN MARIE (1772–1853), a French jurist. See SEA LAWS, Vol. XXI, p. 612.

PARDO, DON EMANUEL. See PERU, Vol. XVIII, p. 692.

PARDOE, JULIA, an English authoress; born in Beverley, in 1806. She published poems and a novel in her fifteenth year, and *Traits and Traditions of Portugal* in 1833. A visit to Constantinople in 1836 led to her *City of the Sultan*, after which she made other interesting journeys and published accounts of them. Died in London, Nov. 26, 1862.

PARDON, in law, is the remission of the penalty inflicted on an offender who has been tried and convicted, and is an act of grace rather than of justice. The right should be used with great discretion in rectifying an obvious miscarriage of justice, or where, through the inevitable imperfection of all laws, individual cases or offenses seem to be visited with too severe a penalty. The power of pardoning crime is, by the constitution and laws of most of the states of the American Union, conferred upon the governors of the respective states. In the following states, however, the governor is assisted by an executive council, when the question of pardon is to be decided: Maine, Florida, Louisiana, New Hampshire, New Jersey, North Carolina and Vermont. In Pennsylvania the governor grants pardons only on the recommendation of a board of pardons. In Illinois also a board of pardons is invested with the power. See also PARDON, Vol. XVIII, pp. 276, 277.

PAREGORIC OR PAREGORIC ELIXIR, the compound tincture of camphor of the pharmacopœia. It consists of an alcoholic solution of opium, benzoic acid, camphor and oil of anise, every fluid ounce containing two grains each of opium and benzoic acid and one and a half grains of camphor. This preparation is much used, both by the profession and the public. It has been found useful in chronic rheumatism, and, especially in the case of children, to relieve slight pains in the stomach and bowels.

PAREIRA-BRAVA, a lofty climbing shrub indigenous to the forests of Peru and Brazil, and bearing bunches of oval berries resembling grapes. The plant yielding the root of commerce is the *Chondrodendron tomentosum*, which has a long branching woody root, of a yellowish to a greenish brown color internally, and has attained considerable reputation in medicine.

PARELLA, a name given to some of those crustaceous lichens which are used to produce Archil, Cudbear and Litmus, but which more strictly belongs to one species, *Lecanora parella*, and the red or crimson dye prepared from it.

PARENCHYMA. See BOTANY, Vol. IV, 75.

PARENT AND CHILD. See INFANT, Vol XIII, p. 3.

PAREPA-ROSA. See ROSA, in these Supplements.

PARESIS. See PARALYSIS, Vol. XVIII, 260.

PARHELIA OR MOCK SUNS. See HALO, Vol. XI, p. 356.

PARIA, GULF OF. See TRINIDAD, Vol. XXIII, p. 610.

PARIAH. See MADRAS, Vol. XV; p. 186.

PARIDÆ. See TITMOUSE, Vol. XXIII, 446.

PARIETAL BONES. See ANATOMY, Vol. I, p. 722.

PARIETAL OR PINEAL EYE. See PINEAL EYE and SENSE-ORGANS, in these Supplements.

PARIMÉ, CORDILLERA OF. See AMERICA, Vol. I, p. 589.

PARIS, CITY OF. (For general article, including map, see PARIS, Vol. XVIII, pp. 278–301.) Since the establishment of the republic the work of improving the city has gone steadily forward. New streets have been opened near the Paris Bourse de Commerce and the Post-office; the Champs de Mars, a waste of sand, has been converted into a beautiful garden, in which rises the Eiffel Tower. The museums of the Jardin des Plantes have been rebuilt; the Quartier Latin has been covered with educational buildings. May 9, 1889, the Paris Universal Exposition was opened in the Champs de Mars. It occupied an area of 173 acres, and in magnitude and comprehensiveness excelled all its predecessors. In 1890–91 two great undertakings were mooted—a system of metropolitan railways to connect the great Parisian stations with the heart of the city, and the conversion of Paris into a seaport by the deepening of the Seine or the construction of a ship-canal to the

Channel. The enthusiastic advocates of the latter scheme predict that in a few years it would make Paris the largest city in Europe and the center of the commerce of the world. No definite steps had been taken in the matter up to the summer of 1896, but its friends still hoped to complete the work in time for the opening of the World's Exposition in 1900. On the 30th of March, 1893, the new Montretout reservoirs were opened, raising the daily water-supply from 150,000 to 270,000 cubic meters. Operations were begun in 1889 for bringing to Paris the water of the river Avre, a tributary of the Eure and a stream of great purity. An aqueduct, 63 miles long, partly under ground and partly above, brings the water to St. Cloud, where a reservoir contains 400,000 cubic meters. One tunnel, at Versailles, is over four miles long. The cost has been 32,000,000 francs. To meet future needs the prefecture is now preparing for a further supply from the Loing and the Lunain.

In the census of 1901 Paris reported a population of 2,660,559.

Paris collects and disburses 350,000,000 francs annually.

	Francs.
Profits from various enterprises, such as markets, gas, water (which pays 12,000,000 francs), street-railways, cabs and other profitable monopolies, paid into the city treasury annually, amount to	40,000,000
Collected from octroi taxes	140,000,000
Direct taxation	35,000,000
Paid from National Treasury	35,000,000
Total	250,000,000

The corporations manufacturing gas must pay the city 200,000 francs a year for the privilege of piping streets, .02 franc a year for each cubic meter supplied, and half the net profit after paying 13½ per cent. on the capital stock of 84,000,000 francs, which stock cannot be watered. The debt of the city of Paris in 1899 amounted to 2,387,216,295 francs (=$477,443,259).

PARIS EXPOSITION (1900). For international exhibitions on a colossal and grandly artistic scale the beautiful French capital can always be trusted to vie with, if not to excel, any other of the world's cities. To those who had the good fortune to see the Exposition of 1900, on the banks of the Seine, with the elaborate arrangements for housing and displaying its array of interesting and attractive exhibits to represent the art, science, agriculture, invention, and manufacture of the chief world-powers, will deem the remark amply justified. In the arrangements for the mammoth exhibition the French commissioners spent money lavishly, as well as expended enormously of energy and labor. The area devoted to the purposes of the Exposition far exceeded that of the year 1889, traces of which remain, in the magnificent Eiffel Tower and other structures; while portions of the park of Vincennes, lying outside the city, were utilized as annexes for the display of the more cumbrous exhibits. Abundant were the facilities for transportation about the grounds, and in some cases ingenious the devices for saving the visitor from undue weariness. But it was in the exhibits themselves, which represented the industry, the invention, or the art taste of the world of to-day, that Paris had most reason to be proud of her great show, whatever illusion her rulers were under as to the effect of the Exposition in promoting peace and good will among the nations. The United States contributed to a marvellous extent to the display and made a most impressive and unique exhibit. Germany, Belgium, Italy, Russia, and Austria, as well as England and her colonies, were also attractively represented, as were China and Japan, and some of the more interesting of Oriental nations. In its educational aspects, and as a means of keenly whetting the intelligent interest and curiosity of visitors in regard to the industrial activities of the age, the Exposition could hardly fail to be of immense advantage, apart from what was claimed for it in abolishing discord among the nations and heralding an era of peace.

The chief commissioner of the 1900 exhibition was M. Alfred Picard, a notable engineer, to whom Paris was greatly indebted for the successful planning and management of the colossal affair, aided by a group of clever artists, contractors, manufacturers, engineers, architects, and other skilled craftsmen. The financial director, acting in unison with the French government and with the Corporation of Paris, was M. Grison; while M. Bonvard was the director of the architectural department, which perhaps more than any other deservedly won praise for the magnificence of the palaces, memorial halls, and pavilions, which housed the exhibits and gave an air of wonderland to the scene. Very remarkable and impressive were the architectural beauties of the Exposition and its grounds. The chief features of note, besides the new Alexander III bridge, and the magnificent vistas of the Champ de Mars, and the Esplanade des Invalides, were the Grand Palace and the "Petit" Palace of Fine Arts, one facing the Avenue Nicholas II, the other forming a continuation of the Alexander III bridge. Finely decorative was the main entrance on the Place de la Concorde, as was the National (Foreign) Pavilions on the Quai D'Orsay, the Palace of the Esplanade, and the Palace of Diverse Industries. Imposing also was the United States Building, on the Quai D'Orsay, which covered nearly 10,000 feet of area, and housed a display of American industry and art worthy of the dignity and high position of the nation. Much of the success of the American exhibit, it ought to be said, was due to the U. S. Commissioner-General, Mr. Ferdinand W. Peck, and his assistant, Mr. B. D. Woodward, aided by the services of Mr. Fred Brackett, the U. S. Secretary and disbursing agent. Highly to be commended also were the skill, enterprise, taste, and patriotism of the array of American exhibitors, including, besides manufacturers, machinists, and inventors, many sculptors, artists, scientists, and artistic craftsmen, whose splendid exhibits did honor to the nation. Other foreign countries also made a large and fine showing at the Exposition, notably Germany, Russia, Austria-

Hungary, Italy, Belgium, Spain, and Switzerland. Great Britain was not prominent in her displays, though her Indian Empire and her colonies, Canada, and Australia, were well represented.

A high compliment was paid the United States in the extent of area afforded by the French authorities to the exhibits of the nation. The location was in almost all instances also favorable. This was particularly noticeable in the prominent positions assigned to the magnificent American exhibits in sculpture as well as in painting. Of the work of our sculptors that was thus honored, the following may be mentioned: Mr St. Gauden's fine equestrian statue of General Sherman; Mr F. MacMonnies' two groups of rearing horses designed for the Memorial Arch in Brooklyn, N. Y.; Mr. St. Gauden's Shaw Memorial, representing "a young officer on horseback among his troops, who press forward to battle, unconscious of the Angel of Death hovering overhead, with her wreath of glory for the brave young hero." The other notable exhibits in sculpture include Mr. Phinnister Proctor's pair of American pumas, "the lions of the Rockies"; Mr. Cyrus E. Dallin's Indian Medicine Man on Indian pony; Mr. MacMonnies' statue of Sir Henry Vane; Mr. G. G. Bernard's God Pan; Mr. Daniel Frenchs' equestrian statue of General Washington; Mr. Rondebush's Wrestlers; and Mr. Paul Bartlett's statue of Michael Angelo, designed for the Congressional Library in Washington.

The position allotted to the United States section of painting was also highly complimentary to our American artists. Among the prominent exhibitors in this department were John S. Sargent, J. MacNeil Whistler, Abbott H. Thayer, G. De Forest Brush, Gari Melchers, Edwin A. Abbey, John W. Alexander, Kenyon Cox, Homer Martin, George Inness, Winslow Homer, Henry B. Snell, William Chase, and Cecilia Beaux. The high appreciation of the achievement of these representative artists was shown practically in the large number of high awards conferred upon their work. G. M. A.

PARIS, a town and the capital of Bear Lake County, extreme southeastern Idaho, near Bear Lake, and ten miles from Montpelier, the nearest railroad station, on the Union Pacific railroad. It is the center of an agricultural, dairying and stock-raising district. Considerable lumber is also obtained in the vicinity. Pop. 1890, 893; 1900, 906.

PARIS, a city and the seat of Edgar County, Illinois, in the center of the eastern border of the state. It is 105 miles east of Springfield, 170 miles south of Chicago, and 18 miles northwest of Terre Haute, Indiana, and is reached by the Cleveland, Cincinnati, Chicago and St. Louis and the Terre Haute and Peoria railroads. It is an agricultural center, an important railroad junction, and the seat of railroad car shops, machine shops, foundries, and numerous other industries tributary to the natural resources of the region. Its population in 1900 was 6,105.

W. F. J.

PARIS, a city and the capital of Bourbon County, northeastern-central Kentucky, on Stoner Creek, 19 miles N. E. of Lexington and 80 miles S. E. of Covington, and on the Kentucky Midland and the Louisville and Nashville railroads. It contains a military institute, has trade in live-stock, whiskey, tobacco, flour and cordage. Pop. 1900, 4,603.

PARIS, a post town and the capital of Oxford County, western Maine, about 50 miles N. E. of Portland, on the Penobscot River, and on the Grand Trunk railroad. It contains the villages of Paris and South Paris, the former has an academy and the latter a cheese factory, foundry, saw and grist mills, and the Oxford Normal Institute. Mount Mica, in the township, has an abundance and variety of minerals. Pop. 1900, 3,225.

PARIS, a town and the capital of Monroe County, Missouri, on the middle fork of Salt River, 25 miles E. of Moberly and 44 miles W. S. W. of Hannibal, on the Missouri, Kansas and Texas railway. It is an agricultural, trade and manufacturing center. Pop. 1900, 397.

PARIS, a town and port of entry of Brant County, southwestern Ontario, Canada, 29 miles W. of Hamilton, on the navigable Grand River, and on the Grand Trunk railroad. It has excellent water-power, which runs woolen, flour, saw and planing mills. In the vicinity extensive gypsum-beds are found. Population 1901, 3,229.

PARIS, a city and the capital of Henry County, northwestern Tennessee, 70 miles W. of Clarksville and 131 miles N. E. of Memphis, on the Louisville and Nashville and the Paducah, Tennessee and Alabama railroads. It has a lucrative trade in tobacco and cotton, contains several factories and mills, and an academy. Pop. 1900, 2,018.

PARIS, a city and the capital of Lamar County, northeastern Texas, 98 miles N. E. of Dallas, and 90 miles W. of Texarkana, on the Gulf, Colorado and Santa Fé, St. Louis and San Francisco and Texas Pacific railroads. It is the trade center and shipping-point of a region producing cotton, grain, fruit and live-stock; has cottonseed-oil, flour, saw and pianing mills, cotton-gins and compresses, large fruit cannery, foundries, artificial ice factory, machine-shops, manufactories of furniture, plows and wagons, and other industries. The city is well supplied with banks, schools and newspapers, and is the seat of the North Texan University. Population 1890, 8,254; 1900, 9,358.

PARIS, a genus of plants of the family *Liliaceæ*, of which one species, *P. quadrifolia*, called herb-paris, is common in moist, shady woods in some localities. It is rarely more than a foot high, with one whorl of generally four leaves and a solitary flower on the top of the stem, f llowed by a berry. The berry is reputed narcotic and poisonous, but its juice has been employed to cure inflammation of the eyes. The root has been used as an emetic.

PARIS, Alexis Paulin, a French historian and philologist; born in Avenay, Marne, March 25, 1800. He was educated at the Collège Rollin and then began the study of law, but soon devoted his entire attention to French history. At the age of 28 he was appointed to an important post in the national library and in 1837 was

made a member of the Academy. He was appointed professor of French literature and language in the Collège de France in 1853, retiring in 1872 to be succeeded by his son Gaston Bruno Paulin Paris (q.v.). He later translated Byron's poems and Moore's *Memoirs of Byron* into French. His principal work was his history of France, published in 1838 in six volumes. He also wrote various other works on French literature and history. He died in Paris, February 13, 1881. W.M.C.

PARIS, Gaston Bruno Paulin, a French philologist; son of Alexis P. Paris (q.v.); born in Avenay, Marne, August 9, 1839. He was graduated from the Collège Rollin and studied in Germany. He lectured on the mediæval language and literature of France at the Collège de France, and in 1872 succeeded his father as professor there. In 1895 he was made a director in the college, and in 1896 he was elected to the French Academy, taking the seat made vacant by the death of Dumas. Having been a pupil at Bonn of Professor Diez, he did much to continue the study of Roman philology which the former had practically founded. His published works include *A Poetical History of Charlemagne* (1866); *Poetry of the Middle Ages* (1885); *French Mediæval Literature* (1888), and several works on philology and French literature. He died in Cannes, France, March 6, 1903. W.M.C.

PARIS, Louis Philippe Albert d'Orléans, Count of, son of the Duke of Orléans and grandson of King Louis Philippe; was born in Paris on August 24, 1838, and was taken to England with the rest of the family at theRevolution of 1848. He received a thorough English education, paying attention to military affairs, and then came to America with his brother, the Duke of Chartres, and served on the staff of General McClellan in the Civil War. Down to 1885 he was the Orleanist pretender to the throne of France and the rival of the Count of Chambord, who was the Legitimist pretender, but after Chambord's death in 1885 the Count of Paris became the royalist candidate of both factions. In 1886 he, with the other royalist and imperialist princes, was expelled from France, and went to England again, where the rest of his life was chiefly spent. He was a man of fine character and ability, and was the author of two standard works, *The Trade Unions of England* (6 vols., 1869) and *A History of the Civil War in America* (7 vols., 1874–89). He married in 1864 a daughter of the Duke of Montpensier, who bore him six children. He died in England on September 8, 1894. His eldest son, Louis Philippe Robert, Duke of Orléans, who was born on February 6, 1869, succeeded him in the dubious honor of the royalist pretendership, but has not proved formidable. In 1890 he defied the law of exile and re-entered France in theatrical fashion, to serve in the army, but was merely locked up for a time for his pains, after which he settled at Brussels. W.F.J.

COMTE DE PARIS.

PARIS, Declaration of. See Declaration of Paris, Vol. VII, pp. 20, 21.

PARIS, Matthew of. See Matthew of Paris, Vol. XV, pp. 640, 641.

PARIS, Treaties of. The treaty of 1763, otherwise known as the *Peace of Paris*, was of great consequence to the people of the American continent, in that all the French possessions in North America east of the Louisiana territory were ceded to Great Britain. (See France, IX, 520.)

The treaty of 1814, which has been designated the *First Peace of Paris*, was so called because a second pacification became necessary after Napoleon's return from Elba and his one hundred days of empire. It followed after the overwhelming victory of the allied Prussians, Russians and Austrians over Napoleon at Leipsic, Oct. 16 to 19, 1813. It reduced the dimensions of France to what they were prior to 1792, and provided for the *Congress of Vienna*. (See Congress, VI, 239.)

The treaty of 1815, called the *Second Peace of Paris*, was between France and the allies after Napoleon's final overthrow at Waterloo. It further reduced the territorial limits of France, and provided that a foreign army should occupy French territory at the expense of France.

The treaty of 1856 is treated at length under the title Declaration of Paris (VII, 20.) The attitude of the United States relative to this treaty should, however, be more fully stated, having in 1856, declined to become a party to the declaration, on the ground that inadequate provision was made for the security from capture of private property at sea. That government contended that a neutral flag should cover free goods — that is, that a neutral vessel should not be searched even for contraband of war. In 1861 Secretary of State William H. Seward declared to Great Britain that the United States would abide by the Declaration of Paris, provided that goods of non-combatants were secured from confiscation during maritime war. Earl Russell thereupon made the additional stipulation that such an agreement should have no "bearing, direct or indirect, on the internal differences now prevailing in the United States."

This was a plain statement that England would accord whatever belligerent rights to the Confederacy that she might choose to do, and Mr. Seward terminated the negotiations. He had previously taken the stand that the Confederates were insurgents, and that until they had shown their capacity to maintain their independence it would be a violation of international courtesy for a foreign state to give them recognition. Not only had he declined all offers from the European nations to arbitrate our internal differences, but he had insisted that the only proper resort was for representatives of the Northern and Southern states to settle their disputes in the halls of Congress.

On Nov. 8, 1861, Captain Wilkes took four Confederate commissioners from the deck of an English steamer, and brought them to Fort Warren, in Boston harbor. This was known as the *Trent* Affair. Secretary Seward claimed that the government did not authorize this act, but declared that the existing condition of international law was such that Captain Wilkes should have brought the *Trent* as a prize before an admiralty court. He concluded, however, that, should the British government demand the prisoners, he would consent to a liberal United States interpretation of neutral maritime rights, and relinquish the prisoners, inasmuch as the United States had resisted the right of search since prior to the War of 1812. Yet this concession does not have the force of a treaty, and the United States is not bound to observe any of the terms of the Declaration of Paris, nor are foreign states bound to observe them toward her in case of war between them.

PARIS BASIN, in geology, the area in which the Cainozoic systems of France are best developed.

PARIS GREEN, a cupric aceto-arsenite powder, called also mitis-green, emerald-green, imperial-green, French green, Vienna green, Schweinfurth green, and sometimes Scheele's green, from which it differs in that it contains acetic acid. As a pigment it is fairly permanent, somewhat lacking in body, and is sparingly employed by artists and decorators for the production of a vivid light green color. As an insecticide it is very poisonous, and is extensively used in the extermination of the cotton-worm, the potato-bug and other noxious insects.

PARK, Edwards Amasa, an American theologian; born in Providence, Rhode Island, December 29, 1808. He was graduated from Brown University in 1826 and from Andover Theological Seminary in 1831. He was then ordained pastor of the Congregationalist Church in Braintree, Massachusetts, and in 1835 accepted the chair of moral and intellectual philosophy at Amherst. In 1836 he was appointed professor of moral and intellectual philosophy at Andover and from 1847 to 1881 held the chair of sacred rhetoric in that institution. He then occupied the chair of theology until his death. He died in Andover, Massachusetts, June 4, 1900. W.M.C.

PARK, Roswell, an American physician and surgeon; born in Pomfret, Connecticut, May 4, 1852. He first studied at Racine College and then at Harvard, and in 1876 graduated from the medical department of the Northwestern University in Chicago. From 1879 to 1882 he was adjunct professor of anatomy there. In 1883 he was appointed professor of surgery at the University of Buffalo, and surgeon to the Buffalo General Hospital. He was one of the attendants upon President McKinley after the latter was shot. He has published *Lectures on Surgical Pathology* (1891); *History of Medicine* (1897), and *Text-Book of Surgery* (1896). W.M.C.

PARK CITY, a city of Summit County, Utah, about 30 miles E. of Salt Lake City, on the Utah Central and the Union Pacific railroads. It is an important silver and lead-mining town, and has quartz-mills, sampling-works and saw-mills. Pop. 1890, 2,850; 1900, 3,759.

PARKER, a city and the capital of Turner County, S. D., 23 miles S.W. of Sioux Falls on the south branch of the Vermillion River, and on the Chicago, Milwaukee and St. Paul and the Chicago and North Western rys. It is the trade center of an agricultural district. Pop. 1900, 893.

PARKER, Alton Brooks, jurist; born in Cortland, N. Y., May 14, 1852; acquired a district school education while working on his father's farm; took the course at the Cortland Academy, and then entered the newly-established State Normal School at Cortland. A chance incident in his father's family created a desire to become a lawyer, and to gain means to study at the Albany Law School he began teaching when sixteen years old, first at Virgil, in his native county, and afterward at Binghamton. With his savings he completed the Normal School course; then went to Rochester as principal of one of the public schools; and, when he had saved sufficient money, went to Albany, and was graduated at the Law School, in 1872. He settled in Kingston, entered the law office of Schoonmaker & Hardenbergh, and was admitted to the bar in 1872. About this time he became interested in the work of the Democratic party in Ulster County, with the result that in 1873 he became clerk of the board of supervisors of the county, and in 1877 was elected surrogate for a term of six years, at the expiration of which he was re-elected. Twice his friends urged his name for the nomination for lieutenant-governor, in 1882, when David B. Hill was selected, and in 1885, when the honor went to Gen. Edward J. Jones. In the latter year, at the solicitation of Mr. Hill, then the Democratic nominee for governor, Judge Parker managed the State campaign. The same year he declined the appointment of first assistant postmaster-general; and on the death of Judge Theodore R. Westbrook, of the Supreme Court of New York, in that year, Governor Hill appointed Judge Parker to fill the vacancy. Near the close of this term he was elected to succeed himself. Judge Parker served as a member of the newly-created Second Division of the Court of Appeals of New York by assignment by the governor in 1889–93, and when about returning to his judicial duties in the Supreme Court, Governor Flower designated him as a member of the General Term of the First District in New York, where he served till 1896, when the Appellate Division of the Supreme Court, created by the new constitution, went into operation. In 1891, 1901, and 1903 Judge Parker was urged to allow the use of his name in connection with the nomination for governor, but declined, as he also did when desired to become a candidate for United States Senator after the election of Mr. Hill as governor. In 1897 he was elected chief justice of the Court of Appeals of New York. For several months prior to the National Democratic Convention of 1904 it

was evident that Judge Parker was the choice of a large proportion of his party for the presidential nomination, and when the convention met it gave him the nomination on the first ballot. Immediately afterward he broke his silence as to his political views by sending to the convention a telegram containing the following words: "I regard the gold standard as firmly and irrevocably established, and shall act accordingly if the action of the convention to-day shall be ratified by the people." He was defeated in the following November election. G.J.H.

PARKER, Foxhall Alexander, an American naval officer; born in New York, Aug. 5, 1821. He entered the navy in 1839; and did service in the West Indies, in Florida, on the Lakes, on the Coast Survey, in the Mediterranean, and with the East India and Pacific squadrons. He was executive officer of the Washington navy yard, 1861–62; was commissioned commander, 1862; and commanded the naval battery at Morris Island, 1863. He was commissioned captain, 1866; commanded the Charlestown navy yard, 1869–70, and the European squadron, 1870–71. He became commodore in 1872; was chief signal officer, 1873–76, and superintendent of the Annapolis Academy, 1878–79. He died in Annapolis, June 10, 1879. E.E.T.

PARKER, Horatio Gilbert, Canadian novelist; born at Camden East, Ontario, Canada, Nov. 23, 1862; educated in Canadian and English schools, and at Trinity College, Toronto, where, for a time, he was lecturer on English literature. In 1886 he went to Australia and became associate editor of the Sydney *Evening Herald*, made a voyage about the South Seas, and wrote three dramas — an adaptation of *Faust* (1888); *The Vendetta* (1889); and *No Defence* (1889). In 1890 he settled in London, where he published *Round the Compass in Australia* (1892), and wrote for English magazines and weekly periodicals the series of short tales of Hudson Bay Company life in the Canadian Northwest, that were afterward collected in *Pierre and His People* (1892). Of his narratives were *Mrs. Falchion* (1893); *The Trespasser* (1893); *The Trail of the Sword* (1894); *A Lover's Diary* (1894); and *The Translation of a Savage* (1894), the latter being a London story. His next and more notable ventures were again in the field of a Canadian romance, *When Valmond Came to Pontiac* (1895), a story founded on the conspiracy of the great chief of the Ottawas; *An Adventurer of the North* (1895); and *The Seats of the Mighty* (1896). In these he manifests increased strength and versatility. His latest works are *The Pomp of the Lavilettes*, *The Battle of the Strong*, *The Right of Way*, *Donovan Pasha*, and *The Ladder of Swords*.

PARKER, Horatio William, an American musician and composer; born in Auburndale, Massachusetts, September 15, 1863. He graduated from the Munich Royal Conservatory in 1885. He has been organist of various churches, and in 1894 was appointed professor of the theory of music at Yale University. His compositions include the oratorio *Hora Novisima*, the first American music given at an English musical festival; *A Wanderer's Psalm*, the oratorio of *St. Christopher* and the cantatas *King Trojan* and *The Kobolds*. W.M.C.

PARKER, Joel, an American jurist and legislator; born in Monmouth County, N. J., Nov. 24, 1816. He was graduated from Princeton in 1839, and was admitted to the bar in 1842. He established a law practice in Freehold, N. J. In 1862 he was elected governor of New Jersey, and was re-elected in 1864, and again in 1870. In 1877 he was nominated for Vice-President by the National Labor party. In 1880 he was appointed associate justice of the Supreme Court of New Jersey, and was reappointed in 1887. He died in Philadelphia, Pa., Jan. 2, 1888. W.M.C.

PARKER, Joseph, an English clergyman and author; born in Hexham, April 9, 1830, and, like Spurgeon, began to preach in early youth. He was ordained pastor of the Congregational Church at Banbury, and then minister of churches in Manchester and London. He visited the United States in 1888. He published a number of works, among which are *Helps to Truth-Seekers* (1857); *Ecce Deus* (1868); and *City Temple Sermons* (1869). Died Nov. 28, 1902.

PARKER, Willard, an American surgeon; born in Hillsboro, N. H., Sept. 2, 1800. He was educated at Harvard, graduating in 1826, after which he studied medicine in Boston, receiving his degree from the Harvard Medical School in 1830. He was subsequently a professor at Berkshire Medical College, Cincinnati Medical College, and New York College of Physicians and Surgeons. He established an extensive practice in New York, taking high rank as a surgeon. He instituted the first college clinic in the United States, at the College of Physicians and Surgeons, in New York City, in 1840; organized the New York Pathological Society in 1843 and the New York Academy of Medicine in 1847. In 1865 he became president of the New York State Inebriate Asylum at Binghampton, holding the office for 20 years. He was a member of leading medical and scientific societies in the United States and Europe. He wrote many valuable treatises on surgery, including *Cystotomy* (1851); *The Nerves* (1856); and *Lectures on Cancer* (1873). He died in New York City, April 25, 1884. W.M.C.

PARKER, William Kitchen, an English naturalist and anatomist; born near Peterborough, Northamptonshire, June 23, 1823. He was educated at Charing Cross Hospital and at King's Hospital College. In 1849 he began the practice of medicine, studied botany and natural history, and was elected a fellow of the Royal Society in 1865. From 1873 to 1883 he was professor of comparative anatomy at the Royal College of Surgeons, London. Although he was deeply interested in biology, he devoted his attention chiefly to the study of comparative osteology and wrote nearly a hundred scientific papers concerning his investigations. These works include *On the Osteology and Systematic Position of Balæniceps* (1860); *The Skull of Batrachia* (1878),

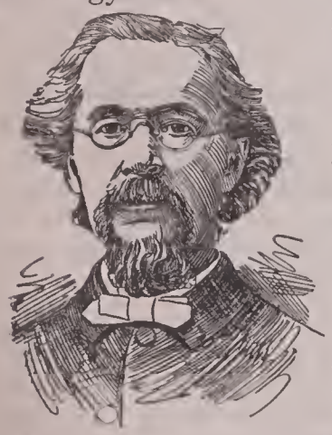
and *Insectivora* (1886). He died in Cardiff, Glamorganshire, Wales, July 3, 1890. W.M.C.

PARKERSBURG, a city of W. Va., about 95 miles below Wheeling, and 12 miles below Marietta, Ohio, on the B. & O., Southwestern and Ohio River railroad. Parkersburg contains a courthouse, 12 churches, several high schools, 4 national banks with a combined capital of over $600,000, gas-works, a fine new building erected by the United States for a post-office and court-house, 5 oil-refineries, 2 large lumber-mills, 3 iron foundries, 5 machine-shops, chemical-works, boiler-shops and barrel factories. One weekly, one semiweekly and two daily newspapers are published. The city has an extensive trade in oil (petroleum), and a large trade in lumber. Pop. 1890, 8,408; 1900, 11,703. See also PARKERSBURG, XVIII, 307.

PARKES, SIR HENRY, an Australian statesman; born in Stoneleigh, England, in May, 1815; emigrated to New South Wales in 1839, and at Sydney became eminent as a journalist, editing *The Empire* from 1849 to 1856. He was a member of the Colonial Parliament in 1854, and Prime Minister in 1872. Was several times head of the ministry, and identified with the promotion of free trade. He was the representative of New South Wales at the colonial conference in London in 1887, and in 1891 was president of the council for arranging a federal union of the Australian colonies. His most important works are *Australian Views of England* (1869); *Fifty Years of the Making of Australian History* (1893). Died in Sydney, April 26, 1896.

PARKESBURG, a borough of Chester County, Pa., 18 miles W. of Westchester and about 55 miles S. E. of Harrisburg, on the Pennsylvania railroad. Pop. 1890, 1,514; 1900, 1,788.

PARKHURST, CHARLES HENRY, an American clergyman and sociologist; born in Framingham, Mass., April 17, 1842. He was graduated from Amherst College in 1866, went abroad two years later and studied theology at Halle and Leipsic. He taught in the Williston Seminary from 1870 to 1873, and from 1874 to 1880 was pastor of the Congregational Church at Lenox, Mass. In 1880 he became pastor of the Madison Square Presbyterian Church, New York City, where for twenty-five years he has held a leading position among New York clergymen. In 1885 he commenced his work as a social reformer and became president of the Society for Prevention of Crime. His personal study of crime in New York led to the famous Lexow Investigation of the charge that the police were in league with metropolitan criminals. He entered into active participation in local politics and was one of the factors which defeated Tammany Hall in 1894. The following year he organized the City Vigilance League of which he has been president. In Presbyterian theology Dr. Parkhurst has been an advocate of revising the confession of faith and was a leading champion of Dr. Briggs at his trial for heresy. His books include: *The Blind Man's Creed* (1883); *The Pattern on the Mount* (1885); *Three Gates on a Side* (1891); *What Would the World Be without Religion?* (1894); *The Swiss Guide* (1894); *Our Fight with Tammany* (1895); *The Sunny Side of Christianity* (1896); *Talks to Young Men* (1897); *Talks to Young Women* (1897); and *Guarding the Cross with Krupp Guns* (1900). W.M.C.



DR. C. H. PARKHURST.

PARKMAN, FRANCIS, an American historian; born Sept. 16, 1823, in Boston, Massachusetts. He entered Harvard University in his seventeenth year, and before graduating in 1844, conceived the idea of writing a history of the French and Indian War. This scheme, despite delicate health and a serious affection of the eyes, he lived to work out, though it embraced much more than a brilliant narrative of that struggle. It included, also, a series of vivid pictures of the early Jesuit missions in North America, sketches of the pioneers of France in the New World, and of the founding of the ill-fated French colony on the St. Lawrence, and a graphic portrayal of the incidents of Mr. Parkman's own sojourn among trans-Missouri Indians before the advent of railways. After leaving Harvard, Parkman read law for two years, then sought recreation in the far West among the Indians, whom he described with much minute and interesting detail in *The Oregon Trail* (1847); after which he produced, in 1851, *The Conspiracy of Pontiac*, the first in publication but the last in chronological matter of the series of narratives dealing with the long struggle for mastery on this continent. In 1865 appeared *The Pioneers of France in the New World*, in 1867 *The Jesuits in North America*, and in 1869 *La Salle and the Discovery of the Great West*. *The Old Régime in Canada* was published in 1874, *Count Frontenac and New France under Louis XIV* in 1877, and, leaping over, for the time being, the intervening history embraced in the two volumes entitled *A Half-Century of Conflict* (1892), there appeared *Montcalm and Wolfe* (2 vols., 1884), the culminating work of the series reciting the momentous events in the deadly struggle between France and England for dominion in the New World. He died in Jamaica Plain, near Boston, Nov. 11, 1893.

FRANCIS PARKMAN.

PARKS, NATIONAL, a term used in the United States to designate territory which has been reserved by act of Congress and exempted from sale by reason of picturesque natural features. Four tracts of land have thus been appropriated

—the Yellowstone region in Wyoming, the Yosemite Valley, the Sequoia or Big Tree Grove, and General Grant Park in California. (For a full description of the first named, see YELLOWSTONE NATIONAL PARK, in these Supplements. For a description of the features and scenery of YOSEMITE PARK, see CALIFORNIA, Vol. IV, pp. 618, 619.) The lands embraced within this latter park were granted by the government to the state of California in 1864, to be "held for public use, resort and recreation." In 1890 a bill was passed in Congress, creating a national park about this territory which the state was holding in trust. Its area is about 40 miles square; it is under the administration of the Secretary of the Interior, and a detachment of U. S. troops is maintained there for patrol duty, to ward off stock-raisers and other trespassers, and to guard against fires.

The SEQUOIA and GENERAL GRANT parks, situated to the south and west of the Yosemite, are tracts of much smaller extent, and were created national parks in 1891, for the purpose of preserving the magnificent growths of *Sequoia*, or redwood trees. They also are patrolled by U. S. troops, under the direction of the Interior Department.

PARKS, NATIONAL MILITARY.— *Gettysburg*. Much work had already been done to preserve this historic battlefield by the Gettysburg Battlefield Memorial Association, but upon the passage of the bill, passed by Congress in 1895, the entire work passed into the hands of the government. It directed the Secretary of War to receive from the Memorial Association deeds of the various tracts, embracing about 800 acres. The work was in charge of commissioners, to lay out roads, and mark out the several lines of battle for all the troops engaged. The bill also provided that adjacent lands occupied by the several divisions on July 1, 2, and 3, 1863, should be acquired by condemnation or purchase. The bill appropriated $75,000 for purposes of improvement, and $5,000 for a bronze tablet, upon which was inscribed the historic address of President Lincoln, Nov. 19, 1863, on the occasion of the dedication of the national cemetery at that place. The various states whose troops were in this engagement, aided by contributions from veterans' associations and other sources, placed numerous fine monuments about the field.

Chickamauga and *Chattanooga*. This park embraces the entire battlefield of Chickamauga and its approaches, inscribing an area of about 15 square miles. The government also acquired title, among other purchases, to Bragg's headquarters on Missionary Ridge, and to Orchard Knob, the headquarters of Grant, Thomas and Granger. The approaches round about Chickamauga, over which the armies reached and left the field, as well as the roads within the park, were substantially rebuilt by the government. The roads about Chattanooga follow the lines of battle. Over Lookout Mountain the route includes the battlefield of Hooker, and near Walthall's, while along Missionary Ridge the crest road follows Bragg's line of battle, in front of Thomas's and Sherman's divisions. The result is a magnificent boulevard, with such charms of bold mountain view, including city, valley and river, which together, with the historic associations, render this drive one with scarcely a parallel. The dedication ceremonies of this national military park were held on Sept. 18–20, 1895, the 32d anniversary of the battle of Chickamauga, and were presided over by Vice-President Stevenson. Federal and Confederate generals were present, besides governors, Representatives and Senators from many states.

Shiloh. In 1895 Congress passed a bill which provided for the establishment of a similar park at the field of Shiloh, in Tennessee, embracing an area of about 3,000 acres, together with an appropriation of $150,000 to carry out the work.

PARKS, NATURAL, OF THE ROCKY MOUNTAINS. These parks constitute one of the interesting features of the state of Colorado. (For a brief and partial description of them, see COLORADO, Vol. VI, pp. 145–147.) The four principal ones within this state bear the names of North Park, Middle Park, Estes Park and South Park. They are not small areas of ground, but great territories, which contain fields and forests, with great stretches of plains on which have roamed immense herds of buffalo or cattle.

North Park, situated in the extreme northern part of the state, covers a part of Routt and Larimer counties. It embraces an area of about 2,500 square miles, and is traversed by the North Fork of the Platte River. It is about sixty miles long and forty miles wide, with an altitude of 9,000 feet above ocean-level. The ranges of the Rockies which environ it rise nearly 5,000 feet higher. The park is, in its general features, an irregular plateau or basin, having a surface with gently rolling hills, and long level bottoms, and valleys clothed with luxuriant grasses and flowers. The hills are covered with timber.

Middle Park, located in Grand County, embraces an area of about 3,000 square miles, and has an altitude of 9,000 feet. Like North Park, it is environed by mountains. Its streams are tributary to Grand River. It contains Grand Lake, on the shore of which is the town of Grand Lake, the county seat of Grand County. About ten miles from Grand Lake is Hot Sulphur Springs, recognized as an attractive spot for invalids and other visitors. The springs are six in number, the waters from which unite in a common stream and flow over rocks into a natural basin. The resorts of Middle Park are fast growing in popularity.

Estes Park is located at the foot of Long Peak, about sixty miles from Denver, and is one of the most beautiful resorts of Colorado. It is about six miles long and four miles wide, with an average height of 7,000 feet. The general contour is much like that of its sister parks, abounding in gentle slopes, dark pines and beautiful winding trails leading from open glades of the valley up dark cañons. Its clear brooks unite to form a considerable stream named Big Thompson's Creek. The road to the park is difficult of ascent,

but is largely traveled by tourists because of the numerous attractions by the way, and by the still greater attraction to be found in the park itself.

South Park, the chief of the park system of Colorado, lies to the south and east of Middle Park, and is isolated from it by a great snowy mountain range. It is fifty miles in length and about ten miles in breadth. Its northern extremity begins about seventy-five miles southwest from Denver, and is reached by the Denver and South Park railway. The maximum elevation is about 10,000 feet and the average elevation about 9,000 feet. Its streams are the tributaries of the South Platte River. Its soil is unexcelled in richness, with easy facilities for irrigation, and the numerous grassy plains are readily converted into luxuriant fields of grain. The park is bounded on the east by a heavily timbered range 2,000 feet above the valley, while to the west are the snowy summits of "the Rockies." The South Park Mineral Springs, and Hartzell's Hot Sulphur Springs are in the southern portion of the park, and give promise of becoming points of great interest to invalids.

San Luis Park, Colorado, lying south of South Park, embraces an area of about 9,400 square miles, or about three times the area of Yellowstone Park. The beautiful San Luis Lake is a principal object of interest, and there are numerous thermal springs possessing medical properties. This park has nowhere an altitude of more than 7,000 feet, and the climate is exceedingly mild and genial.

PARKVILLE, a city of Platte County, northwestern Missouri, 10 miles N.W. of Kansas City, on the Missouri River, 22 miles below Leavenworth, Kansas, and on the Kansas City, St. Joseph and Council Bluffs railroad. It is in a district containing coal, building-stone and brick-clay, and yielding corn, small grains, dairy products, hemp and wool. The city has saw-mills, brickyards and machine-shops. It is the seat of Park College (Presbyterian), a co-educational institution established in 1875, and which, in 1904, had 24 instructors, 405 students and a library of 15,000 volumes. Population, 1890, 769; 1900, 931.

PARLEMENT, the name applied, in France, down to the Revolution, to certain superior and final courts of judicature, in which, also, the edicts of the king were registered before they became laws. Of these the chief was that of Paris, but there were no fewer than twelve provincial parlements. These, though not actually connected with that of Paris, invariably made common cause with it in its struggles with the royal power. The Parlement of Paris dated from the fourteenth century. Its influence grew during the sixteenth century, and it began to find courage to deliberate on the royal edicts, as well as merely register them, which the King could always force them to do by coming in person and holding a *lit de justice*. Louis XV exiled the members from Paris in 1753 for their interference in the struggle between the Jansenists and the Jesuits, and in 1770 abolished the old Parlement altogether and established the Parlement Maupeou. Louis XVI, however, recalled the former councillors.

PARLEY, PETER See GOODRICH, SAMUEL G., Vol. X, p. 689.

PARLIAMENTARY LAW, the name of that body of rules or usages commonly observed in deliberative assemblies. These usages are sufficiently understood to be put in practice whenever men gather together for conference and the expression of a common judgment. In the main, they followed the principles or order observed by legislative bodies, and hence the name "parliamentary law."

All deliberative bodies that have continued existence adopt their own rules of proceeding, and these supersede any other methods of doing business. Yet there is a substantial accord in all adopted systems of deliberative order, for they all rest upon precedents found to be fair and convenient. Thus a lodge, the political conventions of a party, each state legislature and Congress have each its own body of rules (see CONGRESS, in these Supplements), and yet through them all may be traced the same general usage.

The following statements exhibit the rules that will be observed in transacting the business of any assembly which has not adopted rules of its own. They are:

Organization. When a number of persons has been called together for conference, on their meeting some individual prominently responsible for the summons, will call the assembly to order and ask for the nomination of a presiding officer or chairman. If several names are proposed, and the proposal seconded, the wish of the meeting is taken, in the order of making the nominations, until a majority of voices are given for one person. This person goes forward and takes the chair, and upon him devolves the enforcement of the rules of order. Usually he does not vote on any matter pending before the assembly, though he may ask to be counted with the others in voting, and his right must be respected. He has no tie vote, for a motion is lost that does not have a majority of voices or votes in its favor. The chairman first asks the meeting to choose a secretary, and he is selected in the same manner as the chairman.

With the selection of a secretary the essential organization is complete. It is the duty of the secretary to keep a record of all proceedings, to see that all resolutions are reduced to writing, if so requested, and to read all resolutions, papers or communications for the information of the meeting, as directed by the chairman.

After the chairman has declared the assembly open for business, motions are in order. A *motion* is a formally worded proposition presented to the assembly for its consideration. The member offering it says: "I move," etc. The resolution which he offers commences: "Resolved," etc. The questions are decided by vote. A majority vote decides the question.

In putting a question the chairman says: "The question is on the adoption of the motion (or

resolution, or amendment) which you have just heard. As many of you as are in favor of its adoption will say Aye." When the ayes have voted he will say: "As many as are opposed will say No." After voting is over, the chairman announces the result. Since he has to judge from the number of voices heard, the vote by voice is only approximate. Holding up the hands and counting the uplifted ones is more reliable. When the chair is in doubt as to his estimate of a vote by voice, he asks the members to rise and stand still until counted. This count decides how many votes there are for and how many against the question. If a member doubts the correctness of the chairman's estimate or a vote by voice he will rise and say: "Mr. President, I call for a division of the house." Upon this the chairman says: "A division is called for. Those in favor of the motion will rise and stand until counted." In a similar way he will take the opposing votes. In taking a division of the house, the standing members may be counted by the chairman, or the clerk, or by one or more members appointed by the chair.

Another method of dividing the house, common in the British House of Commons and in Congress, is to have those favoring a proposition pass between two tellers and be counted, and then in the same way take the negative vote.

Again, in representative bodies, a vote may be taken by making each member answer when his name is called and having his vote recorded. In Congress this mode of voting must be resorted to when the demand for it is sustained by one fifth of the members present. Voting by ballot is usually required in the election of officers, in the admission of new members, and also when secrecy is desired. In the admission of members, white and black balls, or slips of paper, are often employed.

Motions, and their Treatment. After a motion has been presented, other motions bearing upon the same subject are in order. The first motion is then called the "main" question, the subsequent ones are subsidiary or secondary. The most common of the subsidiary motions is that to amend the main one. The mover offers an amendment. Then others may move to amend the amendment, but no further amendment can be offered until the second one is disposed of. The vote on the amendment to the amendment must first be taken. If adopted, the question arises on allowing the amended amendment to modify the main question. If this prevails, then a vote must be taken on adopting the main question as amended. If all amendments are rejected, a vote is taken on the resolution as originally offered.

If a motion to *postpone to a certain day* is moved and carried, when the day has come the subject is entitled to be taken up in preference to everything else except privileged questions. If a motion to *postpone indefinitely* is made and carried, the question is killed, and to bring the subject up again would require new proceedings from the beginning, at some later time.

A motion to *refer* or *commit*, if adopted, takes the question from the meeting and transfers it to the consideration of a committee. A motion to *recommit* takes a subject already reported by a committee back to the same committee. All the above-mentioned motions are debatable.

A motion to *lay on the table* is not debatable. If adopted, it removes the question from consideration until the assembly votes to take it up. This can be done at any time by a majority vote. The motion to lay on the table carries the main question and all amendments with it.

The *previous question* is a method of cutting off debate. It is undebatable. It is equivalent to the question, Shall the discussion now cease? A member rises and says: "I move the previous question." Then the chairman puts the question before the house by saying: "Shall the main question be now put?" If the previous question is carried, the debate on a pending amendment, or both amendment and the main question, is stopped.

Incidental Questions. There is a class of questions which are called incidental. These include,— 1. Questions of order; 2. Objections to the consideration of a question; 3. Reading of papers; 4. Withdrawal of a motion; and 5. Suspension of the rules.

If anything in the procedure is against parliamentary law or the rules of the house, and a member, rising, addresses the house thus: "I rise to a point of order," the chairman will interrupt the proceedings and say: "The member will state his point of order." The member then will state his point, and the chairman thereupon will decide whether the point is, or is not, well taken. If, now, any member is dissatisfied with the decision of the chair, he takes "an appeal to the house." The question then is: "Shall the decision of the chair stand as the judgment of the assembly?" An appeal to the house is debatable, except when the previous question was pending at the time when the point of order was raised. To sustain the chair does not require more than a majority vote. Even a tie vote sustains his decision.

Privileged Questions. Some questions may be introduced at almost any time, and must be considered before any other subject that may be before the house. These privileged questions are: 1. To adjourn; 2. To fix the date to which the body shall adjourn; 3. Questions of privilege; 4. A call for the order of the day.

A motion to adjourn is nearly always in order. The exceptions are these: If a motion to adjourn has just been lost, it cannot be repeated until there has been some business done or some progress in the debate made since the motion had been lost. Neither can the motion to adjourn be made while a member has the floor. But the member may give way in order that the motion may be presented. A motion to adjourn cannot be received while the yeas and nays are being called, or while the members are voting on any question, or when the previous question has

been called and sustained and is still pending. The motion to adjourn cannot be debated or amended. It supersedes all other motions except the one to fix the date to which to adjourn. The motion to fix the time to which the adjournment will stand, when the meeting does adjourn, takes precedence of all other questions. It may be made after the meeting has voted to adjourn, as long as the chairman has not announced the result of the vote. It may be amended by changing the date of reassembling.

The general rule as to the rank of questions is that of the United States House of Representatives, which is as follows: "When a question is under debate no motion shall be received but to fix the day to which the house shall adjourn, to adjourn, to take a recess, to lay on the table, for the previous question . . . to postpone to a certain day, to refer or amend, or to postpone indefinitely, which several motions shall have precedence in the foregoing order."

A motion to *reconsider*, if carried, brings back before the house a question that has been decided, and places it again before the house just as it stood before the vote was taken upon it; but, as the rule of the United States House of Representatives puts it, "the fact of a question having been decided under the operation of the previous question does not prevent debate on the motion to reconsider if the original question was otherwise debatable." The motion to reconsider may be applied to votes on all questions excepting on motions to adjourn, to suspend the rules, affirmative votes on motions to lay on the table or take from the table, on matters which have passed from the possession of the house, and on the previous question when it has been partly executed. It may be made when other business is before the house.

Duties of the Chairman. The chairman must recognize the member who rises first and addresses him first. No member can be deprived of his rights by the chair, as long as he is in order. But there is this exception: When the member, upon whose motion the subject on hand has been brought before the house, has not spoken on the question and asks to be heard, the chairman is bound to give him the first chance to speak. During the debate the chairman has no right to cut it off before all the members who have asked for the floor have had their chances. When a vote has been taken and the result announced, if it appears that a member had risen and addressed the chair at the proper time, but was not recognized, even then his right to speak must be conceded, and the question voted upon will stand as though no vote had been taken.

Most legislatures have rules of order substantially like those of the House of Representatives in Congress. Two excellent manuals of parliamentary law are *Roberts's Rules of Order* (1893) and *Reed's Parliamentary Rules* (1894). See also PARLIAMENTARY PROCEDURE, Vol. XVIII, p. 317.

PARMA, ALEXANDER FARNESE. See FARNESE, Vol. IX, pp. 34, 35.

PARMA, DUKES OF. See PARMA, Vol. XVIII p. 319.

PARNAHYBA OR PARANAHYBA RIVER. See BRAZIL, Vol. IV, p. 199. For the town, see PARNAHYBA, Vol. XVIII, p. 262.

PARNASSIENS, a group of French poets of the second empire, so designated from the title of the volume *Parnasse Contemporain*, which comprised their first poems, collected in 1866. These poems are characterized by a cultivation of metrical form before all else, and the rejection of emotion as a poetic stimulus in favor of that which is spectacular or which appeals to the senses.

PARNELL, CHARLES STEWART, reformer; born in Avondale, Ireland, in June, 1846; was educated at Cambridge University. In 1874 he was elected to succeed his father as high sheriff of Meath, and in 1875 was a successful candidate for the House of Commons, where very little attention was paid to him at first except that he was recognized as a follower of Mr. Butt, the exponent of Home Rule for Ireland. During the first session of the House he carefully studied everything that was said and done. In the second session he began to comment on matters of small importance. Thus he trained himself and finally drifted to the topics uppermost in his mind, Home Rule in Ireland. At first he was treated with contempt, then jeered and hooted at; but he was determined to be heard. Finally his opponents, seeing they could not subdue him by noise, allowed him to speak. After the death of Mr. Butt he became the leader of the Irish party in the House of Commons. When he was chosen leader of his party, it was composed of only four members, but at the end of seven years it had increased to eighty. In 1879 he visited the United States and was listened to by great throngs. The result of this visit was the organization of many branches of the Irish Land League, and a great amount of money was raised to forward the cause. In 1881 Gladstone introduced his Coercion Bill against Ireland, which, after a stormy scene, was passed. In 1885, when, under Parnell, eighty members were elected to Parliament, Gladstone changed his views, and on April 8, 1886, introduced the celebrated bill under which Ireland was to have a government of its own. This bill was defeated by a margin of only thirty votes. At this juncture Parliament was dissolved and an appeal taken to the country. The result of the election, as shown when Parliament assembled, was 277 members for Home Rule, and 392 against it. Mr. Gladstone and Parnell were now firm friends. The cause of the latter was gaining steadily, but all his work of years

CHARLES STEWART PARNELL.

was defeated, when Captain O'Shea secured a divorce from his wife whom he accused of undue intimacy with the Irish leader, to whom Mrs. O'Shea was afterward married. After this the cause of Home Rule rapidly declined, Parnell becoming very bitter toward his former friend and benefactor, Mr. Gladstone. Mr. Parnell died in Brighton, England, October 6, 1891. G.J.H.

PARNELL, HENRY BROOK. See CONGLETON, Vol. VI, p. 235.

PARNELL INQUIRY. See HOME RULE, in these Supplements.

PARNELLITES AND ANTI-PARNELLITES. See HOME RULE, in these Supplements.

PAROL, a term used in American law to describe verbal contracts, and written contracts not under seal. All contracts, whether in writing or verbal, are called parol contracts unless they are under seal. Sealed instruments are generally called specialties. Under the old common law the pleadings in a suit were sometimes referred to as the parol. Parol evidence is that which is given in open court verbally.

PAROLE, the declaration made by a person in which there is no more than his sense of honor to restrain him from breaking his word Thus a prisoner of war may be released from actual prison on his parole that he will not go beyond certain designated limits, or he may even be allowed to return to his own country on his parole not to fight again, during the existing war, against his captors. To break parole is accounted infamous in all civilized nations, and an officer or soldier who has done so forfeits any claim to be treated as an honorable man, nor can he expect quarter should he again fall into the hands of the enemy.

PAROPAMISAN MOUNTAINS. See ASIA, Vol. II, p. 599.

PAROTID GLAND. See DIGESTIVE ORGANS, Vol. VII, p. 193.

PAROWAN, a city and the capital of Iron Co., Utah, about 220 miles S.S.W. of Salt Lake City, on Center Creek. It is situated in an agricultural region said to contain coal, iron and silver. The city has tanneries, saw-mills and a flour-mill. Pop. precinct, 1900, 1,039.

PARR, KATHARINE, a tutor to Queen Elizabeth and last wife of Henry VIII. See ENGLAND, Vol. VIII, p. 302; also CATHERINE PARR, Vol. XXVI, p. 87.

PARR, THOMAS, a centenarian. See LONGEVITY, Vol. XIV, p. 869.

PARRAKEET, PARAKEET OR PARROQUET. See PARROT, Vol. XVIII, p. 327.

PARRIDÆ. See JACANA, Vol. XIII, p. 541.

PARROTT, ROBERT PARKER, an American inventor; born in Lee, N. H., Oct. 5, 1804. He was graduated from the United States Military Academy in 1824, and until 1830 was instructor in natural science in that institution. In 1836 he served in the war against the Creeks, with the rank of captain, and in the same year became a member of the United States Ordnance Bureau in Washington. He resigned his commission and while superintendent of a cannon foundry at Cold Spring, N. Y., invented the well known Parrott gun, or rifle cannon, which came into prominence during the Civil War. He severed his connection with the Cold Spring foundry in 1867 and became engaged in various business enterprises in New York City. He died in Cold Spring, N. Y., Dec. 24, 1877. W.M.C.

PARRY, CHARLES CHRISTOPHER, botanist; born in Worcestershire, England, Aug. 28, 1823; came to the United States in 1832; was educated at Union College, and practiced medicine in Davenport, Ia. While thus engaged his botanical studies in the surrounding district gave him reputation as an able botanist, and in 1848 he was appointed botanist on the Geological Survey of the Northwest, and afterward on that of the Mexican boundary. Subsequently he was botanist to the Pacific Railroad Survey of the 35th parallel, and from 1867 to 1871 did botanical work for the Department of Agriculture. He made extensive collections in the West and many new species were discovered by him, a number of them bearing his name in their specific title. He was the author of *Botanical Observations in Western Wyoming* (1874); *Botanical Observations in Southern Utah* (1875); *Revision of the U. S. Pacific Coast Species of Arctostaphylos* (1883); *The North American Genus Ceanothus* (1888), etc. He died at Davenport, Ia., Feb. 20, 1890. G.J.H.

PARRY, SIR CHARLES HUBERT HASTINGS, musician; born in Bournemouth, England, Feb. 27, 1848; was educated at Oxford University, and then applied himself to the study of music. He achieved distinction in this profession, and in 1899 was chosen professor of music at the University of Oxford. Subsequently he became chorus leader of the university, and director of the Royal College of Music. He was also elected honorary fellow of Exeter College, Oxford. His compositions include *Music to the Birds of Aristophanes; Music to the Frogs of Aristophanes; Judith; Ode for St. Cecilia's Day; The Lotus Eaters; L'Allegro and Penseroso; Blest Pair of Sirens; Invocation to Music; De Profundis; Job; King Saul; Magnificat; Song of Darkness and Light*, etc. He was also the author of *Studies of Great Composers; Evolution of the Art of Music*, and numerous articles in *Grove's Dictionary of Music* and *Summary of Musical History*. G.J.H.

PARRY, JOSEPH, a British musical composer; born in Merthyr-Tydfil, Wales, May 21, 1841. In 1854 he went to the United States with his parents, but in a few years returned and received instruction in music, for which he had real talent. In 1862 he won prizes at the Llandudno Eisteddfod, and in 1863 at the Swansea Eisteddfod. In 1868 he entered the Royal Academy of Music, and studied under Sterndale, Garcia and Steggall. He was appointed professor of music at the University College, Aberystwith, and soon after took his Mus Bac. degree at Cambridge, and in 1878 that of Mus. Doc. at the same university. Among his compositions are *Blodwen*,

an opera performed in 1878, and *Emmanuel*, an oratorio performed in 1880. Died Feb. 17, 1903.

PARRY SOUND, a town and the capital of Muskoka and Parry Sound District, northwestern Ontario, Canada, 50 miles N. of Midland, on Parry Sound, an eastern arm of Georgian Bay; at the western terminus of the Canadian Atlantic railroad and having steamboat connection with lake ports. The town is the center of a district devoted almost exclusively to the lumber industry; has large sawmills in the vicinity, and is an important shipping-point for their product. Population 1901 (estimated), 2,884; with McDougall and Parry Island, 3,337.

PARSEES. See PARSIS, Vol. XVIII, pp. 330–333.

PARSLEY. See HORTICULTURE, Vol. XII, p. 302; and UMBELLIFERÆ, in these Supplements.

PARSNIP. See HORTICULTURE, Vol. XII, p. 297; and AGRICULTURE, Vol. I, p. 328.

PARSON-BIRD. See HONEY-EATER, Vol. XII, p. 143.

PARSONS, a city of Labette County, southeastern Kansas, about 35 miles S. of Humboldt and about 12 miles N.W. of Oswego. It is an important railroad center, being located upon the Kansas City, Fort Scott and Memphis and on several branches of the Missouri, Kansas and Texas railroads; is a trading and shipping point for a farming and grazing district; contains machine-shops of the Missouri, Kansas and Texas railroad, giving employment to a large number of hands, and manufactories of plows, furniture, pottery and tiles; has banks, several churches, a public library, good school system, two daily and six weekly newspapers. Population 1890, 6,736; 1900, 7,682.

PARSONS, a post borough of Luzerne County, eastern Pennsylvania, 2 miles E. of Wilkesbarre, on the Delaware and Hudson railroad and the Central Railroad of New Jersey. It is in a region devoted almost exclusively to coal-mining, and has several collieries. Population 1900, 2,529.

PARSONS, SAMUEL HOLDEN, an American soldier; born in Lyme, Conn., May 14, 1737. He was graduated from Harvard, and was admitted to the bar in 1759. He was a member of the Connecticut State Assembly for many years, and at the outbreak of the Revolution was appointed colonel of the Sixth Connecticut regiment. In August, 1776, he was made a brigadier-general. After the evacuation of Boston by the British he was transferred to New York, where he participated in the battles of Long Island and White Plains. In 1777 he was promoted major-general and succeeded to the command of Gen. Putnam. In 1785 President Washington appointed him a commissioner to negotiate with the Western Indians, and in October, 1787, he was appointed one of the judges of the Northwest Territory. He was accidentally drowned near Marietta, Ohio, Nov. 17, 1789. W.M.C.

PARSONS, THEOPHILUS, an American jurist; born in Byfield, Mass., Feb. 24, 1750. He graduated at Harvard in 1769, and practised law in Falmouth (now Portland), Me., and in Byfield, and later established himself at Newburyport, Mass. In 1778 he became a member of the Essex Junto, and in 1788 he was influential in the ratification of the Federal Constitution, and was the author of the so-called "conciliatory resolutions." He occasionally served in the legislature, but took no prominent part in public affairs. In 1800 he removed to Boston, and in 1806 was appointed chief justice of the Supreme Judicial Court, a position he held till his death in Boston, Oct. 30, 1813. E.E.T.

PARSONS, THOMAS WILLIAM, an American poet; born in Boston, Aug. 18, 1819. His father was a physician, and intended his son for that profession. He was educated at the Boston Latin School, and graduated in medicine at the Harvard Medical School. For some time he practised dentistry, but he travelled much and resided much abroad, especially in Italy. In 1843 he published a translation of the first ten cantos of the *Inferno*, and in 1867 a revision with seven more cantos. The complete epic appeared in 1893, his version having been made a life labor. Many of his volumes of verse were printed privately for circulation among friends, as he was never eager for publication. Several collections of his poems were published, including *Ghetto di Roma* (1854); *The Magnolia* (1867); *The Shadow of the Obelisk* (1872); *Circum Præcorda* (1892); and a final selection in 1893, after his death, which took place in Scituate, Mass., Sept. 3, 1892. E.E.T.

PARTHENOGENESIS, in botany, is applied to cases in which the oösphere (female gamete) germinates without fertilization, as though it were an oöspore. Notable examples are to be found among the *Saprolegniæ*, a fungus group of water-molds. The so-called cases of parthenogenesis among seed-plants do not belong in this category.

PARTHENOGENESIS, a mode of reproduction in which ova develop without being fertilized. This phenomenon is common among certain lower crustacea, certain insects and some plants. In the common bee the eggs last deposited develop, without fertilization, into drones. In some flies the ova develop parthenogenetically while still in the larval stage, a condition known as pædogenesis. In the pyllopods and other entomostracan crustaceans, males seem to appear only on the beginning of unfavorable conditions, such as the approach of winter. At such times eggs are laid and fertilized. These lie dormant until the return of favorable conditions, when they develop into individuals, which reproduce parthenogenetically. Parthenogenetic generations then succeed one another until unfavorable conditions return. No satisfactory explanation has yet been advanced. Weismann held that there was some connection between parthenogenesis and the number of polar bodies separated from the egg, since in certain parthenogenetic eggs but one polar body is formed, while two are usually formed in all eggs requiring fertilization. However, this explanation is not satisfactory, for in some cases two polar bodies are formed and the egg develops parthenogenetically. See HYMENOPTERA, Vol. XII, p. 609; INSECTS, Vol. XIII, p. 153; REPRODUCTION, Vol.

XX, p. 440; and EMBRYOLOGY, in these Supplements.

PARTHENON. See ATHENS, Vol. III, pp. 6, 7. Sculptures of. See ARCHÆOLOGY, Vol. II, p. 311; also ARCHITECTURE, Vol. II, opp. p. 353.

PARTHIAN, EMPIRE. See PERSIA, Vol. XVIII, pp. 597–617.

PARTICK, a town of Lanarkshire, southwestern Scotland, prettily situated, chiefly on a rising ground on the Kelvin, immediately above its junction with the Clyde, and 3 miles N.W. of the Cross of Glasgow, of which city it now forms a suburb. Nine tenths of the workmen of Partick are engaged in shipbuilding-yards, but there are also many flour-mills, cotton factories and bleach-fields. Many of the inhabitants carry on business in Glasgow and have handsome homes in Partick. Population 1901, 54,274.

PARTNERSHIP. Every association of two or more persons for the purpose of doing business on joint or undivided account is a partnership. As a rule, the term is only applied to unincorporated business associations. A partnership may be constituted either by the respective persons contributing capital or skill, or one or more furnishing capital and others skill.

The general principles of law governing contracts are to be extended to the relation of persons in partnership with each other. Persons entering into partnership must not be incapacitated to enter into this contract; that is, they must not be minors, or imbeciles, or under duress, etc. The capital of a mercantile partnership usually consists of personal property, though there may also be real estate, and for the purposes of the partnership. The question may arise whether this land is to be governed by the technical rules applying to real estate, or by those which prevail in the law of personal property. If a partner dies, his widow can have no dower in this land, nor can his heirs inherit, until all the partnership debts are paid and the joint affairs are fully settled. After this the widow can have her dower and the heirs can inherit.

The "good-will" of a partnership is often an important part of its assets. This is the expectation that customers will continue to resort to the place where the business is transacted. The good-will is property of a peculiar kind. It cannot be sold by a sheriff on an execution, as it is in its nature intangible. When one of the partners dies, his executor can only realize something from this source by selling the stock and premises together. In this case the good-will goes naturally with the sale of the premises.

Partners are classified into secret, dormant, nominal and ostensible. A "dormant" partner is one who supplies capital but takes no active part in the management. A "secret" partner is one who is not known as a partner, though he may be active in the interest of the concern. A "nominal" or "quasi" partner is one who has no real connection with the firm, but holds himself out as a partner. Persons who give credit to the firm on the faith of his name may hold him liable on the ground of estoppel.

In some of the states there is a partnership known as limited. In a "limited" partnership no liability is incurred by the members beyond the amount of their subscription. It is in the nature of a corporation. "Joint-stock companies" are partnerships consisting of a large number of persons whose liability is usually that of a general partner. Holding land in partnership by speculators is recognized as true partnership, but farming land on shares has been held to be no partnership.

One who merely lends his name to a firm (nominal partner) is liable to those who have acted upon the supposition that he was in fact a partner. He may directly assert his partnership, or he may give the firm permission to use his name over the shop-door or in printed notices, bills, advertisements, etc.: in all cases he will be estopped from denying his liability as a partner, even if he has no share whatever in the firm. It is essential, however, that this holding himself out as a partner should have been prior to the contract with the third person, as well as the inducement to it.

A point of interest in partnership law is the capacity of one member of a firm to bind his associates in respect to third persons. The partnership liability rests upon the participation in the profits; because, whenever a person takes by agreement a share of the profits of a firm, he withdraws a portion of the funds to which the creditors of the firm had a right to look for reimbursement. He should accordingly be held liable to the creditors. This is the doctrine laid down in a celebrated early English case, *Waugh vs. Carver*, which has been quite generally followed in the courts of the United States. The New York court of appeals has reaffirmed, in the case of *Leggett vs. Hyde*, the correctness of this theory, and makes the participation of profits the basis of partnership.

If a partner gives a promissory note and signs the firm-name without the consent of his associates, and this note is taken up before maturity in the regular course of business by a purchaser in good faith, the latter can collect the note from the firm, notwithstanding the partner who has executed the note has no right whatever to bind the firm by such a note. The ground of this rule is, that the partner issuing the note had the "apparent authority" to issue it, and that a third party could not possibly distinguish this note from others which the partner has a real right to issue. If, however, the purchaser of the note knew, or had reasons to know, that the partner was violating his duty, the firm will not be liable for the note.

Owing to the intimate relations between partners, the act of one is for many purposes the act of all. Notice to one of any fact touching their common business is notice to all. An admission made by one is supposed to be made by all. Such an admission, if it affects their common interests is receivable in evidence. If one of the partners commits a wrongful act (tort), or commits a fraud, in connection with the common business, all of them are answerable for it. The liability ceases when the wrongful act is wholly unconnected with the partnership business.

The relation of partners between themselves is

largely based on trust and confidence. This view prevents each one from doing any act without the partners' consent in reference to the firm business, which shall inure to his own advantage. Thus, if he buys up a claim against the firm for less than its face value, he can only charge to the firm what he actually paid. If he take from a landlord, in his own name, a renewal of a valuable lease belonging to the firm, he will be obliged to account as a trustee for the profits which may accrue.

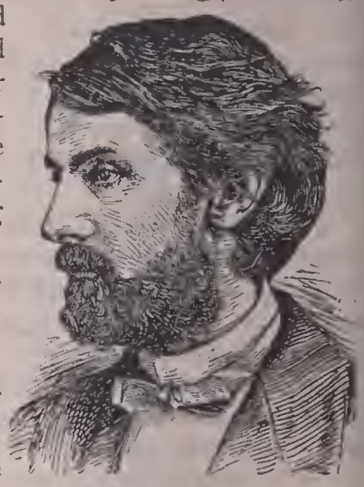
DISSOLUTION OF PARTNERSHIP. A partnership may be dissolved in a number of ways. The leading modes are:

(*a*) The express consent of the parties.
(*b*) The sale by one of his interest.
(*c*) Death of one or more members.
(*d*) Bankruptcy.
(*e*) Marriage of a female partner.
(*f*) Insanity legally established.
(*g*) The fact that one becomes by the law of nations an enemy of his associates.
(*h*) The action of a court of equity decreeing a dissolution on such grounds as, that the ends sought to be accomplished are impracticable; or, that one of the firm is so conducting himself as to bring disaster upon the common interests; or, is in such a state of mind that he cannot contribute to the common advantage, etc.
(*i*) The voluntary withdrawal of a member.

The effect of the dissolution is to prevent any new contracts from being made. It only remains to pay outstanding debts and to close existing transactions. Actual notice of dissolution must be brought home to persons who have been in the habit of dealing with the firm; with regard to persons who have had no previous dealings with the firm, notice in the newspapers is sufficient. This notice is necessary to terminate the agency of each partner and his powers and liabilities as such. When the dissolution takes place by operation of law or by the death of a partner, notice is not necessary. See also PARTNERSHIP, Vol. XVIII, pp. 334–337.

PARTON, ARTHUR, an American landscape-painter; born in Hudson, New York, March 26, 1842; studied at the Pennsylvania Academy of Fine Arts in Philadelphia; went to Europe in 1870, and studied in Paris; removed to New York in 1865; associate of the Academy of Design in 1871 and academician in 1884. In 1886 he received a gold medal at the American Art Association for his *Evening after the Rain.* Among the more important of his works are *On the Road to Marcy*, owned by Charles Farwell of Chicago; *A Mountain Brook*, purchased by A. T. Stewart, New York; *November*, owned by Lord Moncke, ex-Governor-General of Canada; *Sycamores of Old Shokam* (1876), in Amherst College collection; *Delaware River, near Milford* (1879); *Winter on the Hudson* (1885); etc.—His brother, ERNEST, also a landscape-painter, was born in Hudson, New York, March 17, 1845; spent two winters in the studio of his brother, but received no instruction from regular masters. In 1873 he opened a studio in London, and frequently exhibited at the Royal Academy, the Academy of Design, New York, and elsewhere. He received a medal from the Boston Art Institute in 1883, and became a member of the Royal Institute of Painters, London, and the Artists' Fund Society, New York. Among his most important works are *Morning Mist* (1873); *Papa's Lunch* (1875); *The Placid Stream* (1876); *The Silent Pool, Reflections, Au Bord de l'Eau* and *On the River Loing* (1878); *Silver and Gold* (1882); *Where Memory Dwells* (1884); *Last of October* (1886); etc.

PARTON, JAMES, an American historian and biographer; born in Canterbury, Eng., Feb. 9, 1822. He was educated in New York city, and became a school teacher in 1845. He was assistant editor of the New York *Home Journal* for three years, being associated with N. P. Willis, whose sister, Sara Payson Willis Eldridge ("Fanny Fern"), he married in 1856. In 1855 he published his *Life of Horace Greeley*, of which over 30,000 copies were sold. This was followed in 1857 by his *Life of Aaron Burr*, which became very popular. He then devoted himself entirely to literature and wrote the *Life of Andrew Jackson* (1859); *Humorous Poetry of the English Language from Chaucer to Saxe* (1856); *General Butler in New Orleans* (1863); *Life and Times of Benjamin Franklin* (1864); *People's Book of Biography* (1868); *Famous Americans of Recent Times* (1870); *Triumphs of Enterprise, Ingenuity, and Public Spirit* (1871); *Topics of the Time* (1871); *Life of Thomas Jefferson* (1874); *Caricature in All Times and Lands* (1875). In 1875 he removed to Newburyport, Mass., where he made his permanent residence, living in more or less retirement. After this he wrote *Life of Voltaire* (1881); *Noted Women of Europe and America* (1883); *Captains of Industry* (1884). He died in Newburyport, Mass., Oct. 17, 1891. W.M.C.


JAMES PARTON.

PARTON, SARA PAYSON WILLIS ("Fanny Fern"), an American author, wife of James Parton; born in Portland, Me., July 9, 1811. She was educated in Boston and Hartford public schools and was married at an early age to Charles H. Eldridge of Boston. A few years later she was widowed, and left dependent upon her own resources. Turning her attention to literature she began writing under the pseudonym of "Fanny Fern." In 1856 she married James Parton, who was associated with her brother, N. P. Willis, in the editorial conduct of the New York *Home Journal.* Her first collection of stories and sketches *Fern Leaves* was published in 1853 and enjoyed wide popularity. She also wrote *Little Ferns* (1853); *Ruth Hall* (1854); *Fern Leaves*, 2nd Series (1854); *Rose Clark* (1857); *Fresh Leaves* (1857); *The Play Day Book* (1857);

A New Story Book for Children (1864); *Ginger Snaps* (1870); *Caper-Sauce* (1872). She died in Brooklyn, N. Y., October 10, 1872. Her husband published *Fanny Fern*, a memorial, the following year. W.M.C.

PARTRIDGE, a popular name applied to several widely different species of game-birds of the grouse family. The partridge of England is *Perdix cinerea*. The red-legged partridge of the continent is *Caccabis rubra*. The ruffed-grouse (*Bonasa umbellus*) of the northern United States is called partridge in some localities. In other localities, quail and other allied birds have the popular name applied to them. PARTRIDGE, Vol. XVIII, p. 337; and QUAIL, Vol. XX, p. 153.

PARTRIDGE, ALDEN, an American soldier; born in Norwich, Vt., about 1785. He was graduated at West Point in 1806, and was assistant professor and afterward professor of mathematics there from that time until 1813. He was professor of engineering from 1813 to 1816, and superintendent from January, 1815, to November, 1816, and from January to July, 1817. In 1818 he left the service with the rank of captain. He was the principal of the exploring survey sent out in 1819 to determine the northwest boundary of the United States. In 1820 he founded at Norwich, Vt., a military academy, which was afterward removed for a time to Middletown, Conn., but was later restored to Norwich and incorporated as Norwich University with Capt. Partridge as its president. He subsequently founded similar institutions in Pennsylvania, Virginia, and Mississippi; and was a member of the legislature from 1833 to 1839. He died in Norwich, Vt., Jan. 16, 1854. E.E.T.

PARTRIDGEBERRY, the common name of *mitchella repens*, a plant of the family *Rubiaceæ*. It is a small plant, common in forests, creeping over the ground, with small, round evergreen leaves, white or purplish-tinged fragrant flowers in pairs at the end of branches, and the two ovaries united to form a single persistent scarlet berry.

PARTURIENT FEVER. See VETERINARY SCIENCE, Vol. XXIV, p. 221.

PARTY-WALL. A party-wall is a wall erected on the boundary-line between two estates, and is owned by and subject to the joint use of the owners of the adjoining estates. The ownership is generally in common, but each party may own the wall to the center and have an easement or right to use the other half, or one party may own the wall and the other own a right to use it as a dividing-wall. Party-walls may become such by contract, prescription or statute.

PARVATI, a myth. See BRAHMANISM, Vol. IV, p. 187.

PARVIN, THEOPHILUS, an American physician; born in Buenos Ayres, Argentina, Jan. 9, 1829. He was educated at the University of Indiana, graduating in 1847. In 1864 he was appointed a professor in the Ohio Medical College and in 1869 was elected professor of obstetrics at the University of Kentucky. In 1872 he went to the Indiana Medical College and ten years later was a professor at the Jefferson Medical College in Philadelphia. He became prominent in his profession, was president of the American Gynecological Society, the American Academy of Medicine and the American Medical Association. He wrote various articles for the medical journals and reviews, and published *Science and Art of Obstetrics* (1866); and *Obstetric Nursing* (1889). He died in Philadelphia, Pa., Jan. 30, 1898. W.M.C.

PASADENA, a city of Los Angeles County, southern California, nine miles N.E. of Los Angeles, on the Los Angeles Terminal and the Southern California railroads, in the San Gabriel valley; is one of the most popular health-resorts of the Pacific coast. Since 1880 its growth has been phenomenal and its population has increased in a greater ratio than that of almost any other town in the state, while the improvements made upon its site are of an attractive and substantial character. It contains churches, schools, banking facilities, etc.; an opera-house and two commodious and well equipped public halls, five hotels, and other accommodations for the convenience of the visitors annually sojourning there to avail themselves of the benefits and health-giving properties of the climate. The raising of oranges and other fruits is the principal business interest of the vicinity, and large shipments of these productions are made yearly from Pasadena to the Eastern states and elsewhere. Some manufacturing is carried on in the city, including grist and planing mills, electric-appliance and barbed-wire factories, a fruit-canning establishment, and other enterprises. The city is lighted with gas and electric lights. Population 1890, 4,882; 1900, 9,117.

PASARGADE. See PERSEPOLIS, Vol. XVIII, p. 570.

PASCAGOULA, Mississippi, a river, bay and town of Jackson County; (1) the river formed by the union of the Chickasawbay and Leaf rivers in Greene County, flows into the bay on the Gulf of Mexico after a tortuous southerly course of 85 miles, 50 miles of which are navigable; (2) the bay at the mouth of the river is an inlet of the Mississippi Sound in the Gulf of Mexico, about 55 miles long and 8 miles broad; (3) the town at the mouth of the river has a good harbor and railway connections. Population, 1901, 708. C.L.S.

PASCO, SAMUEL, lawyer; born in London, England, June 28, 1834; removed to Prince Edward Island, and later to Massachusetts. He was graduated at Harvard University in 1858; and was principal of Waukeenah Academy. When the Civil War broke out he entered the Confederate army as a private, and served till the close. He then became clerk of the circuit court of Jefferson County, Fla., and in 1868 was admitted to the bar. In 1872 he was chosen a member of the State Democratic Convention; in 1876–88 was its chairman; in 1880–1900 was a member of the National Democratic Convention; in 1887 speaker

of the State Legislature; in 1887–99 a United States Senator, and in the latter year became a member of the Isthmian Canal Commission.

G.J.H.

PASCOAG, a village of Providence County, northern Rhode Island, 23 miles W.N.W. of Providence, on the New York and New England railroad. It is in a section having numerous manufacturing towns and machine-shops and many woolen-mills. Pop. 1890, 2,246 (not returned in census of 1900).

PASEWALK, a town of Pomerania, northeastern Prussia, 24 miles by rail W.N.W. of Stettin, on the Uker River. It was plundered and burned three times—by the Imperialists in the Thirty Years' War, by the Poles in 1657, and by the Russians in 1713. It is inclosed by a wall, and has manufactories of leather and woolen cloth. Population, 10,520.

PASHA, a Turkish title formerly bestowed upon princes, but now given to provincial governors, military leaders, and others. The distinctive badge of a pasha is one or more horsetails waving from a lance, three horsetails being the insignia of the pasha of the highest rank, who may also have the title of vizier. There are also pashas whose rank is indicated by two horsetails, and others by one.

R.W.C.

PASHT OR PAKHT. See EGYPT, Vol. VII, p. 622.

PASINI, ALBERTO, an Italian *genre* painter; born in Busseto, near Parma, Italy, in 1820; chevalier of the Order of Saints Maurice and Lazarus, and of the Legion of Honor; officer of the Orders of Turkey and Persia. He was a pupil of Ciceri, Isabey and Rousseau. His pictures are for the most part scenes in Turkey and other Oriental countries, and are notable for their rich coloring. Eleven of them were at the Paris Exposition in 1878, where he gained a medal of honor. *Turkey in Asia* and *The Door of a Khan at Brousse* were at the Salon in that year. His *Damascus* is in the Walters Gallery, Baltimore.

PASIPHÆ. See MINOS, Vol. XVI, p. 501.

PASO DEL NORTE, EL, a city of Mexico. See JUAREZ, in these Supplements.

PASPATI, ALEXANDER GEORGE, a Greek philologist and historian; born in the island of Scio, in 1814; captured in 1822 and sold into slavery at Smyrna; taken to the United States; graduated at Harvard in 1831; studied medicine in Paris and Pisa in 1834–39; a physician in Constantinople in 1840–78; and professor in the university at Athens. He was well versed in linguistic science, his philological investigations taking a wide range. His works were published in English, French and Greek, a number being devoted to an exposition of the modern Greek dialects and the Gypsy language and literature. They include *Études sur les Tchinghianés ou Bohémiens de l'Empire Ottoman* (1870); *The English Version of the Revised New Testament* (1882); etc. He died Dec. 24, 1891.

PASQUE-FLOWER. See HORTICULTURE, Vol. XII, p. 260.

PASSAGLIA, CARLO, an Italian theologian; born near Lucca, March 2, 1812; educated as a Jesuit; in 1844 became professor in the Collegio Romano. He left the Jesuits in 1859, and took an active part in the discussions as to the temporal power of the Pope. In 1861 he published his *Pro Causa Italica ad Episcopos Italianos*, in which he maintained that the secular power of the Pope was unnecessary, and counseled him to abandon it in obedience to the voice of united Italy. For this work he was compelled to leave Rome; King Victor Emmanuel at once appointed him professor of moral philosophy at the University of Turin. He was elected a member of the Italian Parliament in 1863, and opposed the occupation of Rome by the French. In 1882 he was reconciled to the Holy See and resumed ecclesiastical functions. He was one of the most learned theologians of Italy, and eminent for his eloquence. He died in Turin, March 12, 1887.

PASSAIC, a city of Passaic County, northern New Jersey, on the Passaic River, and on the Delaware, Lackawanna and Western, the New York, Lake Erie and Western and the New York, Susquehanna and Western railways, 11 miles by rail N.W. of Jersey City and 5 miles S.S.E. of Paterson. The city is beautifully situated on ground rising gradually as it is removed from the river, and from this high ground a view is obtained over a wide expanse of country. The public buildings include a city hall, public library, 15 churches and 6 school buildings. There are electric lights, electric street-railways, macadamized streets, water-works, fire and police departments, banks, clubs, two daily, one semiweekly and three weekly newspapers. The leading industries of the city are foundries and print-works, manufactories of woolens and shoddy, whips, india-rubber and chemicals. The Passaic River, on which the city of Passaic is situated, after rising in Morris County runs southeastward a short distance, then northeastward, forming the boundary between Essex and Morris counties enters Passaic County, and, after passing Paterson, where its course is marked by a fall of 72 feet, making attractive scenery and furnishing water-power for many factories, it flows south and empties into Newark Bay, three miles below Newark. It has a course of about one hundred miles, navigable a short distance from its mouth. Population 1890, 13,028; 1900, 27,777.

PASSAMAQUODDY BAY, an inlet opening out of the Bay of Fundy, forming part of the boundary between Maine and New Brunswick, having a length of about twelve miles and a width at the entrance of eight miles. It receives the St. Croix, Didgeguash, and other rivers; is deep, sheltered, and incloses several islands, of which Deer and Campobello have good harbors. The bay is the seat of important fisheries, is surrounded by picturesque scenery, and has tides averaging 25 feet in height.

PASSAVANT, WILLIAM ALFRED, an American clergyman; born in Zelienople, Pa., Oct. 9, 1821. He was educated at Jefferson College, and the Lutheran Theological Seminary, was ordained in 1842 and accepted a pastorate in Baltimore, Ind. He was in charge of a parish in Pittsburg, from 1844 to 1855, after which he devoted himself entirely to editorial and philanthropic work in connection with the Lutheran Church. He founded hospitals in Chicago, Milwaukee and

Pittsburg, and orphan asylums at Mount Vernon, N. Y., Rochester, Pa., and Zelienople, Pa. In co-operation with A. Louis Thiel he founded Thiel College at Greenville, Pa., in 1870 and in the next few years travelled about the country and secured funds for these institutions amounting to over $1,000,000. The order of deaconesses was introduced by him into the United States. He edited the *Missionary* at Pittsburg from 1845 to 1861, and in 1880 founded the *Workman* at Pittsburg, of which he was editor. He was one of the founders of the Lutheran Theological Seminary established in Chicago, Ill., in 1891. He died in Pittsburg, Pa., June 3, 1894. W.M.C.

PASSAVANT, WILLIAM ALFRED, JR., a clergyman, son of preceding; born in Pittsburg, Pa., Jan. 23, 1857; educated at Western University, Pittsburg, and Muhlenberg College and Theological Seminary, Philadelphia; entered the ministry in 1879, and became pastor at Baden and Pittsburg, Pa. He became editor of *The Workman* in 1887, and superintendent of English Home Missions of the General Council in 1889. On the death of his father, in 1894, he succeeded him in the care of the established benevolent institutions. He died July 1, 1901.

PASS CHRISTIAN, a town of Harrison County, Mississippi, in the southeastern part of the state, has risen into great prominence as a winter resort for health and pleasure. It lies on Mississippi Sound, fronting upon the Gulf of Mexico, near the Bayou St. Louis, and is on the Louisville and Nashville railroad, 82 miles from Mobile and 58 miles from New Orleans. It has a fine water front, with good and shaded roads, boating piers, bathing beach, etc., and is supplied with a number of hotels and boarding cottages, which give accommodation to a large transient population. The permanent population in 1900 was 2,028. W.F.J.

PASSENGER-PIGEON. See PIGEON, Vol. XIX, pp. 93, 94.

PASSERES, a large order of birds characterized by the arrangement of the bones of the palate and by the number and attachment of the song-muscles. It is nearly synonymous with *Passeriformis* and *Insessores* (q. v.). See SPARROW, Vol. XXII, p. 383. R.W.C.

PASSERINE BIRDS. See ORNITHOLOGY, Vol. XVIII, pp. 44, 45.

PASSION-FLOWER FAMILY. See PASSION-FLOWER, Vol. XVIII, pp. 347, 348.

PASSIONISTS, a religious congregation of priests of the Roman Catholic Church, the object of whose institute, indicated by their name, is to preach "Jesus Christ and Him crucified." The founder, St. Paul of the Cross, was born in 1694, near Genoa, obtained the sanction of Benedict XIV in 1741, and died at the mother-house of the society on the Cœlian Hill at Rome in 1775. The cross appears everywhere as their emblem, and a large crucifix forms a part of their very striking costume. For a time the congregation remained in obscurity; but in the first half of the nineteenth century it rose into notice. In 1842 it secured a footing in England. The American province, begun in 1852, numbers between one hundred and two hundred religious houses.

PASSION-PLAYS. See DRAMA, Vol. VII. See, also, OBER-AMMERGAU, in these Supplements.

PASSIVITY OF METALS. Some metals, such as iron, cobalt, nickel, and perhaps others, treated with a strong oxidizing agent, such as concentrated nitric or chromic acid, are no longer acted on by acids or many other reagents that usually attack them. This is probably due to the formation of a thin layer of oxide, which protects the rest of the metal. If the passive metal is heated in a reducing-gas, or rubbed or put in an acid in contact with platinum, it becomes active again. Gun-barrels are made passive to protect them from rusting. See ELECTROLYSIS, Vol. VIII, p. 103.

PASSPORTS. The use of passports in continental Europe and in times of peace has become much more infrequent of late years. But there are many advantages in possessing one in case of any accident or mishap to a traveler. The European law and practice is concisely stated under PASSPORT, q.v., Vol. XVIII, p. 349. The Department of State in America is charged with the issuance of passports. Its regulations and required formalities are briefly as follows:

Passports are issued only to citizens of the United States, upon application, supported by proof of citizenship. When the applicant is a native citizen of the United States he must transmit his own affidavit of this fact, stating his age and place of birth, with the certificate of one other citizen of the United States to whom he is personally known, stating that the declaration made by the applicant is true. The affidavit must be attested by a notary public, under his signature and seal of office. When there is no notary in the place, the affidavit may be made before a justice of the peace or other officer authorized to administer oaths; but if he has no seal, his official act must be authenticated by certificate of a court of record. A person born abroad who claims that his father was a native citizen of the United States must state in his affidavit that his father was born in the United States, has resided therein, and was a citizen of the same at the time of the applicant's birth. This affidavit must be supported by that of one other citizen acquainted with the facts.

If the applicant be a naturalized citizen, his certificate of naturalization must be transmitted for inspection (it will be returned with the passport), and he must state in his affidavit that he is the identical person described in the certificate presented. Passports cannot be issued to aliens who have only declared their intention to become citizens. Military service does not of itself confer citizenship. A person of alien birth, who has been honorably discharged from military service in the United States, but who has not been naturalized, should not transmit his discharge-paper in application for a passport, but should apply to the proper court for admission to citizenship, and transmit the certificate of naturalization so obtained. The signature to the application and oath of allegiance should conform in orthography to the applicant's name as written in the naturalization paper, which the department follows. Every applicant is required to state his occupation and the place of his permanent legal residence, and to declare that he goes abroad for temporary sojourn and intends to return to the United States with the purpose of residing and performing the duties of citizenship therein. The wife or widow of a naturalized citizen must transmit the naturalization certificate of the husband, stating in her affidavit that she is the wife or widow of the person described therein. The children of a naturalized citizen claiming citizenship through the father must transmit the

certificate of naturalization of the father, stating in their affidavits that they are children of the person described therein, and were minors at the time of such naturalization. The oath of allegiance to the United States will be required in all cases.

The application should be accompanied by a description of the person, stating the following particulars, viz.: Age:——years. Stature: ——feet——inches (English measure). Forehead:——. Eyes:——. Nose:——. Mouth:——. Chin:——. Hair:——. Complexion:——. Face:——. If the applicant is to be accompanied by his wife, minor children, or servants, it will be sufficient to state the names and ages of such persons and their relationship to the applicant, when a single passport for the whole will suffice. For any other person in the party a separate passport will be required. A woman's passport may include her minor children and servants.

By act of Congress approved March 23, 1888, a fee of one dollar is required to be collected for every citizen's passport. That amount in currency or postal note should accompany each application. Orders should be payable to the disbursing clerk of the Department of State. Drafts or checks are inconvenient and undesirable. A passport is good for two years from its date, and no longer. A new one may be obtained by stating the date and number of the old one, paying the fee of one dollar, and furnishing satisfactory evidence that the applicant is at the time within the United States. The oath of allegiance must also be transmitted when the former passport was issued prior to 1861. Citizens of the United States desiring to obtain passports while in a foreign country must apply to the chief diplomatic representative of the United States in that country, or, in the absence of a diplomatic representative, then to the consul-general, if there be one, or, in the absence of both the officers last named, to a consul. Passports cannot be lawfully issued by state authorities, or by judicial or municipal functionaries of the United States. (Revised Statutes, section 4075.) To persons wishing to obtain passports for themselves, blank forms of application will be furnished by the Department of State on request, stating whether the applicant be a native or naturalized citizen, or claims citizenship through the naturalization of husband or parent. Communications should be addressed to the Department of State, indorsed, "Passport Division," and each communication should give the postoffice address of the person to whom the answer is to be directed. Professional titles will not be inserted in passports. Persons applying for blank forms for passports should state whether the forms are required for native or naturalized citizens, as there are several forms, each different to meet the case required, and it will often save time and trouble if this caution is observed.

Passports are necessary for the Turkish dominions, including Egypt and Palestine, and must be certified by a Turkish consular officer before entering Turkish jurisdiction. Persons quitting the United States with eventual purpose of visiting any part of Turkey, are advised that their passports may conveniently be certified in advance by the consul-general of Turkey at New York, thus avoiding possible difficulty in obtaining the prescribed *visa* in another country *en route*.

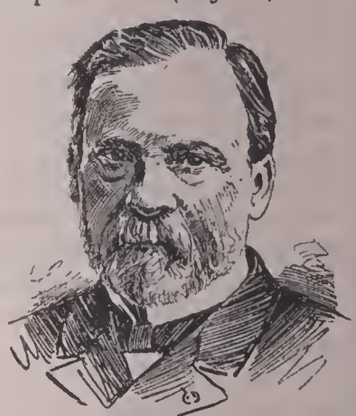
Persons traveling with United States passports desirous of entering Germany from France should not neglect to have their passports viséed by the consul-general of Germany at Paris, thus possibly saving themselves much inconvenience and delay.

It is also understood that in many of the large cities of Germany passports are required of all foreigners who therein take up even a short residence.

PASTA, Giuditta Judith, an Italian opera-singer; born of Jewish parents in Como, near Milan, April 9, 1798; educated in music in Como and at the Conservatoire, in Milan; married Pesta, a singer. Her first triumph was at Verona, in 1822. The next year she appeared at the Paris Italian Opera, where her singing was greatly admired. From 1825 to 1833 she sang in London, Paris and other cities. Her magnificent voice passed easily from the highest soprano notes to the gravest contralto tones; in addition she possessed fine dramatic power. *La Sonnambula* was written for her by Bellini; her principal rôles were Medea, Desdemona, Semiramide, Nina, Camilla, and Giulia in *Romeo e Giulia*. She retired from the stage in 1834, and died April 1, 1865.

PASTELS or PASTILS. See Crayon, Vol. VI, p. 492.

PASTEUR, Louis, a French chemist and biologist; born in Dôle, in the department of Jura, Dec. 27, 1822; received the degree of D.Sc. from the École Normale in 1847; professor of physics in the Faculty of Sciences, Strasburg, in 1849; dean of the Faculty of Sciences at Lille in 1854; "scientific director" of the École Normale, Paris, in 1857; professor of geology, physics and chemistry at the École des Beaux-Arts, Paris, in 1863; professor of chemistry at the Sorbonne in 1867. His work in molecular chemistry won him the Jecker prize in 1861; but he is noted chiefly for his discoveries in the chemistry of fermentation (see Fermentation, Vol. IX, pp. 84, 85) and in mycology (see Schizomycetes, Vol. XXI, p. 417). He ascertained the causes of certain deteriorations of wine, and found a preventive. His investigation of the disease of the silk-worm resulted in finding both the cause and the cure (see Silk, Vol. XXII, p. 65). He discovered the bacilli which cause anthrax in cattle, and a cure by inoculation (see Murrain, Vol. XVII, p. 65). He found the cause of hydrophobia to be a microbe in the nerve-centers, and its preventive and cure in the employment of an attenuated or "cultured" form of the same microbe (see Rabies, Vol. XX, p. 206). In 1888 he established the Pasteur Institute in Paris for the treatment of rabies, which was opened in the presence of President Carnot. In 1890 a hospital for the treatment of rabies by the Pasteur method was founded in New York City. In recognition of his services to science and industry he received in 1872 a prize of 10,000 florins from the Austrian Ministry of Agriculture; in 1873 one of 12,000 francs from the Société d' Encouragement; and in 1874 a life-pension of 12,000 francs from the French government. He was elected a member of the London Royal Society in 1869, and of the French Academy of the Institute of France in 1881. His seventieth birthday was celebrated before a brilliant official assembly at the Sorbonne, in 1892. He contributed many articles to scientific periodicals, and wrote *Nouvel Exemple de Fermentation* (1863); *Études sur le Vin* (1866); *Études sur le Vinaigre* (1868); *Études sur la Maladie*



LOUIS PASTEUR.

des Vers de Soie (1870); *Les Microbes* (1878). He died Sept. 28, 1895.

PASTOR, a bird. See STARLING, Vol. XXII, pp. 474, 475.

PATAPSCO RIVER. See MARYLAND, Vol. XV, p. 609.

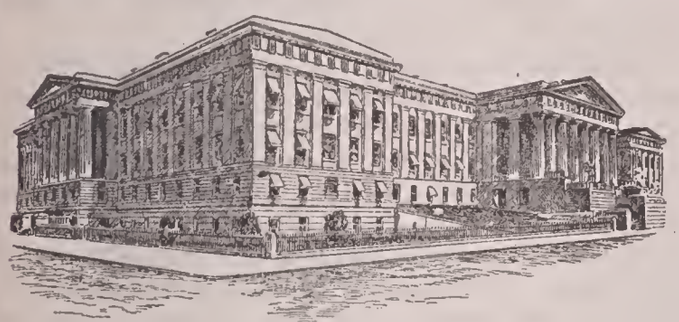
PATCHOGUE, a village of Suffolk County, southeastern New York, on Great South Bay on the southern shore of Long Island, 53 miles E. of New York City, and on the Long Island railroad. It has a harbor with good dock facilities, and is one of the most popular resorts on the Long Island coast. The most important industries are the taking and exporting of fish and oysters, shipbuilding and manufacture of lace, crape, paper, flour, sash and doors. The village was incorporated in 1893, and by the 12th census (1900) it had a population of 2,926.

PATELLA OR KNEE-PAN. See ANATOMY, Vol. I, p. 727.

PATELLIDÆ. See MOLLUSCA, Vol. XVI, pp. 668–671.

PATENT LAWS AND SYSTEM OF THE UNITED STATES, THE. Nearly every civilized nation has provided in a greater or lesser degree for the encouragement and protection of inventive skill and industry, and in some of the older European countries for generations exclusive privileges have been granted to the producers of things new and useful in art, science, literature and mechanics. The article on PATENTS, Vol. XVIII, pp. 359–363, being practical and present rather than historical, dealt with the English patent law and practice, and was restricted to a brief mention of the existing laws of America in this regard.

In colonial days the restrictive policy of the mother-country operated disastrously on patents as well as manufactures, and in consequence the



THE PATENT OFFICE, WASHINGTON, D. C.

American colonies had made little progress in arts or manufactures up to the signature of the Declaration of Independence. England's emissaries, the royal governors of colonies, were charged with the repression of every industry liable to enter into competition with the artisans at home. Nearly everything had to be imported in exchange for raw agricultural products, and rarely indeed were exclusive manufacturing privileges granted to exceptionally favored colonists in New England. Intercolonial trade was hampered and exportation to the West Indies stopped. Even the Bible was not to be printed in America. There was warrant enough for the words of the Declaration as to "cutting off our trade with all parts of the world." Few, indeed, could be classed under Andrew Marvell's (q. v., Vol. XV, pp. 595, 596) humorous *Character of Holland*, where

> "To make a bank was a great plot of state;
> Invent a shovel, and be a magistrate."

Even under this blighting influence, a forecast of America's prominence in inventive genius is to be found in the first recorded patent, granted to Joseph Jenks, of Lynn, Massachusetts, by special act of the General Court of Massachusetts Bay Colony, May 6, 1646. It related to improvements in water-mills, the making of scythes, and to improvements in saw-mills; and was followed in May, 1655, by another patent to the same inventor in respect to scythes. But there were few inventors and fewer patents until the first notes of the peal of liberty rang throughout the land.

FOUNDATION OF THE AMERICAN PATENT SYSTEM. Upon the experience and practical workings of the various systems of the Old World the American laws and practice have been founded, the English theories entering most largely into them. Prior to the adoption of the Federal Constitution, some of the states or provincial governments granted to inventors exclusive privileges, but for obvious reasons these were of little or no value. The foundation of the Republic, and the adoption in 1788 of a constitution wherein and whereby Congress was empowered "to promote the progress of science and useful arts by securing, for limited times, to authors and inventors, the exclusive right to their respective writings and discoveries," were the first real steps toward the United States system of patents. Legislation soon ensued to shape generalities into practical form, and by an act of Congress, approved April 10, 1790, the first American patent system was founded. Thomas Jefferson inspired it, and may be said to have been the father of the American Patent Office. He took great pride in it, it is said, and gave personal consideration to every application that was made for a patent during the years between 1790 and 1793, while the power of revision and rejection granted by that act remained in force. It is related that the granting of a patent was held to be in these early times quite an event in the history of the State Department, where the clerical part of the work was then performed. It is a matter of tradition that when an application for a patent was made under the first act, Jefferson would summon Henry Knox of Massachusetts, who was Secretary of War, and Edmund Randolph of Virginia, who was Attorney-General, these officials being designated by the act, with the Secretary of State, as a tribunal to examine and grant patents; and that these three distinguished officials would examine the application critically, scrutinizing each point of the specification and claims carefully and rigorously. The result of this examination was, that during the first year a majority of the applications failed to pass the ordeal, and only three patents were granted. In those days every step in the issuing

of a patent was taken with great care and caution, Jefferson seeking always to impress upon the minds of his officers and the public that the granting of a patent was a matter of no ordinary importance. During the year 1791, 33 patents were granted; in 1792 the number was 11; and in 1793, 20—making 67 in all under the first statute.

The law of 1790, laying the foundation of the patent-system, constituted a tribunal consisting of the Secretary of State, the Secretary of War and the Attorney-General of the United States, whose duty it was, according to the language of the act, "to grant patents for any such useful art, manufacture, engine, machine or device as they should deem sufficiently useful and important." This language in the act was held to give this board authority to refuse patents for want of novelty in invention or insufficiency of utility or importance, which authority was, as before remarked, exercised with great rigor.

The first act required that patents should not be granted for more than fourteen years, and there was no provision for an extension. It required that "a written specification be filed with the Secretary of State, containing a description of the article desired to be patented, accompanied with drafts or models, and explanations and models." It also required that the specification should be so particular, and the models so exact, as not only to distinguish the invention or discovery from other things before known and used, but also to enable a workman or other person skilled in the art or manufacture whereof it was a branch, or wherewith it might be nearest connected, to make, construct or use the same, to the end that the public might have the full benefit thereof after the expiration of the patent term. This law also directed the Secretary of State to furnish copies of any such specification, and to permit any such models to be copied by any person making application therefor. The act also provided for the repeal of any patent obtained surreptitiously or by false suggestion, and that in all suits brought for the repeal of a patent so obtained, the original patent or specifications should be *prima facie* evidence of priority of invention. It provided no remedy for interfering applications, and apart from the thorough inspection it required it was, read by the light of the present practice, exceedingly defective. It was in many respects more equitable to all classes than the law which superseded it. There was no provision for an appeal from the decision of the tribunal above named by the act of 1790, and the strictness with which it exercised its powers was the cause of serious complaint. Inventors contended that these officers exercised arbitrary powers, and that they were, by education and interest, hostile to the classes who sought the benefits of the patent law.

There is no doubt but that this was true to a greater or less extent; or rather, it is true that they reluctantly granted patent privileges from a well-settled conviction that a too liberal exercise of that power would be detrimental to the interests of the country. Mr. Jefferson, however, if not his associates, held to the view that the patent law was not framed to collect revenue, but to encourage the production of something new and useful, and therefore believed in dealing liberally with those to whom patent rights were granted. The act of 1790 prescribed the following fees for the granting of patents, which are in striking contrast with those exacted by the act of 1793, which was framed by those who were supposed to favor the classes seeking patent privileges: "For receiving and filing the petition, fifty cents; for filing specifications, per copy-sheet containing one hundred words, ten cents; for making out the patent, two dollars; for affixing the great seal, one dollar; for indorsing the day of delivering the same to the patentee, including all intermediate services, twenty cents." When the patent under this act had passed the ordeal of the board, it still required the certificate of the Attorney-General and the signature of the President to make it complete. The impetus given to inventive genius by the act of 1790 created interests hostile to the power of revision and rejection which it authorized, and so rapidly did they develop that in 1793, by the act of February 24th, this power was destroyed, much to the detriment of the material interests of the country.

Just who drew the act of 1793 is not known, but that it met with Mr. Jefferson's opposition is a matter of history. It is said that he pointed out the consequences which would result from breaking down the barriers thrown around the granting of patents by the act of 1790, and held that the promiscuous granting of exclusive privileges, or "the creation of monopolies," as he called them, in any art or industry, was against the theory of popular government and pernicious in its effects. After the act of 1793 became a law, the control of the patent business still continued in the State Department.

There were remarkable differences between the two statutes. The act of 1790 made no distinction between citizens of the United States and aliens as to their rights under the patent law, but the act of 1793 refused patents to persons not citizens of the United States. By an act passed April 17, 1800, the law was so amended as to give aliens who had resided two years in this country the same rights as citizens, provided they filed an affidavit with their application, setting forth their desire and inclination to become citizens of the United States. The act of 1793 was in general construction much the same as that of 1790, except that the power of rejection was destroyed and the duty of granting patents lodged with the Secretary of State alone. It still required, however, the certificate of the Attorney-General as to the correctness of form to be affixed, and also the signature of the President. This statute provided that interfering applications should be submitted to the arbitration of three persons, one of whom was to be chosen by each of the applicants and the third to be appointed by the Secretary of State. The decision

of this tribunal was to be final, and if either party refused to go into arbitration the patent was to issue to the opposing party. There was no provision for an extension of a patent.

During the years from 1790 to 1802 a single clerk in the State Department performed the work of the Patent Office, and a dozen pigeonholes contained the entire records. In that year quite a noted scientific gentleman named Dr. Thornton was appointed by Mr. Jefferson to the office, and he was thereafter styled its "superintendent." For twenty-six years he was the autocrat of the Patent Office, and some amusing stories are related as to his management of its affairs. An official of the department relates that during his superintendence he conceived himself to be invested with much discretionary power, for he held to the maxim that "the patent-law was made solely for the encouragement of authors and inventors, and not to collect revenue." He would therefore exercise his judgment about the payment of fees, the result being that after his death there was quite a deficit between the amount that was and that which should have been to the credit of the patent fund in the treasury. During Dr. Thornton's administration of the office it was no unusual thing to find the doctor a co-patentee, while he was determining all questions which might arise under the law and the practice which he himself dictated.

Dr. Thornton took great interest in the office, and he dictated its action with a power that knew no master. The duties of his position not being onerous, he conducted an extended correspondence upon scientific subjects with the patent officials of the Old World and scientists generally, which he left as a part of the archives of the office when he died, "as a monument of his fidelity to and interest in the advancement of American mechanics." A story is told of him that during the War of 1812, when the British captured the city of Washington and destroyed the capitol building, a loaded cannon was trained upon the Patent Office for the purpose of destroying it, and he is said to have put himself before the gun, and in a frenzy of excitement exclaimed: "Are you Englishmen, or only Goths and Vandals? This is the Patent Office, a depository of the ingenuity and inventions of the American nation, in which the whole civilized world is interested. Would you destroy it? If so, fire away, and let the charge pass through my body." The effect is said to have been magical upon the soldiers, and to have saved the Patent Office from destruction.

A Mr. Jones succeeded Dr. Thornton as superintendent of the Patent Office, and from 1828 till 1830 administered its affairs. Dr. J. D. Craig succeeded to the position in the last-named year, and remained until 1836.

On the 28th of April, 1810, Congress passed an act authorizing the President to erect or procure by purchase a building suitable for the accommodation of the general postoffice and of the "office of the keeper of the patents," in such situation and finished in such manner as the interests of the United States and the safety and the convenience of those officers, respectively, and the arrangement of the models in the Patent Office should, in his opinion, require. The sum of $20,000 was appropriated for the purposes expressed in the act, and a building purchased on the site now occupied by the Postoffice Department. By act of March 7, 1812, a further appropriation of $9,553.91 was made to repair it. Previous to this time the Patent Office was in the building at present occupied by the War Department, and even at this early day so important a branch of the public service had it become that it was deemed best to provide more space for it. In 1812 it was removed to a building standing on the site occupied by the present Postoffice Department building, where it remained until destroyed by fire in 1836.

During the years from 1790 to 1812, inventors confined themselves almost wholly to agricultural and commercial objects. Implements for tilling the soil and converting its products, and machinery for navigation, attracted most attention. Manufactures, except of a purely domestic character for domestic purposes, were hardly known. The arts were poorly understood and little cultivated. The necessities of the New World drove its enterprise into other channels, and its people looked to Europe for manufactured products not directly connected with the necessities of life or demanded by the development of its commerce and agriculture. The War of 1812, however, forced our people to attempt production in many branches of manufacture and industry heretofore almost wholly uncultivated, and the result was the most remarkable development of human ingenuity ever known to any age or country. It is a source of great regret that no well-preserved history of American inventions dating from this time is in existence, and that no classified list of models which were in the office at the time of the fire in 1836 can be obtained. The earliest date that can be reached is Jan. 21, 1823, and that is only partially complete, but it gives the number in the most important classes as follows:

List of Models in the Patent Office, Jan. 21, 1823.

Propelling-boats	38
Carding-machines	8
Making carriage-wheels	4
Plows	65
Threshing-machines	20
Winnowing-machines	25
Bridges	13
Sawmills	26
Water-mills	17
Windmills	7
Water-wheels	26
Pumps	66
Presses	56
Looms	45
Stocking-looms	3
Spinning-machines	28
Fire-engines	10
Steam-mills	14
Nail-cutting machines	95
Machines for making barrels, etc	1
Mud-machines	7
Flax-dressing machines	2

File-cutting machines	6
Machines for cutting dye-woods	6
Cloth-shearing machines	16
Straw-cutting machines	10
Boring-machines	3
Locks	12
Guns	2
	635
For various other purposes	1,184
Total	1,819

These models were classified as follows:

I.—*Agriculture.* Plows, harrows, cultivators, planting, seeding, mowing and threshing machines, rakes, wheat-fans, straw-cutters, etc.

II.—*Factory Machinery.* For cotton, wool, flax, hemp, paper-rolling and slitting-mills, nail-cutters, etc.

III.—*Navigation.* Ships, boats, marine railways, canal-locks, mud-machines, dry-docks, etc.

IV.—*Land Works.* Railways, roads, bridges, excavating and boring machines, pile-engines, etc.

V.—*Common Trades.* Brick-making and planing machines, trip-hammers, bellows, turning-lathes, chains, washing-machines, household furniture and utensils; also, boots, shoes, saddles, harness, etc.

VI.—*Wheel Carriages.* Coaches, chairs, wagons, carts, waywisers, mail-bags, boats, etc.

VII.—*Hydraulics.* Pumps, fire-engines, hose-valves, etc.

VIII.—*Calorific and Steam Apparatus.* Furnaces, fireplaces, stoves, boilers, stills, steam-engines, etc.

IX.—*Mills.* Water and other wheels, grist-mills, saw-mills and the various parts of their machinery.

X.—*Lever and Screw Power.* Applied to printing, coining and other presses.

XI.—*Arms.* Cannons, mortars, muskets, rifles, pistols, percussion and other locks, swords, etc.

XII.—*Mathematical Instruments.* For surveying, mining and nautical purposes.

XIII.—*Chemical Compositions.* Patent medicines, cements, dyes, etc.

XIV.—*Fine Arts.* Musical instruments, paints, varnishes, gildings, sculpture, architecture and gardening.

From 1790 to the re-organization of the Patent Office in 1836 there were granted 11,348 patents, a large number of which, on account of lack of novelty or usefulness, were valueless, but among them were some of the most important inventions of the age. The abuses which grew out of the promiscuous granting of patents without further inquiry than as to the payment of the fee and the form of the application, attracted public attention in the early part of the present century, but it was not until 1836 that opposition to this system was strong enough to invoke Congressional action. Early in that year Senator Ruggles, of Maine, who was the early champion of a reform of the abuses which the act of 1793 made possible, moved in the Senate for "a select committee of five to take into consideration the state and condition of the Patent Office and the laws relating to the issuing of patents for new and useful inventions and discoveries." The committee was appointed, and on the 28th day of April, of the same year, made an extended report, setting forth the abuses which had grown up as a necessary consequence of the act of 1793, and presented a bill for a re-organization of the Patent Office, which became a law on July 4, 1836.

The number of patents granted each year from 1790 to July 4, 1836, is as follows:

In 1790, 3; in 1791, 33; in 1792, 11; in 1793, 20; in 1794, 22; in 1795, 12; in 1796, 44; in 1797, 51; in 1798, 28; in 1799, 44; in 1800, 41; in 1801, 44; in 1802, 65; in 1803, 97; in 1804, 84; in 1805, 57; in 1806, 63; in 1807, 99; in 1808, 158; in 1809, 203; in 1810, 223; in 1811, 215; in 1812, 238; in 1813, 181; in 1814, 210; in 1815, 173; in 1816, 206; in 1817, 174; in 1818, 222; in 1819, 156; in 1820, 155; in 1821, 168; in 1822, 200; in 1823, 173; in 1824, 228; in 1825, 204; in 1826, 323; in 1827, 331; in 1828, 368; in 1829, 447; in 1830, 544; in 1831, 573; in 1832, 474; in 1833, 586; in 1834, 630; in 1835, 757; in 1836, 723.

The fees which were the results of this business had accumulated a surplus in the treasury, on Jan. 1, 1837, to the credit of the patent fund over and above all expenses incurred, of $156,907.73.

In remarkable contrast to the above results stands the record of business transacted by the office after its re-organization in 1836. The statement for the period extending from 1837 to 1896 is as follows:

The rapid increase of the patent business since 1836 can be readily seen by a comparison of the figures given in the two statements of the business of the office. From 1790 to 1837, a period of 46 years, 11,445 patents were granted, yielding a profit to the office of $156,907.73. From Jan. 1, 1837, to Sept. 30, 1877, a period of about 41 years, there were issued 192,332 patents, including reissues, which, together with the other business, placed to the credit of the patent fund on Sept. 30, 1877, $1,099,940.41.

From 1793 to 1868 the moneys earned by the Patent Office were kept as a separate fund in the Treasury, known as "the patent fund." The Commissioner of Patents drew against it for the expenses of his office, and the surplus, over and above the expenses, was kept intact and credited to this fund, and permitted to accumulate. On July 20, 1868, Congress passed an act "that all money to the credit of the patent fund, or in the hands of the Commissioner of Patents, and all moneys thereafter received at the Patent Office, for any purpose or from any source whatever, shall be paid into the treasury as received, without any deduction whatever." By this act the accumulation of the profits of the Patent Office for 75 years was turned into the common fund of the Treasury, and appropriations made for its support the same as for the other departments of the government. Although a separate account is kept with the Patent Office, there is no fund now intact in the Treasury representing its accumulations and known as "the patent fund."

PROVISIONS OF THE LAW OF 1836. The committee appointed by the Senate in 1836 presented with its report a bill for the re-organization of the Patent Office, which became a law on the 4th of July of the same year.

By this statute the Patent Office was created a bureau of the Department of State, whose chief officer was to be called Commissioner of Patents; he was to be appointed by the President, by and with the advice and consent of the Senate.

COMPARATIVE STATEMENT OF THE BUSINESS OF THE OFFICE FROM 1837 TO 1896, INCLUSIVE.

Year.	Applications.	Caveats Filed.	Patents and Reissues.	Cash Received.	Cash Expended.	Surplus.
1837	----------	----------	435	$ 29,289.08	$ 33,506.98	----------
1838	----------	----------	520	42,123.54	37,338.92	$ 4,784.62
1839	----------	----------	425	38,019.97	34,543.51	3,476.46
1840	765	228	473	38,056.51	39,020.67	----------
1841	847	312	495	40,413.01	52,666.87	----------
1842	761	291	517	36,505.63	31,241.73	5,264.20
1843	819	315	519	35,315.81	30,776.96	4,538.85
1844	1,045	380	497	42,509.26	36,344.53	6,164.73
1845	1,246	452	503	51,076.14	39,395.65	11,680.49
1846	1,272	448	638	50,264.16	46,158.71	4,105.45
1847	1,531	533	569	63,111.19	41,878.35	21,232.84
1848	1,628	607	653	67,576.69	58,905.84	8,670.85
1849	1,955	595	1,077	80,752.78	77,716.44	3,036.34
1850	2,193	602	993	86,927.05	80,100.95	6,826.10
1851	2,258	760	872	95,738.61	86,916.93	8,821.68
1852	2,639	996	1,019	112,056.34	95,916.91	16,139.43
1853	2,673	901	961	121,527.45	132,869.83	----------
1854	3,324	868	1,844	163,789.84	167,146.32	----------
1855	4,435	906	2,013	216,459.35	179,540.33	36,919.02
1856	4,960	1,024	2,505	192,588.02	199,931.02	----------
1857	4,771	1,010	2,896	196,132.01	211,582.09	----------
1858	5,364	943	3,710	203,716.16	193,193.74	10,522.42
1859	6,225	1,089	4,538	245,942.15	210,278.41	35,663.74
1860	7,653	1,084	4,819	256,352.50	252,820.80	3,531.79
1861	4,643	700	3,340	137,354.44	221,491.91	----------
1862	5,038	824	3,521	215,754.99	182,810.39	32,944.06
1863	6,014	787	4,170	195,593.29	189,414.14	6,179.15
1864	6,972	1,063	5,020	240,919.98	229,868.00	11,051.98
1865	10,664	1,937	6,616	348,791.84	274,199.34	74,592.50
1866	15,269	2,723	9,450	495,665.38	361,724.28	133,941.10
1867	21,276	3,597	13,015	646,581.92	639,263.32	7,318.60
1868	20,445	3,705	13,378	681,565.86	628,679.77	52,886.09
1869	19,271	3,624	13,986	693,145.81	486,430.74	206,715.07
1870	19,171	3,273	13,321	669,456.76	557,147.19	112,309.57
1871	19,472	3,366	13,033	678,716.46	562,091.64	116,624.82
1872	18,246	3,090	13,590	699,726.39	665,595.00	34,131.39
1873	20,414	3,248	12,864	703,191.77	691,178.98	12,012.79
1874	21,602	3,181	13,599	738,278.17	679,288.41	58,989.76
1875	21,638	3,094	14,837	743,453.36	721,657.71	21,795.65
1876	21,425	2,697	15,595	757,987.65	652,542.60	105,445.05
1877	20,308	2,809	14,187	732,342.85	613,152.62	119,190.23
1878	20,260	2,755	13,444	725,375.55	593,082.89	132,292.66
1879	20,059	2,620	13,213	703,931.47	529,638.97	174,292.50
1880	23,012	2,490	13,947	749,685.32	538,865.17	210,820.15
1881	26,059	2,406	16,584	853,665.89	605,173.28	248,492.61
1882	31,522	2,553	19,267	1,009,219.45	683,867.67	325,351.78
1883	34,576	2,741	22,383	1,146,240.00	675,234.86	471,005.14
1884	35,600	2,582	20,413	1,075,798.80	970,579.76	105,219.04
1885	35,717	2,552	24,233	1,188,089.15	1,024,378.85	163,710.30
1886	35,968	2,513	22,508	1,154,551.40	992,503.45	162,047.95
1887	35,613	2,622	21,477	1,144,509.60	994,472.22	150,037.38
1888	35,797	2,251	20,506	1,118,516.10	973,108.78	145,407.32
1889	40,575	2,481	24,158	1,281,728.05	1,052,955.96	228,772.09
1890	41,048	2,311	26,292	1,340,372.66	1,099,297.74	241,074.92
1891	40,552	2,408	23,244	1,271,285.78	1,139,713.35	131,572.43
1892	40,753	2,290	23,559	1,286,331.88	1,110,739.24	175,592.59
1893	38,473	2,247	23,769	1,242,871.64	1,141,038.45	101,833.19
1894	38,439	2,286	20,867	1,187,439.58	1,100,047.12	87,392.46
1895	40,680	2,415	22,057	1,245,246.93	1,084,496.51	160,750.42
1896	41,660	2,460	22,791	1,307,090.30	1,097,368.85	209,721.45

By the same act a chief clerk of the Patent Office was provided for, who was to have custody of the seal and of the records and models of the office, and was to perform all the duties of the Commissioner during his absence.

It also provided for an examining clerk at a salary of $1,500 a year, whose duties were the same as those of a principal examiner at present. Two clerks at $1,200 each and one at $1,000 were provided for, and also a machinist at $1,250 and a messenger at $700. The commissioner and chief clerk were both required to give bonds for the faithful performance of the duties of their office. Under this statute patents were to be issued for a term not exceeding 14 years, the fee for the same being $30. The patents might be extended for a period of seven years upon payment of an additional sum of $30, if the Secretary of State, the Commissioner of Patents and the Solicitor of the Treasury, who were by the act appointed a board to hear and decide upon the evidence for or against the extension, should

decide favorably. Notice of the extension was to be published in a Washington newspaper, and the board was to sit at the time and place given in the notice. This statute provided nearly the same regulations in relation to specifications, drawings and models as the original act of 1790. The same oath or affirmation as to the originality of the inventions was also preserved. The most important feature of all was, however, the system of examination into novelty and usefulness which this act provided, and which has had such marked influence upon the patent interests of the country.

This section of the law provided "that the Commissioner shall make, or cause to be made, an examination of the alleged new invention or discovery; and if, on any such examination, it shall not appear to the Commissioner that the same had been invented or discovered by any other person in this country prior to the alleged invention or discovery thereof by the applicant, or that it had been patented or described in any printed publication in this or any foreign country, or had been in public use or on sale with the applicant's consent or allowance prior to the application, if the Commissioner shall deem it to be sufficiently useful and important it shall be his duty to issue a patent therefor. But whenever, on such examination, it shall appear to the Commissioner that the applicant was not the original and first inventor or discoverer thereof, or that any part of that which is claimed as new had before been invented or discovered or patented or described in any printed publication in this or any foreign country, as aforesaid, or that the description is defective and insufficient, he shall notify the applicant thereof, giving him briefly such information and references as may be useful in judging of the propriety of renewing his application, or of altering his specification to embrace only that part of the invention or discovery which is new. In every such case, if the applicant shall elect to withdraw his application, relinquishing his claim to the model, he shall be entitled to receive back twenty dollars, part of the duty required by this act, on filing a notice in writing of such election in the Patent Office, a copy of which, certified by the Commissioner, shall be a sufficient warrant to the Treasurer for paying back to the said applicant the said sum of twenty dollars. But if the applicant in such case shall persist in his claim for a patent, with or without any alteration of his specification, he shall be required to make oath or affirmation anew in manner as aforesaid; and if the specification and claim shall not have been so modified as, in the opinion of the Commissioner, shall entitle the applicant to a patent, he may, on appeal and upon request in writing, have the decision of a board of examiners, to be composed of three disinterested persons, who shall be appointed for that purpose by the Secretary of State, one of whom, at least, to be selected, if practicable and convenient, for his knowledge and skill in the particular art, manufacture, or branch of science to which the alleged invention appertains, who shall be under oath or affirmation for the faithful and impartial performance of the duty imposed upon them by said appointment. Said board shall be furnished with a certificate in writing of the opinion and decision of the Commissioner, stating the particular grounds of his objection, and the part or parts of the invention which he considers as not entitled to be patented; and the said board shall give reasonable notice to the applicant, as well as to the Commissioner, of the time and place of their meeting, that they may have an opportunity of furnishing them with such facts and evidences as they may deem necessary to a just decision; and it shall be the duty of the Commissioner to furnish to the board of examiners such information as he may possess relative to the matter under their consideration; and on an examination and consideration of the matter by such board, it shall be in their power, or of a majority of them, to reverse the decision of the Commissioner, either in whole or in part, and, their opinion being certified to the Commissioner, he shall be governed thereby in the further proceedings to be had on such application: *Provided, however*, That before a board shall be instituted in any such case, the applicant shall pay to the credit of the Treasury, as provided in the ninth section of this act, the sum of twenty-five dollars, and each of said persons so appointed shall be entitled to receive for his services in each case a sum not exceeding ten dollars, to be determined and paid by the Commissioner out of any moneys in his hands, which shall be in full compensation to the persons who may be so appointed for their examination and certificate as aforesaid."

Under this act the present system of examination was instituted. The machinery which it constituted in case of an appeal being desired from the primary examiner remained in force until March 2, 1861, when Congress passed an act creating a tribunal consisting of three persons, to be known as examiners-in-chief. Previous to the establishment of this board it had been the practice of the office to detail three examiners to perform the work at present devolving upon the board of examiners-in-chief. But sometimes persons not connected with the office were called upon to act as judges in an appeal case. As a new board was organized for each case, there was often a want of harmony among its members regarding rules of procedure and lack of legal training evident in the decisions reached. When the patent business began to increase rapidly, this system failed to meet the demands of the office, in consequence of the great amount of litigation which arose. Hence the present Board of Appeal was constituted, whose duty it is to hear and determine all questions on appeal from the decisions of the primary examiners.

The statute of 1836 embodied most of the methods for disposing of interfering applications that are now in force. It also provided for an arrangement and classification of models in the office, so that they should be easy of access for study and inspection. This statute also laid the foundation for the creation of the present valuable scientific library of the office, and $1,500 was appropriated for it. Up to the time of the fire, in 1836, $1,000 had been spent upon a few unimportant books, which were all destroyed except a single volume of *Repertory of Arts*. This is now preserved in the United States Patent Office Library as the only existing relic of the conflagration of Dec. 15, 1836.

The statute of 1836 retained the discrimination in favor of American patentees, but it was so modified as to require a residence of only one year, and provided that a subject of Great Britain should pay $500 upon making his application and for all other foreign applicants the fee was $300. This discrimination was kept up in favor of American inventors until the act of March 2, 1861, abolished it. This law provided that there should be no discrimination against aliens unless the country to which they owed allegiance discriminated against citizens of the United States.

The law of 1836 created what is known as the caveat system, by which an inventor could, by paying $20, file in the Patent Office a caveat setting forth the design and purpose of his invention, its principal and distinguishing character-

istics, and praying for protection of his right until he could mature his invention. This paper was to be filed in the confidential archives of the office, and when the patent was taken out, the sum of $20 deposited as a fee for filing the caveat was to be applied upon the regular fees for issuing the patent.

This section also provided that if within one year from the time of filing the caveat any interfering application should be filed, it was the duty of the Commissioner to deposit his specification, drawings and model in the confidential archives of the office, and to give notice to the person filing the caveat of such interfering application, who must within three months mature his patent and file his description, specification, drawings and models, or lose the benefit of the security which the filing of his caveat gave him. This act continued in force exactly as it was passed until March 2, 1861, when the fee was reduced to $10, as at present; and the refunding of any part of the sum or placing it to the credit of the inventor, when application was finally made for a patent, was forbidden.

The tribunal which was created by Congress for the purpose of hearing and determining applications for extension of patents continued to exercise that power until May 27, 1848, when Congress passed an act which transferred that duty to the Commissioner of Patents alone. The Commissioner had sole authority for the extension of patents until March 2, 1861, when Congress passed an act extending the patent term to 17 years, and providing that a patent thereafter granted should not be extended. Extensions were, however, made after the passage of this law, of patents granted prior to 1861, but upon patents granted after that date it required a special act of Congress in each case for the commissioner to grant an extension. And it still requires special legislation to secure an extension.

The New Organization. Soon after the passage of the law of 1836 the Patent Office was reorganized, and Henry L. Ellsworth of Connecticut was appointed Commissioner of Patents, J. W Hand chief clerk, Chas. M. Keller examiner of patents, and Henry Stone draftsman.

By act of Congress of July 4, 1836, the sum of $108,000 was appropriated to build the present Patent Office. The foundations were laid in the fall, but while work was progressing the nation suffered an irreparable loss. On the morning of Dec. 15, 1836, the postoffice building was discovered to be on fire, and, although many of the archives of the general postoffice department were saved, not a thing was preserved in the Patent Office, save one volume from the library, of little value to any one.

The Committee on Postoffices and Post Roads submitted, Jan. 20, 1837, a report on the destruction of the postoffice, in which they said that the evidence taken was conclusive that the fire originated in the cellar under the city postoffice, but in which room they were unable to say with certainty.

On Dec. 19, 1836, on motion of Senator Ruggles of Maine, a committee of five was appointed to examine and report the extent of the loss sustained by the burning of the Patent Office, and to consider what measures ought to be adopted to repair the loss and to establish such evidences of property in patented inventions as the destruction of the models and drawings may have rendered necessary for its security. On Jan. 9, 1837, the committee made an extended report, in which they say: "The Patent Office contained the largest collection of models in the world. It was an object of just pride to every American able to appreciate its value as an item in the estimate of national character, or the advantages and benefits derivable from high improvement in the useful arts—a pride which must now stand rebuked by the improvidence which exposed so many memorials and evidences of the superiority of American genius to the destruction which has overtaken them. The number of models was about seven thousand. Many of them displayed great talent, ingenuity and mechanical science."

In addition to this report, this committee presented a bill in conformity with their views. This bill became a law on March 3, 1837. It gave any person in possession of a patent issued prior to Dec. 15, 1836, the right to record the same anew in the Patent Office, without charge, together with the descriptions, specifications and drawings belonging to the same. This law also imposed upon the Commissioner of Patents the duty of obtaining, as far as practicable, copies of patents, specifications, drawings, etc., for the purpose of having them transcribed and recorded. It also gave the Commissioner authority to record any authenticated copy of the original record, specification or drawing which he could obtain, and he was also permitted under this act to record any drawing produced as a delineation of the invention, if it was reinforced by an oath and referred to in the specification, even if it was not originally annexed to the patent.

Meanwhile, work progressed on the new Patent Office, which was completed for occupancy in 1852. An appropriation of $50,000 in March, 1849, transferred in the same act the Patent Office from the Department of State to the then newly created Department of the Interior.

The Patent Office was doomed to another and irreparable loss in its new quarters. There was a popular faith that whatever might be the security offered to the records of the government elsewhere, the important and valuable archives of the Department of the Interior were sheltered in a building nearly, if not wholly, fire-proof. Here were the records of the Land Office, Bureau of Indian Affairs and others of the many distinct bureaus connected with this department. Here, too, were the records, original drawings and models of the Patent Office, forming a collection of inestimable value and world-wide fame.

Shortly after eleven o'clock on the 24th of September, 1877, columns of smoke were seen issuing from its roof, and a shower of flying cin-

ders gave evidence that a serious fire had begun its work. So great was the faith of the officers, clerks and other employees of the department, however, in the security of the building against fire, that for some time the alarm did not create very great apprehension as to the safety of the building or its valuable contents.

Aid came from near-by towns, but when the fire was extinguished it was found that the Patent Office was almost the only sufferer, aside from the damage to the building. The roof and the model-rooms and contents on the west and north sides were completely destroyed. In these two halls were 87,000 models. Among them were several thousand known as "pending" and "issue" cases. The former were those cases in which the applications were still pending in the examiners' rooms, and the latter belonged to that class of cases allowed by the examiners and still awaiting the payment of the final fees. The loss of these fell on the inventors. The loss of rejected models was not serious. These models, in all cases where they were required, had been returned to the parties furnishing them. Some, which were of use as illustrating mechanics or applied science, had been, from time, to time, loaned to schools and seminaries, to be returned if called for. Most of those in the Ninth-Street loft, about twelve thousand in number, were practically valueless, and were kept only because of the possible injustice that might result if they were disposed of without notice to the applicants.

The loss by fire and water of photo-lithographic copies of drawings, it is estimated, amounted to 40,000 sets of 150 copies each, or about 600,000 copies in all. The drawings were copies only, and they could be replaced at an estimated expense of $60,000. Thirty patented drawings in the class of wood-working machinery, which were in the hands of tracers in the model-rooms, were lost, as were also the models. Three original patented drawings of different classes of inventions which were being traced in the model-room to fill orders from attorneys, were destroyed. Two of these, having been traced some three months back for photo-lithographic reproduction, were at once restored by being mounted upon card-board. There were also some ten drawings, specifications and models destroyed of incomplete applications, they being in the hands of model draftsmen in the west hall of the model-room who were engaged in making drawings therefrom to fill orders. Eleven volumes of English patented drawings were missing. Nine of them were known to be in the model-room and were undoubtedly destroyed. Other minor losses occurred.

The Present Patent Laws. The statutes were amended in 1861, and finally, in 1870, the provisions then in force were consolidated into a single code, which four years later became part of the Revised Statutes of the United States. The essence of the American system and its best feature is the examination before allowance by an examiner of patents. This examination relates to both the novelty and utility of the alleged invention. The latter question is easily disposed of, since, under the rulings of the office and the courts, every invention is considered "useful" if not actually found pernicious or dangerous. It sometimes occurs that a mechanical device is pronounced inoperative and a patent refused, but in such a case the applicant is allowed to file affidavits to the contrary. In fact, if the applicant's faith in the utility of his invention is strong enough to lead him to pay the office-fees, he is thought to be the best judge of this question.

The question of novelty is hard to decide. This is determined by a reference to American and foreign patents, printed scientific works in all languages, and all the information the examiner is able to collect from all sources relating to the art upon which he is especially employed.

The drawings of American patents are arranged by classes for the readiest reference. The English drawings are in bound volumes, with copious indexes and digests. These are kept in the library. In many examiners' rooms are manuscript digests, prepared with great labor, and setting forth the subject-matter of all patents belonging to the particular class under that examiner's special supervision. The library is filled with works on mechanics, and some that relate to every branch of industry.

With all these facilities, which are very imperfectly set forth here, the work of the examiner is intricate and delicate. It is an occurrence most rare for a device to be presented which is in all its features fully anticipated, either in some former patent or printed publication. The question usually turns upon distinctive claims for special features in the device, wherein it is alleged to differ from others of the same kind, and the solution of this question involves the nicest discrimination, both as to mechanical construction and interpretation of language and of law.

After a rejection of his claims, or any part of them, the applicant may amend them, and the new claims are again examined. A second rejection upon the same reference is "final," whereupon the applicant may, if he desires, take an appeal to the Board of Examiners-in-Chief. Should the board sustain the examiner in his decision, an appeal lies to the Commissioner in person. Should the examiner be reversed, the case is remanded to him for issue.

After rejection by the examiner, the applicant may amend at any time within two years; but if no action is made in that time, the application is considered abandoned.

All applications are examined in the order of their receipt by the examiner. The only exceptions to this rule are reissues, extensions and original applications in which the invention is deemed of special value to the government, and a request for its speedy examination is made by the head of an executive department.

Close study, thorough knowledge of the art, keen discernment and the highest intellectual

training are demanded of the examiner. The value of his work, in avoiding needless and expensive litigation, is inestimable.

The examination of an application prior to a grant of a patent, and the restriction of a patent to what is new therein, is, as has been said, the essence of the American patent system. The same plan has been adopted in a modified form by the government of the Dominion of Canada, and was favorably considered by the World's Patent Congress at Vienna in 1873, and by official representatives of the British and French governments, although it has not yet been adopted in those countries.

Several of the South American republics have patent systems copied mainly from that of the United States, but all these are yet in their infancy.

Of course there are objections that could be urged against the American system, but a careful review of the different systems in operation in the Old World, however, demonstrates the fact that the American practice produces more favorable results than any other, and is generally more satisfactory to all concerned, besides being more economical.

The American system requires a model, drawing and specification with each application, and a fee of $15. This fee pays for the examination, and in return for it the applicant is informed, from the best official data, as to whether his alleged invention is new in whole or in part. If it possesses novelty, he can obtain a patent by the payment of an additional $20, making $35 in all, as the fee for a patent for 17 years. (When a case is appealed from adverse decision of the examiner there are small additional fees.) The patent is published as soon as granted, and a certified copy of the specification and a photolithograph of the drawing sent to every United States court, where it is open to public inspection. Other copies are kept for sale by the Patent Office, and a digest of the case, containing the claims and vital part of the drawing, is published in the weekly *Official Gazette*, which is sent free to eight libraries in each Congressional district, and is sent to subscribers at $5 per annum.

A brief résumé of the rules of the patent office is as follows:

Applicants. A patent may be obtained by any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, and not in public use or on sale in the United States for more than two years prior to his application, unless the same is proved to have been abandoned.

A patent may also be obtained by any person who, by his own industry, genius, efforts and expense, has invented and produced any new and original design for a manufacture, bust, statue, alto-relievo or bas-relief; any new and original design for the printing of woolen, silk, cotton or other fabrics; any new and original impression, ornament, pattern, print or picture to be printed, painted, cast or otherwise placed on or worked into any article of manufacture; or any new, useful and original shape or configuration of any article of manufacture, the same not having been known or used by others before his invention or production thereof, nor patented nor described in any printed publication, upon payment of the fees required by law and other due proceedings had.

If it appear that the inventor, at the time of making his application, believed himself to be the first inventor or discoverer, a patent will not be refused on account of the invention or discovery, or any part thereof, having been known or used in any foreign country before his invention or discovery thereof, if it had not been before patented or described in any printed publication.

Joint inventors are entitled to a joint patent; neither of them can obtain a patent for an invention jointly invented by them. Independent inventors of distinct and independent improvements in the same machine cannot obtain a joint patent for their separate inventions. The fact that one person furnishes the capital and another makes the invention does not entitle them to make an application as joint inventors; but in such case they may become joint patentees.

The receipt of letters-patent from a foreign government will not prevent the inventor from obtaining a patent in the United States unless the invention shall have been introduced into public use in the United States more than two years prior to the filing of the application. But every patent granted for an invention which has been previously patented by the same inventor in a foreign country will be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest unexpired term; but in no case will it be in force more than seventeen years.

The Application. Applications for letters-patent of the United States must be made to the Commissioner of Patents, and must be signed by the inventor, if alive. A complete application comprises the first fee of $15, a petition, specification and oath; and drawings, model or specimen when required. The petition, specification and oath must be in the English language.

The application must be completed and prepared for examination within two years after the filing of the petition; and in default thereof, or upon failure of the applicant to prosecute the same within two years after any action thereon, of which notice shall have been duly mailed to him or his agent, the application will be regarded as abandoned, unless it shall be shown to the satisfaction of the Commissioner that such delay was unavoidable.

The Petition. The petition must be addressed to the Commissioner of Patents, and must state the name and residence of the petitioner requesting the grant of a patent, designate by title the invention sought to be patented, contain a reference to the specification for a full disclosure of such invention, and must be signed by the applicant.

The Specification. The specification is a written description of the invention or discovery, and of the manner and process of making, constructing, compounding and using the same, and is required to be in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which the invention or discovery appertains, or with which it is most nearly connected, to make, construct, compound and use the same.

The specification must set forth the precise invention for which a patent is solicited and explain the principle thereof, and the best mode in which the applicant has contemplated applying that principle, in such manner as to distinguish it from other inventions.

In case of a mere improvement, the specification must particularly point out the parts to which the improvement relates, and must by explicit language distinguish between what is old and what is claimed as new; and the description and the drawings, as well as the claims, should be confined to the specific improvement and such parts as necessarily co-operate with it.

The specification must conclude with a specific and distinct claim or claims of the part, improvement or combination which the applicant regards as his invention or discovery.

When there are drawings, the description will refer to

the different views by figures and to the different parts by letters or numerals (preferably the latter).

The following order of arrangement should be observed in framing the specification: 1. Preamble stating the name and residence of the applicant, the title of the invention, and, if the invention, has been patented in any country, the country or countries in which it has been so patented, and the date and number of each patent. 2. General statement of the object and nature of the invention. 3. Brief description of the several views of the drawings (if the invention admits of such illustration). 4. Detailed description. 5. Claim or claims. 6. Signature of inventor. 7. Signatures of two witnesses.

The specification must be signed by the inventor or by his executor or administrator, and the signature must be attested by two witnesses. Full names must be given, and all names, whether of applicants or of witnesses, must be legibly written.

Two or more independent inventions cannot be claimed in one application; but where several distinct inventions are dependent upon each other and mutually contribute to produce a single result they may be claimed in one application.

If several inventions, claimed in a single application, be of such a nature that a single patent may not be issued to cover them, the inventor will be required to limit the description, drawing and claim of the pending application to whichever invention he may elect. The other inventions may be made the subjects of separate applications, which must conform to the rules applicable to original applications. If the independence of the inventions be clear, such limitation will be made before any action upon the merits; otherwise it may be made at any time before final action thereon, in the discretion of the examiner.

The specification and claims must be plainly written or printed on but one side of the paper. All interlineations and erasures must be clearly referred to in marginal or foot notes on the same sheet of paper. Legal-cap paper with the lines numbered is deemed preferable, and a wide margin must always be reserved upon the left-hand side of the page.

The Oath. The applicant, if the inventor, must make oath or affirmation that he does verily believe himself to be the original and first inventor or discoverer of the art, machine, manufacture, composition or improvement for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; and shall state of what country he is a citizen and where he resides. In every original application the applicant must distinctly state, under oath, whether the invention has or has not been patented to himself, or to others with his knowledge or consent, in any country, and, if it has been, the country or countries in which it has been so patented, giving the date and number of each patent; and should also state that it has not been patented, in any other country or countries than those mentioned, and that, according to his knowledge and belief, the invention has not been in public use or on sale in the United States for more than two years prior to the application in this country.

If such application shall be found to be patentable, on the payment of the final fee, or at some time before patent shall issue, applicant shall file a statement setting forth, by date and number, so far as known, any patents for the same invention, granted to him or to others with his knowledge or consent, between the date of the execution of the application and the date of such payment.

The oath or affirmation may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides in a foreign country, before any minister, chargé d'affaires, consul or commercial agent holding commission under the government of the United States, or before any notary public of the foreign country in which the applicant may be, the oath being attested in all cases, in this and other countries, by the proper official seal of the officer before whom the oath or affirmation is made.

The Drawings. The applicant for a patent is required by law to furnish a drawing of his invention whenever the nature of the case admits of it.

The drawing may be signed by the inventor, or the name of the inventor may be signed on the drawing by his attorney in fact, and must be attested by two witnesses. The drawing must show every feature of the invention covered by the claims.

The following rules are rigidly enforced:

Drawings must be made upon pure white paper of a thickness corresponding to three-sheet Bristol-board. The surface of the paper must be calendered and smooth. India ink alone must be used, to secure perfectly black and solid lines.

The size of a sheet on which a drawing is made must be exactly 10 by 15 inches. One inch from its edges a single marginal line is to be drawn, leaving the "sight" precisely 8 by 13 inches. Within this margin all work and signatures must be included.

All drawings must be made with the pen only. Every line and letter (signatures included) must be absolutely black.

Drawings should be made with the fewest lines possible consistent with clearness. By the observance of this rule the effectiveness of the work after reduction will be much increased. Shading (except on sectional views) should be used only on convex and concave surfaces, where it should be used sparingly, and may even there be dispensed with if the drawing is otherwise well executed.

The Model. Preliminary examinations will not be made for the purpose of determining whether models are required in particular cases. Applications complete in all other respects will be sent to the examining divisions, whether models are or are not furnished. A model will only be required or admitted as a part of the application when on examination of the case in its regular order the primary examiner shall find it to be necessary or useful. In such case, if a model has not been furnished, the examiner shall notify the applicant of such requirement, which will constitute an official action in the case.

The model must clearly exhibit every feature of the machine which forms the subject of a claim of invention, but should not include other matter than that covered by the actual invention or improvement, unless it be necessary to the exhibition of the invention in a working-model.

The model must be neatly and substantially made, of durable material, metal being deemed preferable; but when the material forms an essential feature of the invention, the model should be constructed of that material. The model must not be more than one foot in length, width or height, except in cases in which the Commissioner shall admit working-models of complicated machines of larger dimensions. If made of wood it must be painted or varnished. Glue must not be used; but the parts should be so connected as to resist the action of heat or moisture. When practicable, to prevent loss, the model or specimen should have the name of the inventor permanently fixed thereon. In cases where models are not made strong and substantial, as here directed, the application will not be examined until a proper model is furnished.

A working-model is often desirable, in order to enable the office fully and readily to understand the precise operation of the machine.

Specimens. When the invention or discovery is a composition of matter, the applicant, if required by the Commissioner, shall furnish specimens of the composition, and of its ingredients, sufficient in quantity for the purpose of experiment.

The Examination. Applications filed in the Patent Office are classified according to the various arts, and are taken up for examination in regular order of filing, those in the same class of invention being examined and disposed of, as far as practicable, in the order in which the respective applications are completed.

The first step in the examination of an application will be to determine whether it is, in all respects, in proper form. If, however, the objections as to form are not vital, the examiner shall proceed to the consideration of the application on its merits; and in such case he must, if possible, in his first letter to the applicant, state all his objections, whether formal or otherwise; and until the

formal objections are disposed of, further action will not be taken upon the merits without the order of the Commissioner.

Rejections and References. Whenever, on examination, any claim of an application is rejected for any reason whatever, the applicant will be notified thereof. The reason for such rejection will be fully and precisely stated, and such information and references will be given as may be useful in aiding the applicant to judge of the propriety of prosecuting his application or of altering his specification; and if, after receiving such notice, he shall persist in his claim, with or without altering his specification, the application will be re-examined. If upon re-examination the claim shall be again rejected, the reasons therefor will be fully and precisely stated.

Upon the rejection of an application for want of novelty, the examiner must cite the best references at his command.

Amendments and Actions by Applicants. The applicant has a right to amend before or after the first rejection or action; and he may amend as often as the examiner presents new references or reasons for rejection.

Designs. A patent for a design may be granted to any person in the cases specified upon payment of the fee required by law and other due proceedings had, as in cases of inventions or discoveries.

Patents for designs are granted for the term of three and one half years, or for seven years, or for fourteen years, as the applicant may, in his application, elect.

The proceedings in applications for patents for designs are substantially the same as in applications for other patents. The specification must distinctly point out the characteristic features of the design, and carefully distinguish between what is old and what is believed to be new. The following order of arrangement should be observed in framing the specification: 1. Preamble, stating name and residence of the applicant, title of the design, and the name of the article for which the design has been invented. 2. Detailed description of the design, as it appears in the drawing, letters or figures of reference being used. 3. Claim or claims. 4. Signature of inventor. 5. Signatures of two witnesses.

When the design can be sufficiently represented by drawings, a model will not be required.

Reissues. A reissue is granted to the original patentee, his legal representatives, or the assignees of the entire interest, when the original patent is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming, as his invention or discovery, more than he had a right to claim as new, provided the error has arisen through inadvertence, accident or mistake, and without any fraudulent or deceptive intention.

Interferences. An interference is a proceeding instituted for the purpose of determining the question of priority of invention between two or more parties claiming substantially the same patentable invention. The fact that one of the parties has already obtained a patent will not prevent an interference, for, although the Commissioner has no power to cancel a patent, he may grant another patent for the same invention to a person who proves to be the prior inventor.

Appeals. Every applicant for a patent, any of the claims of whose application have been twice rejected for the same reasons, upon grounds involving the merits of the invention, such as lack of invention, novelty or utility, or on the ground of abandonment, public use or sale, inoperativeness of invention, aggregation of elements, incomplete combination of elements, or, when amended, for want of identity with the invention originally disclosed, or because the amendment involves a departure from the invention originally presented; and every applicant for the reissue of a patent whose claims have been twice rejected for any of the reasons above enumerated, or on the ground that the original patent is not "inoperative or invalid," or if so inoperative or invalid that the errors which rendered it so did not arise from "inadvertence, accident or mistake," may, upon payment of a fee of $10, appeal from the decision of the primary examiner to the examiners-in-chief. The appeal must set forth in writing the points of the decision upon which it is taken, and must be signed by the applicant or his duly authorized attorney or agent.

There must have been two rejections of the claims as originally filed, or, if amended in matter of substance, of the amended claims; and all the claims must have been passed upon, and all preliminary and intermediate questions relating to matters not affecting the merits of the invention settled, before the case can be appealed to the examiners-in-chief.

Issue. If, on examination, it shall appear that the applicant is justly entitled to a patent under the law, a notice of allowance will be sent him or his attorney, calling for the payment of the final fee within six months from the date of such notice of allowance, upon the receipt of which within the time fixed by law the patent will be prepared for issue.

After notice of the allowance of an application is given, the case will not be withdrawn from issue except by approval of the Commissioner, and if withdrawn for further action on the part of the office, a new notice of allowance will be given. When the final fee has been paid upon an application for letters-patent and the case has received its date and number, it will not be withdrawn or suspended from issue on account of any mistake or change of purpose of the applicant or his attorney, nor for the purpose of enabling the inventor to procure a foreign patent, nor for any other reasons except mistake on the part of the office, or because of fraud or illegality in the application, or for interference.

Date, Duration and Form of Patents. Every patent will bear date as of a day not later than six months from the time the application was passed and allowed and notice thereof was mailed to the applicant or his attorney, if within that period the final fee be paid to the Commissioner of Patents, or if it be paid to the Treasurer or any of the assistant treasurers or designated depositaries of the United States, and the certificate promptly forwarded to the Commissioner of Patents; and if the final fee be not paid within that period, the patent will be withheld.

A patent will not be antedated.

Every patent will contain a short title of the invention or discovery, indicating its nature and object, and a grant to the patentee, his heirs and assigns, for the term of seventeen years, of the exclusive right to make, use and vend the invention or discovery throughout the United States and the territories thereof. But if the invention has been previously patented abroad, the term of the patent will expire with the term of the foreign patent. The duration of a design patent may be for the term of three and a half, seven or fourteen years. A copy of the specifications and drawings will be annexed to the patent and form part thereof.

Delivery. The patent will be delivered or mailed on the day of its date to the patentee, unless there be an attorney of record, in which case it will be delivered to him or the patentee, as the attorney may request; but it will not, without a special request from the applicant, be delivered to an associate or substitute attorney.

Correction of Errors in Letters-Patent. Whenever a mistake, incurred through the fault of the office, is clearly disclosed by the records or files of the office, a certificate, stating the fact and nature of such mistake, signed by the Secretary of the Interior, countersigned by the Commissioner of Patents and sealed with the seal of the Patent Office, will, at the request of the patentee or his assignee, be indorsed without charge upon the letters-patent and recorded in the records of patents, and a printed copy thereof attached to each printed copy of the specification and drawing.

Whenever a mistake, incurred through the fault of the office, constitutes a sufficient legal ground for a reissue, such reissue will be made, for the correction of such mistake only, without charge of office fees, at the request of the patentee.

Mistakes not incurred through the fault of the office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters-patent to the patentee or his agent. Changes or corrections will not be made in letters-patent after the delivery thereof to the patentee or his attorney, except as above provided.

Abandoned, Forfeited, Revived, and Renewed Applications.

An abandoned application is one which has not been completed and prepared for examination within two years after the filing of the petition, or which the applicant has failed to prosecute within two years after any action therein, of which notice has been duly given or which the applicant has expressly abandoned by filing in the office a written declaration of abandonment, signed, by himself (and assignee if any), identifying his application by title of invention, serial number and date of filing.

Prosecution of an application to save it from abandonment must include such proper action as the condition of the case may require. The admission of an amendment not responsive to the last official action, or refusal to admit the same, and any proceedings relative thereto, shall not operate to save the application from abandonment under section 4894 of the Revised Statutes.

Before an application abandoned by failure to complete or prosecute can be revived as a pending application, it must be shown to the satisfaction of the Commissioner that the delay in the prosecution of the same was unavoidable.

When a new application is filed in place of an abandoned or rejected application, a new specification, oath, drawing and fee will be required; but the old model, if suitable, may be used.

A forfeited application is one upon which a patent has been withheld for failure to pay the final fee within the prescribed time.

Extensions. Patents cannot be extended except by act of Congress. An examination invariably precedes such action by Congress.

Disclaimers. Whenever, through inadvertence, accident or mistake, and without any fraudulent or deceptive intention, a patentee has claimed as his invention or discovery more than he had a right to claim as new, his patent shall be valid for all that part which is truly and justly his own, provided the same is a material or substantial part of the thing patented; and any such patentee, his heirs or assigns, whether of the whole or any sectional interest therein, may, on payment of the fee required by law (ten dollars), make disclaimer of such parts of the thing patented as he or they shall not choose to claim or to hold by virtue of the patent or assignment, stating therein the extent of his interest in such patent. Such disclaimer shall be in writing, attested by one or more witnesses, and recorded in the Patent Office; and it shall thereafter be considered as part of the original specification to the extent of the interest possessed by the claimant and by those claiming under him after the record thereof. But no such disclaimer shall affect any action pending at the time of filing the same, except as to the question of unreasonable neglect or delay in filing it.

Caveats. A caveat, under the patent law, is a notice given to the Patent Office of the caveator's claim as inventor, in order to prevent the grant of a patent to another person for the same alleged invention upon an application filed during the life of the caveat without notice to the caveator.

Any citizen of the United States who has made a new invention or discovery and desires further time to mature the same may, on payment of a fee of ten dollars, file in the Patent Office a caveat setting forth the object and the distinguishing characteristics of the invention, and praying protection of his right until he shall have matured his invention. Such caveat shall be filed in the confidential archives of the office and preserved in secrecy, and shall be operative for the term of one year from the filing thereof.

The caveat may be renewed, on request in writing, by the payment of a second caveat fee of ten dollars, and it will continue in force for one year from the date of the payment of such second fee. Subsequent renewals may be made with like effect. If a caveat be not renewed, it will still be preserved in the secret archives of the office.

An alien has the same privilege, if he has resided in the United States one year next preceding the filing of his caveat, and has made oath of his intention to become a citizen.

Assignments. Every patent or any interest therein shall be assignable in law by an instrument in writing, and the patentee or his assigns or legal representatives may, in like manner, grant and convey an exclusive right under the patent to the whole or any specified part of the United States.

Office Fees. Nearly all the fees payable to the Patent Office are positively required by law to be paid in advance; that is, upon making application for any action by the office for which a fee is payable. For the sake of uniformity and convenience, the remaining fees will be required to be paid in the same manner.

The following is the schedule of fees and of prices of publications, etc., of the Patent Office:

On filing each original application for a design patent for three years and six months	$10.00
On filing each original application for a design patent for seven years	15.00
On filing each original application for a design patent for fourteen years	30.00
On allowance of an application for a design patent, no further charge.	
On filing each caveat	10.00
On filing each original application for a patent	15.00
On allowance of an original application for a patent, except in design cases	20.00
On filing a disclaimer	10.00
On filing every application for the reissue of a patent	30.00
On filing each application for a division of a reissue	30.00
On allowance of an application for the reissue of a patent, no further charge.	
On filing every application for an extension of a patent	50.00
On the granting of every extension of a patent	50.00
On filing an appeal for the first time from a primary examiner or the examiner of interferences to the examiners-in-chief	10.00
On filing every appeal from the examiners-in-chief to the Commissioner	20.00
For manuscript copies of records in the English language, for every one hundred words or fraction thereof	.10
If certified, for the certificate, additional	.25
For copies of drawings not in print, the reasonable cost of making them.	
For uncertified copies of the specifications and accompanying drawings of all patents which are printed, per copy	.10
For twenty coupon orders, each coupon good until used for one copy of a printed specification and drawing	2.00
For certified copies of printed patents:	
For specification and drawing, per copy	.10
For the certificate	.25
For the grant	.50
For the specification, if not in print, for every one hundred words or fraction thereof	.10
For the drawings if in print	.10
For the drawings, if not in print, the reasonable cost of making them.	
For certifying to a duplicate of a model	.50
For abstracts of title to patents or inventions:	
For the certificate of search	1.00
For each brief from the digest of assignments	.20
For copies of matter in any foreign language, for every one hundred words or a fraction thereof,	.10
For translation, for every one hundred words or fraction thereof	.50
For recording every assignment, agreement, power of attorney, or other paper, of three hundred words or under	1.00
For recording every assignment, agreement, power of attorney, or other paper of over three hundred words and under one thousand words,	2.00
For recording every assignment, agreement, power of attorney, or other paper of over one thousand words	3.00
For assistance to attorneys and others in the examination of records, one hour or less	.50
Each additional hour or fraction thereof	.50
For assistance to attorneys in the examination of patents or other matter in the scientific library, one hour or less	1.00

For each additional hour or fraction thereof	1.00
For subscription to the *Official Gazette*, published every Tuesday, all subscriptions to commence with the beginning of a volume, none being taken for a less period than three months, and there being no club rates or discount to newsdealers, as follows:	
To all subscribers within the United States and Canada, one year	5.00
To foreign subscribers, except in Canada	7.00
Single numbers.....	.10
For bound volumes of the *Official Gazette*:	
Semiannual volumes, from Jan. 1, 1872, to June 30, 1883, full sheep binding, per volume.....	4.00
Semiannual volumes, from Jan. 1, 1872, to June 30, 1883, half sheep binding, per volume.....	3.50
Quarterly volumes subsequent to July 1, 1883, full sheep binding, per volume.....	2.75
For the annual index—lists of patentees and inventions, alphabetically arranged, with date of patent, number, etc., from January, 1872—one volume each year, full law binding, per volume.....	2.00
In paper covers, per volume.....	1.00
For the general index—a list of inventions patented from 1790 to 1873, with the name of inventor, residence, date of patent, number, etc. —three volumes full law binding, per set.....	10.00
For the index from 1790 to 1836—a list of inventions patented from 1790 to 1836, photolithographed from Patent-Office Reports—one volume, full law binding	5.00
For the monthly volumes, containing the specifications and photolithographed copies of the drawings of all patents issued during the month, certified, bound full sheep, per volume.	12.00
For the monthly volumes, containing the specifications and photolithographed copies of the drawings of all patents issued during the month, certified, bound half sheep, per volume,	10.00
For the index to patents relating to electricity, granted by the United States prior to June 30 1882, one volume, 250 pages, bound.....	5.00
In paper covers.....	3.00
Annual appendixes for each fiscal year subsequent to June 30, 1882, paper covers.....	1.50
For Commissioners' Decisions:	
For 1869–71, bound in one volume, full law binding	2.00
For 1872–74, bound in one volume, full law binding	2.00
For 1875–76, bound in one volume, with decisions of United States courts in patent cases, full law binding	2.00
For 1875–76, bound in paper covers	1.00
For 1877–83, one volume each year, with decisions of the United States courts, full law binding, per volume.....	2.00
For 1877–83, bound in paper covers.....	1.00
Pamphlet of the Rules of Practice.....	Free.
Pamphlet of the patent laws.....	Free.

There are no annual reports for gratuitous distribution.

Publications. The *Official Gazette*, a weekly publication which has been issued since 1872, takes the place of the old *Patent Office Report*. It contains the claims of all patents issued, including reissues, with portions of the drawings selected to illustrate the inventions claimed. It also contains decisions rendered by the courts in patent cases and by the Commissioner of Patents, and other special matters of interest to inventors.

The *Gazette* is furnished to subscribers at the rate of $5 per annum. When sent abroad an additional charge of $2 is made for the payment of postage. Representatives and senators are each entitled to a copy, and each is entitled to designate eight public libraries to which the *Gazette* will be sent without charge. Single copies are furnished for ten cents each.

An index is published annually, which is sent to all subscribers and designated libraries without additional cost.

Printed volumes are issued monthly, containing the entire specifications and drawings of all patents issued during the previous month. These are authenticated by the seal of the office, and may be used as evidence through out the United States. One copy is deposited in the Library of Congress and in each state and territorial library, and one copy in the custody of the clerk of each United States district court, for general reference.

RULES AND FORMS ADOPTED FOR THE REGISTRATION OF TRADE-MARKS UNDER THE ACT OF 1881.

Who May Obtain Registration. Any person, firm or corporation domiciled in the United States or located in any foreign country which, by treaty, convention, or law affords similar privileges to citizens of the United States,* and who is entitled to the exclusive use of any trade-mark and uses the same in commerce with foreign nations or with Indian tribes.

Any citizen or resident of this country wishing the protection of his trade-mark in any foreign country the laws of which require registration in the United States as a condition precedent.

Statutory Requirements. Every applicant for registration of a trade-mark must cause to be recorded in the Patent-Office—

The name, domicile and place of business or location of the firm or corporation desiring the protection of the trade-mark, and the residence and citizenship of individual applicants.

The class of merchandise and the particular description of goods comprised in such class to which the trade-mark has been appropriated.

A description of the trade-mark itself, with fac-similes thereof, and the mode in which it has been applied and used.

The length of time during which the trade-mark has been used by the applicant on the class of goods described.

A fee of $25 is required on filing each application, except in the cases hereinafter named.

The Application. An application for the registration of a trade-mark will consist of a statement or specification, a declaration or oath, and the fac-simile with duplicates thereof. The statement and declaration should be written on one side of the paper only.

These should be preceded by a brief letter of advice requesting registration and signed by the applicant.

The statement should announce the full name, citizenship, domicile, residence and place of business of the applicant (or, if the applicant be a corporation, under the laws of what state or nation incorporated), with a full and clear specification of the trade-mark, particularly discriminating between its essential and non-essential features. It should also state from what time the trade-mark has been used by the applicant, the class of merchandise and the particular goods comprised in such class

*The following is a list of the governments with which conventions for the reciprocal registration and protection of trade-marks have been entered into by the United States, with the dates of the respective conventions. The laws of Switzerland and the Netherlands being so framed as to afford reciprocal privileges to the citizens or subjects of any government which affords similar privileges to the people of those countries, the mere exchange of diplomatic notes, giving notice of the fact, accomplishes all the purposes of a formal convention.

Austria-Hungary	June 1, 1872
Belgium	July 30, 1869
Belgium.....	July 9, 1884
Brazil	Sept. 24, 1878
France	Apr. 16, 1869
German Empire	June 1, 1872
Great Britain.....	July 17, 1878
Italy.....	Mar. 19, 1884
Russia.....	June 27, 1868
Servia	Dec. 27, 1882
Spain.....	Apr. 19, 1883
Switzerland.....	May 16, 1883
The Netherlands.....	Feb. 16, 1883

The declaration with Great Britain is drawn so as to confer mutual trade-mark rights upon the subjects and citizens of each of the contracting parties throughout the dominions and possessions of the other. Citizens or residents of British colonies are therefore permitted to register their trade-marks under this treaty whenever it is satisfactorily shown that in the respective colonies similar protection is afforded to citizens of the United States.

The following governments are members of the International Union for the Protection of Industrial Property, created by the convention at Paris, of March, 1883, to which the United States acceded in 1887: Belgium, Brazil, the Dominican Republic, France, Great Britain, Guatemala, Italy, The Netherlands, Norway, Portugal, San Salvador, Servia, Spain, Sweden, Switzerland, Tunis.

The people of the French and Spanish colonies, Dutch East India colonies, and the British colonies of New Zealand and Queensland are entitled to the benefit of this convention.

to which the trade-mark is appropriated, and the manner in which the trade-mark has been applied to the goods.

The declaration should be in the form of an oath by the person or by a member of the firm or by an officer of the corporation making the application, to the effect that the party has at the time of filing his application a right to the use of the trade-mark described in the statement; that no other person, firm or corporation has a right to such use, either in the identical form or in such near resemblance thereto as might be calculated to deceive; that such trade-mark is used in lawful commerce with foreign nations or Indian tribes, one or more of which should be particularly named; and that it is truly represented in the fac-simile presented for registry.

Fac-Similes to be Filed. An applicant for registration of a trade-mark must in every case, which admits of it, furnish a drawing thereof which conforms to the rules for drawings of mechanical patents. If for any reason such drawing does not constitute a satisfactory fac-simile of the trade-mark, two copies of the trade-mark, as actually used, must be deposited in addition to the required drawing, to be preserved in the office for reference.

Proceedings in the Office. All applications for registration are considered in the first instance by the trade-mark examiner. An adverse decision by such examiner upon the applicant's right to registration will be reviewed by the Commissioner in person upon petition without fee.

No trade-mark will be registered unless it shall be made to appear that the same is used as such by the applicant in commerce between the United States and some foreign nation or Indian tribe, or is within the provisions of a treaty, convention or declaration with a foreign power, nor which is merely the name of the applicant, nor which is identical with a known or registered trade-mark owned by another and appropriated to the same class of merchandise, or which so nearly resembles some other person's lawful trade-mark as to be likely to cause confusion in the mind of the public or to deceive purchasers, or which is merely descriptive in its nature.

The statement may be amended to correct informalities or to avoid objections made by the office, or for other reasons arising in the course of examination; but no amendments will be admitted unless warranted by something in the statement or fac-simile as originally filed. In respect to amendments the established rules in regard to applications for patents will be observed. The declaration cannot be amended. If that filed with the application is faulty or defective, a substitute declaration may be filed.

In case of conflicting applications for registration, or in any dispute as to the right to use which may arise between an applicant and a prior registrant, the office will declare an interference, in order that the parties may have an opportunity to prove priority of adoption or right; and the proceedings on such interference will follow, as nearly as practicable, the practice in interferences upon applications for patents; but each applicant and registrant will be held to the date of adoption alleged in the statement filed with his application. On the petition of any party dissatisfied with the decision of the examiner of interferences, the case will be reviewed by the Commissioner without fee.

When these requirements have been complied with, and the office has adjudged the trade-mark lawfully registrable, a certificate will be issued by the Commissioner, under seal of the Interior Department, to the effect that applicant has complied with the law, and that he is entitled to the protection of his trade-mark in such case made and provided. Attached to the certificate will be a fac-simile of the trade-mark and a printed copy of the statement and declaration.

The protection for such trade-mark will remain in force for thirty years, and may, upon the payment of a second fee, be renewed for thirty years longer, except in cases where such trade-mark is claimed for and applied to articles not manufactured in this country, and in which it receives protection under the laws of any foreign country for a shorter period, in which case it will cease to have force in this country, by virtue of the registration, at the same time that the trade-mark ceases to be exclusive property elsewhere.

The right to the use of any trade-mark is assignable by an instrument in writing, and provision is made for recording such instrument in the Patent Office. But no such instrument or conveyance will be recorded unless the trade-mark shall have first been registered as provided by law; and it must be identified by its certificate number. No particular form of instrument is prescribed.

The *Official Gazette* of the Patent Office will contain a list of all trade-marks registered, with the name and address of the registrant, an illustration of the trade-mark, a brief statement of its essential features, and the particular description of goods to which it is applied.

Fees:

On filing an application for registration of a trade-mark	$25.00
For abstract of title:	
For the certificate of search	1.00
For each brief from the digests of assignments	.20
For copies of matter in any foreign language, for every 100 words or fraction thereof	.10
For translation, for every 100 words or fraction thereof	.50
For recording every assignment, agreement, power of attorney, or other paper, of 300 words or under	1.00
For recording every assignment, agreement, power of attorney, or other paper of over 300 words and under 1,000 words	2.00
For recording every assignment, agreement, power of attorney, or other paper of over 1,000 words,	3.00
For assistance to attorneys and others in the examination of records, one hour or less	.50
Each additional hour or fraction thereof	.50
For single printed copy of statement and declaration	.10
If certified, for the certificate, additional	.25
Single copy of the *Official Gazette*	.10
Annual subscription *Official Gazette*	5.00

REGISTRATION OF PRINTS AND LABELS.

Sections 3, 4 and 5 of the act of Congress relating to patents, trade-marks and copyrights, approved June 18, 1874 (18 Statutes at Large, p. 78) provide as follows:

SEC. 3. That in the construction of this act the words "engraving, cut, and print" shall be applied only to pictorial illustrations or works connected with the fine arts, and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office. And the Commissioner of Patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright of prints, except that there shall be paid for recording the title of any print or label not a trade-mark $6, which shall cover the expense of furnishing a copy of the record, under the seal of the Commissioner of Patents, to the party entering the same.

SEC. 4. That all laws and parts of laws inconsistent with the foregoing provisions be and the same are hereby repealed.

SEC. 5. That this act shall take effect on and after the first day of August, eighteen hundred and seventy-four.

The words "prints" and "labels" as used in this act so far as it relates to registration in the Patent Office are construed as synonymous, and are defined as any device, picture, word or words, figure or figures (not a trade-mark) impressed or stamped directly upon the articles of manufacture, or upon a slip or piece of paper, or other material, to be attached in any manner to manufactured articles, or to bottles, boxes and packages containing them, to indicate the contents of the package, the name of the manufacturer, or the place of manufacture, the quality of goods, directions for use, etc.

By the words "articles of manufacture" (to which such print or label is applicable by this act) is meant all vendible commodities produced by hand, machinery or art.

But no such print or label can be registered unless it properly belongs to an article of commerce, and be as above defined; nor can the same be registered as such print or label when it amounts to a lawful trade-mark, or when its use in connection with the article to which it is applied is arbitrary or fanciful.

To entitle the owner of any such print or label to register the same in the Patent Office, it is necessary that five copies of the same be filed, one of which copies shall be certified under the seal of the Commissioner of Patents, and returned to the registrant.

The certificate of such registration will continue in force for twenty-eight years.

It has been held in a United States circuit court that the use of a label in the sale of the merchandise it is intended to designate prior to the deposit of such label in the Patent Office amounts to a publication thereof (Marsh *et al. vs.* Warren *et al.*, XIV O. G., 678.) Since in the same decision the court held that in a suit for infringement of a registered label the bill must aver that the title and label were deposited before publication, it is evident that any such use will vitiate a registration subsequently effected.

The fee for registration of a print or label is $6, to be paid in the same manner as fees for patents.

The benefits of this act seem to have been originally confined to citizens or residents of the United States, but are extended by existing treaties to British, German, Italian and Belgian subjects.

BIBLIOGRAPHY. The bibliography of the United States patent system is extensive. The patent laws, rules of procedure and annual reports of the Commissioner of Patent afford a valuable insight into the actual working of the system, while *The Official Gazette of the United States Patent Office* is the most authoritative chronicle of all applications received and patents granted. *An Account of the Destruction by Fire of the Patent Office* (1877) is full of valuable historical data, and L. H. Campbell's *The Patent System* is a valuable work from the pen of one of the examiners. Turning to the more legal text-books, mention may be made of O. F. Bump's *Law of Patents, Trade-Marks and Copyright* (1877); R. M. Clapp's *Law in Patents and Decisions of the Courts* (1885); C. E. Coddington's *Digest of Law of Trade-Marks* (1877); H. C. Merwin's *Patentability of Inventions* (1883); C. S. Whitman's *Patent Laws and Practice* (1879); H. T. Fenton's *Law of Patents for Designs* (1889); G. H. Knight's *Patent Office Manual* (1893); and W. C. Robinson's valuable and voluminous *Law of Patents for Useful Inventions* (3 vols., 1890). The legal text-books relative to the English law and practice of patents are mentioned in Sonnenschein's *Best Books.*

PATER, Walter Horatio, an English critic in literature and art; born in London, Aug. 4, 1839. He was educated at King's School, Canterbury, and at Queen's College, Oxford, taking a second-class in classics in 1862. Three years later he was elected a fellow of Brasenose College, and there, for a time, acted as dean and lecturer. He then traveled on the European continent. In Italy, especially, with a student's enthusiasm, he familiarized himself with the scenes and historic mementoes of the classical and mediæval eras of which he was afterward exquisitely to write. Pater began his literary career by contributing a paper on Coleridge's works to the *Westminster Review*, and in 1873 he published a series of essays on art and letters, entitled *Studies in the History of the Renaissance.* This was followed, in 1885, by *Marius the Epicurean, His Sensations and Ideas*, being the imaginary mental history of a youth educated in Roman paganism and perplexed with the problem of life. In 1887 appeared four artistic stories under the title of *Imaginary Portraits*, and in 1889 a volume of appreciative literary criticism, with an essay on style, entitled *Appreciations. Plato and Platonism* followed in 1893, and after his death appeared *Greek Studies* (1894), and *Gaston de Latour* (1896), an unfinished romance of much splendor of phrase and setting. Mr. Pater's death, at Oxford, July 30, 1894, at a comparatively early age, was a great loss, for he was a writer of subtle and searching insight, while his literary style has given new attractions to art, as well as a new delight to lovers of Greek ideals and the Greek spirit.

PATERNITY. See Medical Jurisprudence, Vol. XV, p. 790.

PATERNOSTER, a tackle. See Angling, Vol. II, p. 33.

PATERSON, the "Lyons of America," a city of considerable size and importance in New Jersey. It has exceptional railroad facilities by the New York, Lake Erie and Western, New York, Susquehanna and Western and the Delaware, Lackawanna and Western railways; is connected with the Delaware River by canal, and a proposal has been made to render the Passaic River navigable to Paterson. The returns of 1900 showed 73 industries in 995 establishments, with $43,510,481 in capital, giving employment to 31,432 persons, paying $14,430,537 and having annual products worth $52,287,975. Of these industries, silk was easily the most important, having 136 establishments, furnishing employment to 16,545 persons, paying $7,027,561 in wages, having a capital of $19,025,564, and producing goods to the value of $26,006,156. Of the many other important industries the most important are foundries and machine-shops, employing over 4,000 hands; dyeing and finishing works; iron and steels works; manufactures of jute and jute goods; malt liquor establishments; linen-thread plant; and numerous building trades.

The assessed valuation of city property in 1900, at about 30 per cent of the market value, was $38,824,280; the municipal debt, $1,605,993; and city taxes limited to 2½ per cent of total valuation. The city has good paved and macadamized streets, 35 miles of electric street-railways, electric lights, water-works, paid fire department, good school system embracing 17 well-equipped buildings, 200 teachers, 64 churches, 31 public halls, 2 parks, large public library, 2 large hospitals, 2 orphan asylums, old ladies' home, 3 national banks with combined capital of $850,000, savings and private banks, 6 daily and 7 weekly newspapers and a monthly periodical. Population 1890, 78,347; 1900, 105,171. See also Paterson, Vol. XVIII, p. 364.

PATHROS. See Egypt, Vol. VII, p. 607.

PATKUL, Johann Reginald (1660–1707). See Charles XII, Vol. V, p. 364.

PATMORE, Coventry Kearsey Deighton, a British poet; born in Woodford, England, July 23, 1823, the son of P. G. Patmore, author of *Literary Reminiscences.* He published a volume of *Poems* in 1844, and three years later joined the staff of librarians in the British Museum, where he remained till 1868. Soon after he settled at Hastings, where he built a large Catholic church. His second volume of poems, *Tamerton Church Tower*, etc., prepared the way for his greatest work, *The Angel in the House*, an exquisite and sincere poem of love from the domestic side, which has had a great popularity. Patmore edited the anthology entitled *The Children's Garland from the Best Poets;* the *Autobiography* of Barry Cornwall; the posthumous poems of his son, Henry Patmore; and *Florilegium Amantis*, a selection from his own poems (1888). Died Nov. 26, 1896.

PATON, John Gibson, a Scotch missionary; born in the parish of Kirkmahoe, May 24, 1824. After some experience in Glasgow City Mission, he offered

his services for the foreign mission-field in connection with the Reformed Presbyterian Church, and in 1858 became missionary in Tanna, New Hebrides. Here he labored, amidst trials and difficulties, till 1862, when he was forced to leave, owing to the hostility of the natives. In the interest of the New Hebrides mission he visited Australia in 1862–63, Great Britain in 1863–64, and the Australian colonies in 1865, when he became missionary on the neighboring island of Aniwa, the whole population of which becoming Christian. He again visited Great Britain and North America in 1892–94. He was a delegate to the Pan-Presbyterian Church in Belfast in 1884, and at Toronto in 1892. His autobiography, edited by his brother, was published in 1889.

PATON, Sir Joseph Noel, a Scotch historical painter; born in Dunfermline, Dec. 13, 1821; and studied for a time at the Royal Academy, London. His cartoon sketch, *The Spirit of Religion*, gained one of the three premiums at the Westminster Hall competition in 1845. Two years thereafter, his oil picture of *Christ Bearing the Cross* and his *Reconciliation of Oberon and Titania* jointly gained the prize of $1,500. *Dante Meditating the Episode of Francesca* was exhibited in Edinburgh in 1852; *The Dead Lady*, in 1854; and *The Pursuit of Pleasure*, in 1855. Among his other pictures are *Home from the Crimea; In Memoriam*, a scene from the Indian Mutiny; and a series of six pictures-illustrations of *Dowie Dens o' Yarrow*. He was queen's limner for Scotland, was the author of two volumes of poems, and received the degree of LL.D., from Edinburgh. He died at Edinburgh, Dec. 26, 1901. R.C.A.

PATRICK, Marcena Richard, an American soldier; born in Jefferson County, N. Y., March 15, 1811. He was graduated from the United States Military Academy in 1835. In 1847 he was promoted to captain and for service in the Mexican War was brevetted major. He resigned from the army in 1850 and in 1859 was appointed president of the New York State Agricultural College. In the Civil War he was appointed brigadier-general, March 17, 1862. He commanded a brigade in Gen. Doubleday's division at the battle of Antietam and was provost-marshal general of the combined armies before Richmond. After the war he was appointed governor of the National Soldiers' Home in Dayton, Ohio. He died there July 27, 1888. W.M.C.

PATRIOTIC SOCIETIES. See Colonial Societies and Genealogies, in these Supplements.

PATRIPASSIANS. See Jesus, Vol. XIII, p. 681.

PATROCLUS. See Achilles, Vol. I, pp. 89, 90.

PATRONAGE. See Advowson, Vol. I, p. 162.

PATRONS OF HUSBANDRY. See Farmers' Organizations, in these Supplements.

PATROONS. See New York, Vol. XVII, p. 466.

PATTEE, Fred Lewis, an American educationist and author; born in Bristol, New Hampshire, March 22, 1866; educated at New Hampton Institution and at Dartmouth College, from which latter institution he graduated in 1888. He was the poet of his class. After serving as principal of high schools in Eatontown, New Jersey, and in Mendon, Massachusetts, he was, in 1890, made principal of Coe's Academy, Northwood, New Hampshire, where he served four years. After 1894 he was professor of English and rhetoric in the Pennsylvania State College. He published *Literature in the Public Schools* (1891); *The Wine of May, and Other Lyrics* (1893); *Pasquaney*, sketches of a New Hampshire lake (1894); *A History of American Literature, with a View to the Fundamental Principles Underlying Its Development* (1896). He contributed the articles American Literature and Canadian Literature, in these Supplements.

PATTEN, Simon Nelson, political economist; born in Sandwich, Ill., May 1, 1852. He was educated at the Northwestern University, Evanston, Ill., and at the University of Halle, Germany, where he graduated Ph.D. in 1878. For ten years after his return home he taught in the Illinois and Iowa public schools, and in special sociological and economic branches, and in 1888 was elected to the chair of political economy in the University of Pennsylvania. He is the author of valuable works on economics, including *Premises of Political Economy* (1885); *The Consumption of Wealth* (1889); *The Theory of Social Forces* (1896), etc. G.J.H.

PATTERSON, Daniel T., an American naval officer; born in New York, March 6, 1786. He entered the navy in 1800, and was attached to the *Philadelphia* when she surrendered to Tripolitan gunboats in October, 1803. He remained a prisoner in Tripoli until peace was concluded in 1805. In 1807 he was promoted lieutenant, and in 1813 master commandant. In 1814 he commanded the naval forces at New Orleans, and co-operated so ably with Gen. Jackson that he received the thanks of Congress. He was promoted captain in February, 1815, was navy commissioner, 1828–32, and in command of a squadron in the Mediterranean, 1832–35. He died, while in command of the navy yard at Washington, D. C., Aug. 15, 1839. E.E.T.

PATTERSON, Carlisle Pollock, an American civil engineer and naval officer, son of D. T. Patterson; born in Shieldsboro, Miss., Aug. 24, 1816. He entered the navy as midshipman in 1830, and after a foreign cruise graduated as a civil engineer at Georgetown College. From 1836 to 1845 he was a member of the United States Coast Survey. In 1849 he retired from the navy and entered the merchant service, commanding the Pacific mail steamship *Oregon* from 1850 to 1860. He was hydrographic inspector and superintendent of the United States Coast Survey from 1861 to 1881. He was also a member of the United States Lighthouse Board and for 20 years was editor of the *Annual Reports* of the United States Coast and Geodetic Survey. He died in Washington, D. C., Aug. 15, 1881. W.M.C.

PATTERSON, Robert, an American soldier; born in Cappagh, County Tyrone, Ireland, June 12, 1792. He was educated in the public schools of Philadelphia, and served as a 1st lieu-

tenant in the War of 1812. He became a prominent merchant of Philadelphia, and was one of the "five Colonel Pattersons" who nominated Jackson for the Presidency. He served in the Mexican War and at the outbreak of the Civil War was made a major-general and placed in command of the Department of Washington. When Gen. McDowell's army advanced into Virginia, Patterson was instructed to remain at Winchester to hold in check the superior forces of the Confederate Gen. J. E. Johnston. His failure to do this, in consequence of which Johnston, reenforcing Beauregard on the battlefield of Bull Run, July 21, 1861, gave the victory to the Confederates, exposed him to severe criticism. On July 27, 1861, he was honorably discharged from the service. In 1865 he published *A Narrative of the Campaign in the Valley of the Shenandoah* in explanation of his conduct of affairs at Bull Run. He died in Philadelphia, Pa., Aug. 7, 1881.

W.M.C.

PATTERSON-BONAPARTE. See BONAPARTE, ELIZABETH PATTERSON, in these Supplements.

PATTI, ADELINA MARIA CLORINDA, prima donna; born of Italian parents in Madrid, Spain, Feb. 19, 1843. In the following year her parents settled in New York city, where her father, Salvatore Patti, became one of the managers of the Italian Opera House in Chambers street. Adelina was first taught music by her half-brother, Ettore Barili, and at the age of seven years began her public career by appearing in the concerts at Tripler's Hall, New York. In 1855, at the age of twelve, she made a tour through the West Indies, being accompanied by the pianist, Gottschalk. On Nov. 24, 1859, she made her first appearance as an operatic singer in New York in the Italian opera, *Lucia di Lammermoor*. She was at once received with great cordiality. Later she devoted two years to study, and then at the age of eighteen, made her *début* as *Amina* in *La Sonnambula* at the Italian Opera House in Covent Garden, London, where she achieved an enthusiastic success, the ablest critics recognizing her as a singer of the highest excellence. In 1862–68 she sang in Paris at the Theatre Italien. While there she created the title rôle in Verdi's *La Jeann d'Arc*, and appeared for the first in *Il Trovatore*. She made many tours through Europe and Great Britain, which brought her world wide fame. In 1881–84 she toured the United States, receiving $5,000 per night for her services. In 1888–89 she traveled in South America at the same remuneration. She revisited the United States in 1892, 1893 and 1903. In December, 1894, she sang before Queen Victoria at Windsor, receiving in reward an autograph portrait of the queen and an ornament of rubies and diamonds on which were the letters V.R.I.

MADAME PATTI.

G.J.H.

PATTI, CARLOTTA, an Italian vocalist, a sister of Adelina Patti; born in Florence, Italy, June, 1840. She received early instruction as a pianist but later devoted her talents to vocal music, and made her first appearance in concert in New York City in 1861. She sang in London and the leading continental cities in 1862 and 1863. She married Ernest de Munck, a celebrated violoncellist, Sept. 3, 1879. Her voice was a very high, flexible soprano, and but for an unfortunate lameness she would have achieved success upon the operatic stage. Her last concert appearance in New York was in 1875. She died in Paris, France, June 27, 1889. W.M.C.

PATTISON, MARK, an English scholar and author; born in Hornby, Yorkshire, in 1813. He received his bachelor's degree from Oriel College, Oxford, in 1836, and three years later was elected to a fellowship in Lincoln College. He contributed to the columns of the *Quarterly*, the *Westminster* and the *Saturday Review*. His *Report on Elementary Education in Protestant Germany* appeared in 1859, and his paper on *Tendencies of Religious Thought in England, 1688–1750*, in *Essays and Reviews* in 1860. In 1861 he was elected rector of his college, and the next year married Emilia Frances Strong, afterward Lady Dilke, who helped him to make Lincoln a social and intellectual center. Besides the books already named, he published *Suggestions on Academical Organization* (1868); Pope's *Essay on Man* (1869); and *Satires and Epistles* (1872); *Isaac Casaubon, 1559–1614* (1875); *Milton*, of the English Men of Letters Series (1879); the *Sonnets of Milton* (1883); and *Sermons* (1885). A volume of his *Memoirs* was published in 1885, and a collection of his *Essays* in 1889. He died at Harrowgate, July 30, 1884.—His sister, DORA WYNDLOW, a nurse, was born in Hauxwell, Jan. 16, 1832. The heroic devotion of Florence Nightingale kindled her enthusiasm, and in 1861 she started a life of labor for others as school teacher at Little Woolston. In 1864 she joined the sisterhood of the Good Samaritans at Coatham, and labored as nurse, first at North Ormesby, and in 1865 at Walsall. She braved the horrors of small-pox in 1868, and again in 1875, but her uncommon strength gave way, and she died in Walsall, Dec. 24, 1878. The workingmen erected a monument to her memory in 1886. *Revised by* R.W.C.

PATTISON, ROBERT EMORY, lawyer; born in Quantico, Somerset Co., Md., Dec. 8, 1850; was educated at the Central High School of Philadelphia; admitted to the bar in 1872; comptroller of Philadelphia in 1877–82; Democratic governor of Pennsylvania in 1882–86 and 1891–95; defeated for governor in 1902; died Aug. 1, 1904. G.J.H.

PATTON, FRANCIS LANDEY, theologian; born in Warwick Parish, Bermuda, Jan. 22, 1843; was graduated at the University of Toronto, Canada, and at Princeton Theological Seminary in 1865, and was ordained a minister of the Presbyterian Church, June 1 of the same year. He

was then installed pastor of the Eighty-fourth Street Presbyterian Church of New York. He remained there till 1867 when he took charge of the Presbyterian Church at Nyack, N. Y. After spending four years in this pastorate he was called to the South Presbyterian Church of Brooklyn. He remained in Brooklyn one year only, being called, in 1872, to the chair of theology at the Seminary of the Northwest (now McCormick Seminary), Chicago. He held this professorship till 1881, and in connection with it was pastor of the Park Presbyterian Church of Chicago from 1874. He was chosen professor of relations of philosophy and science to the Christian religion in 1881 at Princeton Theological Seminary. This chair had been founded and endowed for him by the late Robert L. Stewart. In connection with this professorship he also accepted that of ethics in Princeton University in 1886. Two years afterward he was elected president of the university, resigning his chair in the seminary. He remained president of the university till 1902, when he resigned and was elected president of the Princeton Theological Seminary. G.J.H.

DR. PATTON.

PATUXENT RIVER. See MARYLAND, Vol. XV, p. 609.

PAUL, EPISTLES OF. See PASTORAL EPISTLES, Vol. XVIII, pp. 425–440; and the specific names of his other epistles, as GALATIANS, CORINTHIANS, etc., in this ENCYCLOPÆDIA.

PAULDING, a village and the capital of a county of the same name, west-northwestern Ohio, 40 miles N.W. of Lima and about 60 miles S.W. of Toledo, on the Cincinnati, Jackson and Mackinaw railroad. It is the center of a region producing corn, wheat, oats, butter, hay, wool, live-stock, and ship timber, and has manufactures of lumber. Pop. 1900, 2,080.

PAULDING, JOHN, an American soldier and patriot; born in New York City in 1758. At the outbreak of the Revolution he enlisted in the Federal army and served throughout the war. He was three times taken prisoner and thrice escaped. He was one of the captors of Major André, and as a reward received a medal from Congress and a pension of $200. He died in Yorktown, Feb. 18, 1818. In 1827 a monument was erected over his remains at Peekskill, N. Y., and one was also erected at Tarrytown, N. Y., on the spot where André was captured. It has the figures of Paulding and his companions searching André for secret documents. W.M.C.

PAULIST FATHERS, an American Roman Catholic missionary society, organized in New York City in 1858, and approved by Pope Pius IX. The society was originally and for some years afterward composed exclusively of priests, who, like its founder, Father Isaac Thomas Hecker, were converts from Protestantism. They take no special vows, and can leave the order at will. They aim to adapt themselves to the usages and needs of American life. They are known collectively as *The Congregation of St. Paul the Apostle.*

PAULOWNIA, a genus of Japanese trees, of a single species, *P. imperialis* belonging to the family *Scrophulariaceæ*, or figworts. It is cultivated for ornament, has large heart-shaped catalpa-like leaves, violet flowers in a large terminal panicle, and turgid pods filled with numerous winged seeds.

PAULSEN, FRIEDRICH, a German philosopher; born at Langenhorn, Schleswig, July 16, 1846; educated at the universities of Erlangen, Bonn and Berlin; in 1878, professor extraordinary, and in 1893 professor ordinary of philosophy and pedagogy at the University of Berlin. Of his works are to be mentioned *Das Realgymnasium und die Humanistische Bildung* (1889); *System der Ethik mit einem Umriss der Staats-und Gesellschaftslehre* (1889); *Immanuel Kant, Sein Leben und Seine Lehre* (1899); *Schopenhauer, Hamlet, Mephistopheles, Drei Aufsätze zur Naturgeschichte des Pessimismus* (1900); *Philosophia Militans, Gegen Klerikalismus und Naturalismus* (1901); *Die Deutschen Universitäten und das Universitäts-Studium* (1902); *Einleitung in die Philosophie* (9th ed., 1903.). G.A.S.

PAULUS, ÆGINETA. See ÆGINETA, Vol. I. p. 164.

PAUNCEFOTE, SIR JULIAN, a British jurist and statesman; born in Munich, Bavaria, Sept. 13, 1828; and educated at Paris, Geneva, and at Marlborough College. He was called to the bar at the Inner Temple in 1852, joined the Oxford circuit, and also practiced as a conveyancer. He was appointed attorney-general of Hongkong in May, 1865; acted as chief justice of the supreme court in 1869; and in 1874 was knighted by patent. In 1873 he was appointed chief justice of the Leeward Islands; in 1874 Assistant Under-Secretary of State for the Colonies; and in 1876 Assistant (legal) Under-Secretary of State for Foreign Affairs. He was created a C.B. and K.C.M.G. in 1880, and in 1882 became Permanent Under-Secretary for Foreign Affairs. In 1885 he received the grand cross of St. Michael and St. George. In 1888 he became British ambassador at Washington; in 1892 received the grand cross of the Bath for his services; and in 1893 was made ambassador extraordinary and plenipotentiary to the United States. In 1894, during a visit home, he was sworn of the Privy Council. In 1899 he was a member of the International Peace Conference at The Hague. He died May 24, 1902.

LORD PAUNCEFOTE.

PAUPERISM. See POOR-LAWS, Vol. XIX, pp. 476–496; and in these Supplements.

PAUROPIDÆ. See CENTIPEDES, Vol. V, p. 296.

PAVEMENTS. See ROADS AND STREETS, Vol. XX, pp. 597–604.

PAVY, OCTAVE, famous naturalist and explorer· one of the heroes of Arctic adventure; was of French ancestry, and was born in New Orleans, Louisiana, in June, 1844. He was educated in Paris as a physician and naturalist, and then returned to America to practice his profession. He became interested in Arctic research, and was commissioned as acting assistant surgeon and was sent north with the Greely expedition to Lady Franklin Bay—one of the ring of circumpolar observation stations. He did much work as a naturalist, made some valuable collections, and discovered a river and a valley which were named for him, but his chief work was done in keeping his comrades alive at Cape Sabine when provisions failed and disease and starvation attacked them. By heroic exertions he saved the lives of most of the party, but he himself died a few days before relief reached the camp, in June, 1884. W.F.J.

PAWNBROKING, a system of money-lending in which the borrower "pledges" or gives as security, his personal or household effects. It has existed in some form among all peoples from earliest times, but its early history is so closely allied with that of usury and banking that it cannot be separated from them, and its evolutionary processes from the time of the Mosaic law to that of the Romans, are unknown. It is probable, however, that banking developed out of pawnbroking.

Up to the fifteenth century the business had been largely carried on by the Jews, but on account of the extortionate rates of interest exacted by them, and influenced perhaps by religious prejudice, European governments began to found or sanction quasi-benevolent institutions, called *monts-de-piété* which lent money at low rates of interest, or gratuitously. These pawn-banks exist in most of the European countries to-day. In Belgium the interest varies from four to six per cent. a year; and in Holland, from five to eighteen per cent. In Germany the maximum rate is two per cent. a month for sums of $7.50 or less, and one per cent. on all larger sums; and in France the maximum rate is six per cent., with a fixed charge of one per cent.

In England, in 1199, the legal rate of interest was fixed at ten per cent., but as the Jewish brokers continued to charge from forty-five to sixty-five per cent., they were, in 1290, expelled from the country. Many Lombard merchants from Italian cities also carried on the pawnbroking business in England, among them being members of the Medici family, from whose armorial bearings the sign of the three golden balls is said to have been derived. These merchants were also expelled from the country, in 1530, for charging exorbitant rates of interest. During the reigns of James I, Charles II, William III, and George I, many plans were tried for regulating the pawnbroking business, but governmental proprietorship, such as prevailed in continental countries, was never adopted.

"Of the history of pledges or pawns in the United States," says Tyler in his work on *Usury*, "there is but little recorded or to be found in books upon the subject. The practice of pledging personal property for the security of claims dates back to the earliest settlements in the country, and the regular business of pawnbroking has been carried on as long, sometimes without the express sanction of statute except as is regulated by the authorities of cities, or generally controlled by rules enforced according to the common law."

In most of the states annual license fees, varying from $25 to $400, are exacted; and in many states bonds, of $300 to $10,000, are required. The monthly rate of interest prescribed by law varies from two to ten per cent., and extra charges are forbidden. In the cases of New York and New Mexico, however, the interest restriction is rendered practically nugatory by the fact that extra charges are not limited. The legal rate of interest in Connecticut is twenty-five per cent. annually; in New Mexico, ten per cent. monthly; and in New York (the law applies only to cities of 200,000 or over) on sums not exceeding $100 three per cent. per month for the first six months and two per cent. per month thereafter, and on sums over $100 two per cent. per month for the first six months and one per cent. thereafter.

Eight states limit the length of the loan, the shortest and longest periods being four months in Massachusetts, and one year in New Jersey, New York, and the District of Columbia. Nearly all of the states having laws on the subject require that unredeemed articles must be disposed of at auction at the expiration of the prescribed time, and the surplus realized (if any) above the amount of the loan and the interest, returned to the owner. In Maine, Idaho, Colorado, Alabama, Texas and Virginia, however, this provision is rendered practically inoperative from the fact that no limit is set to the length of the loan. Vermont is the only state that has made no law concerning pawnbroking, but in several states the only enactments made by the legislatures, have been those giving the power of regulating the business to the municipalities.

Although the United States, like England, has avoided governmental participation in the pawnbroking business, there are in most of the large cities of the country, loan associations which correspond in many respects to the *monts-de-piété* of Europe. R.W.C.

PAWNEE, a city and the capital of Pawnee County, northeastern Oklahoma, on Bear Creek. Its nearest railroad station is Red Rock, on the Atchison, Topeka and Santa Fé railroad, about 25 miles northwest. Perry, 30 miles westward, is the nearest important city. Pawnee is of very recent growth, and in 1900 had a population of 1,464.

PAWNEES OR PANI, a tribe of North American Indians, comprising the four tribes of Lanks, Republican Panis, Grand Panis and Tapage Panis. Their original location was in the region of the Platte River. They constantly fought the Sioux, the Sacs and Foxes, the Arapahoes and the Kiowas. In

1833 they surrendered their lands south of the Nebraska to the United States government, and for a time lived peaceably on a reservation north of that river. Later, defeated by the Sioux, they retreated to the south of the Nebraska, and in 1876 moved into the Indian Territory. In 1870 they numbered about 3,000; in 1885, 1,045; and in 1895, 710. See also INDIANS, Vol. XII, pp. 865, 871.

PAWNEE CITY, a village and the capital of Pawnee County, southeastern Nebraska, about 60 miles S.E. of Lincoln, on the Burlington and Missouri River in Nebraska and the Chicago, Rock Island and Pacific railroads. It is situated in a farming and grazing district, producing corn, wheat, hay, butter, pork and live-stock. Building-stone, timber, peat and fire-clay are found. Population 1890, 1,550; 1900, 1,969.

PAW PAW, a village and the capital of Van Buren County, southwestern southern peninsula of Michigan, on the Paw Paw River, and on the South Haven and Eastern railroad, 20 miles W.S.W. of Kalamazoo. It has an excellent water-power, flour-mill, large creamery, foundry and machine-shops, and a trade in wheat, lumber and fruit. Population 1890, 1,391; 1900, 1,465.

PAWPAW. See PAPAW, in these Supplements.

PAWTUCKET, a city of Rhode Island, on Pawtucket River, about 4 miles N.E. of Providence. In 1890 Pawtucket had two lines of railways, the New York and New England and the New York, New Haven and Hartford. The returns for the year 1900 showed 70 industries, in 534 establishments, capitalized at $22,399,187, employing 13,328 persons, to whom were paid $6,011,896, and turning out products valued at $24,080,328. The leading industry is the manufacture of cotton goods, including cotton thread. Others include the manufacture of hosiery and knit-goods, dyeing and finishing of textiles, one establishment alone turning out 20,000,000 yards of calico annually; manufacture of foundry and machine-shop products; slaughtering and meat-packing. There is a large shipping trade in coal, lumber, bricks, cement, etc. The city has a public park, laid out at a cost of almost $1,500,000; a public library, good public schools, three national banks with combined capital of $800,000, and a like number of savings banks with aggregate deposits of over $3,000,000; street-railways and electric-light plants, and three daily and four weekly newspapers. Population 1890, 27,633; 1900, 39,231. See also PAWTUCKET, Vol. XVIII, p. 450.

PAXTON, a city and the capital of Ford County, northeastern central Illinois, 49 miles E. of Bloomington, and about 100 miles S.S.W. of Chicago, on the Illinois Central and the Lake Erie and Western railroads. It is an important shipping-point for farm produce and live-stock, has brick and tile works, carriage and plow factories and a flour-mill. The city has water-works and electric-light plant, and is the seat of Rice Collegiate Institute, a co-educational institution for secondary instruction, established by the Congregationalists in 1878. Population 1890, 2,187; 1900, 3,036.

PAYER, JULIUS, an Austrian painter and explorer; born near Teplitz, Austria, Sept. 1, 1842. He was educated at the military college of Neustadt, and entered the Austrian army in 1859. While stationed in Italy he explored several groups of Alpine mountains. In 1870, with Weyprecht, he directed an Austrian polar expedition which penetrated the sea between Nova Zembla and Spitzenbergen. In 1872 Payer and Weyprecht discovered the archipelago which they called Franz Josef Land in honor of the emperor. In 1874 Payer resigned from the army and studied art. His most celebrated paintings are *The Bay of Death*, *The Death of Franklin*, *Abandoning the Ship*, and *Never to Return*. In 1876 he published an account of his researches. (See also POLAR REGIONS, Vol. XIX). W.M.C.

PAYN, JAMES, novelist; was born at Cheltenham, England, on February 28, 1830, and was educated at Eton, Woolwich and Cambridge. Immediately upon his graduation from the university in 1854, he began a most successful literary career. In 1858 he became editor of *Chambers's Journal*, and for years wrote exclusively for it. In 1882 he became editor of the *Cornhill Magazine*. He wrote more than a hundred volumes of fiction, including some of the most popular novels of the time. Among them may be named *Lost Sir Massingherd; By Proxy; The Luck of the Darrells; The Talk of the Town; Gwendolyn's Harvest*, etc. He also wrote *Some Literary Recollections* and *Gleams of Memory*, the last being an autobiography. He died in London on March 25, 1898. W.F.J.

PAYNE, HENRY B., legislator; born in Hamilton, N. Y., Nov. 30, 1810; was graduated at Hamilton College in 1832; admitted to the bar in Cleveland, O., in 1834; member of the state senate in 1849–50; several times a delegate from Ohio to national Democratic conventions; was elected to Congress in 1874, and to the United States Senate in 1884; member of Electoral Commission in 1876. He was a candidate for the Presidential nomination in 1880. He died in Cleveland, O., Sept. 9, 1896. G.J.H.

PAYNE, HENRY C., appointed Jan. 1902, U.S. postmaster-general in President Roosevelt's cabinet, was a well-known publicist in Milwaukee, Wis., recently receiver of the Northern Pacific R. R. Born at Ashfield, Mass., Nov. 23, 1843; he removed to Milwaukee in 1863. Died October 4, 1904.

PAYNE, JOHN, poet; born in London, England, Aug. 23, 1842; studied law and became a solicitor in 1867. His fame, however, rests on his literary work. His publications include *The Masque of Shadow; Intaglios; Songs of Life and Death; Lautrec; New Poems*, and *Francis Villon: A Biographical Study*. He also published translations of the *Poems of Francis Villon;* of the *Rubaiyat of Omar Khayyám*, and of the *Arabian Nights Entertainments*. Mr. Payne became noted for his proficiency in Oriental languages from which he has largely translated. G.J.H.

PAYNE, JOHN HOWARD, an American actor and dramatist, author of "Home, Sweet Home"; born in New York city, June 9, 1792. At the age of 15 he left his home in Easthampton, N.

Y., and spent several months in Boston. He then became a clerk in a New York counting house, meanwhile editing *The Thespian Mirror* He studied for two years at Union College, and in 1809 made his first appearance on the stage as Young Norval at the Park Theatre, New York. In 1812 he went to England where he appeared at the Drury Lane Theatre, London, and made numerous provincial tours. While in London he wrote several dramas adapted from the French, among them *Clari, or the Maid of Milan*, in which appeared the song *Home, Sweet Home.* Payne knew intimately many English literary celebrities and corresponded with Coleridge and Lamb. In 1818 he brought out a successful tragedy, *Brutus*, in which he would have taken the title rôle but for the objections of his manager Kean, who became famous in the part. In 1826 he was the editor of *The Opera Glass.* He returned to New York in 1832 and from 1841 to 1845 he was United States Consul at Tunis, Africa. He returned there in 1851 and died there April 10, 1852. In 1883 his remains were removed to Washington, D. C., and interred in Oak Hill Cemetery, where a monument has since been erected. W.M.C.

PAYSON, a city of Utah County, central Utah, near the southern end of Utah Lake, on the Rio Grande Western and Union Pacific railroads, 66 miles S. of Salt Lake City. It is a trade center of a mining, agricultural and dairying region, and has manufactures of furniture. Population 1890, 2,135; 1900, 2,636.

PAZAND MSS. See PAHLAVI, Vol. XVIII, p. 140.

PAZ-SOLDAN, PEDRO, a Peruvian poet; born in Lima in 1839. In 1850 he went to Europe to pursue literary studies at Madrid, Paris and Rome. After returning home in 1863 he served in various government offices at Lima, and was sometimes sent abroad in a diplomatic capacity. To the Peruvian journals he contributed many sketches of travels and manners. His *Poesias Peruanas* (1867) give graphic pictures of the people and scenery of Peru. His *Chispazos* is a little volume of sonnets and epigrams. He also published a *Diccionario de Peruanismos*, in which he illustrated the variations of Peruvian speech from pure Castilian.

PEABODY, a city of Marion County, southeastern central Kansas, 18 miles N.E. of Newton and about 50 miles S.W. of Emporia, on the Atchison, Topeka and Santa Fé and Chicago, Rock Island and Pacific railroads. It is in a rich agricultural and cattle-raising district, and the most important shipping-point in the state for corn-fed cattle and hogs; is the seat of the Kansas silk station; and has a foundry, windmill factory, creameries and flour-mills. Population 1890, 1,474; 1900, 1,369.

PEABODY, a town in Essex County, Massachusetts, on the Boston and Maine railroad. Population 1890, 10,158; 1900, 11,523. See PEABODY, Vol. XVIII, p. 452.

PEABODY, ANDREW PRESTON, an American clergyman and author; born in Beverly, Mass., March 19, 1811. He was graduated at Harvard College in 1828, finished his course of study at the Cambridge Divinity School in 1832, remained as tutor at Cambridge one year after, and was ordained pastor of the South Congregational Church in Portsmouth, N. H., in October, 1833. He was professor of Christian morals at Harvard from 1861 to 1881. In 1862 and 1868–69 he was acting president of Harvard. He was editor of the *North American Review* from 1852 to 1861, and was also editor of the *Christian Register* for several years. He wrote upward of 50 volumes, including *Lectures on Christian Doctrine* (1844); *Sermons of Consolation* (1847); *Conversation: Its Faults and Its Graces* (1856); *Christianity the Religion of Nature* (1864); *Reminiscences of European Travel* (1868); *Christian Belief and Life* (1875); *Harvard Graduates Whom I Have Known* (1890). As a critical Biblical scholar and acute reasoner, he stood in the front rank of the clergymen of letters of New England. He died in Cambridge, Mass., March 10, 1893. W.M.C.

REV. A. P. PEABODY.

PEABODY, ELIZABETH PALMER, an American educator; born in Billerica, Massachusetts, May 16, 1804; sister of Mrs. Nathaniel Hawthorne and Mrs. Horace Mann; taught in Bronson Alcott's school. She was one of the first to introduce into the United States the kindergarten system, and published a number of works, among which are *The Kindergarten in Italy* (1872); *Letters to Kindergartners* (1886); *Æsthetic Papers* (1849); *Chronological History of the United States* (1856); *Last Evening with Allston, and Other Papers* (1887); and edited Mrs. Mann's *Guide to the Kindergarten* (1877). She died in Jamaica Plain, Massachusetts, Jan. 3, 1894.

PEABODY, FRANCIS GREENWOOD, clergyman and educator; born in Boston in 1847; was graduated at Harvard University in 1869 and at its Divinity School in 1872. In 1880–86 he was Parkman professor of theology at the latter institution, and in the latter year became Plummer professor of Christian Morals at Harvard University. He is the author of *Short Addresses to Young Men on Personal Religion; Jesus Christ and the Social Question*, etc. G.J.H.

PEABODY EDUCATION FUND. In 1867, George Peabody (q.v., Vol. XVIII, p. 452) established a fund of $2,100,000, increased in 1869 to $3,384,000, to be devoted to education in the Southern states of the Union. The fund was placed under the control of 16 trustees. The general agent of the fund, with headquarters at Washington, District of Columbia, has charge of the distribution of the fund in the Southern states. In its earlier history, the chief aim of the fund was to encourage and secure the establishment of public school systems for the free education of all children. That having

been accomplished, the income of the fund is now used for the training of teachers through normal schools and teachers' institutes. Up to October, 1889, the fund had furnished $1,800,000 in aid of schools. For 1889–90 the fund stood $2,075,175 in good securities and $607,000 in "inactive" bonds.

PEACE PRESERVATION ACT. See HOME RULE, in these Supplements.

PEACE RIVER, a large river of Canada. It rises in two branches, in the Rocky Mountains, in northern British Columbia, and flows northeast to the outlet of Lake Athabasca, where it takes the name of Slave River, turns north and empties into Great Slave Lake by five widely separated mouths. The delta thus formed is, with that of the Athabasca River, the most fertile part of the country. The river has a length of about eight hundred miles, but it is much encumbered with rapids, although navigable by small steamers for some distance. The Peace River was followed by Sir A. Mackenzie in his expedition of 1792–93.

PEACH, a tree and its fruit; for a description of which, see PEACH, Vol. XVIII, pp. 453, 454. In the United States they cannot be raised profitably north of lat. 43° N. They reach their highest perfection in the middle states. Many peaches are dried, canned or made into brandy. The California product, famous the world over, is large, and of excellent quality. Those raised in Missouri, Ohio, Illinois, Michigan and in neighboring states are generally smaller than the Californian peach. According to the United States census report for 1890, there were, that year, 53 885,597 bearing trees in the whole country, from which 36,367,747 bushels of peaches were sold. Of this product, 5,525,119 bushels were raised in Georgia. The chief states besides Georgia were, in order, in amount of product, Texas, Arkansas, North Carolina, Tennessee, Alabama, Kansas, California, Missouri, South Carolina, Mississippi, Maryland and New Jersey. The last-named state sold 776,078 bushels.

PEACH CURL is a disease of peach trees causing the leaves to curl or become puckered early in the season. In most cases the leaves die and the fruit, deprived of nourishment, also falls. Spray the trees with Bordeaux mixture, viz., 2 pounds of copper sulphate, 2 pounds quick-lime and 20 gallons of water. W. R. B.

PEACH YELLOWS, the worst form of disease in peach trees. The cause of the disease is unknown and there is no known cure for it, save extermination of the tree, root and branch. It is communicable from tree to tree, in an orchard, but the means of communication is unknown. The symptoms of the disease are red spots on the fruit and stiff, yellowish, small leaves. W. R. B.

PEAK DISTRICT, England, a mountainous and forested region in the northwest angle of Derbyshire, which reaches a maximum altitude of 2,088 feet in Kinder Scout, frequently called "the Peak," 4 miles southeast of Glossop. The region of great scenic, historic, and romantic interest, is a noted tourist resort; the vales of Mattock, Dovedale, Millersdale, Castleton and Glossop, the banks of the Derwent, Dove and Wye, and the numerous limestone stalactitic caverns being notable. Peak Cavern or Devil's Hole near Castleton penetrates 2,250 feet into the mountain, 600 feet below its summit, and contains several chambers, one being 220 feet long, 210 feet wide, and 120 feet high. The ruins of Peveril Castle, built by the hero of Sir Walter Scott's novel, *Peveril of the Peak*, a natural son of William the Conqueror, still dominate a spur overlooking Castleton. C. L. S.

PEALE, CHARLES WILSON, artist; born in Chestertown, Md., April 16, 1741; studied painting at Annapolis, Md., under Hesselins, a German painter, and later at Boston. He went to London in 1770 and took lessons from Benjamin West. Returning to the United States he established himself in Philadelphia. During the Revolutionary War he showed his patriotism in various ways. When the militia of Philadelphia was called to active service he was appointed a lieutenant, and later was promoted captain. He commanded his company in the engagements of Trenton and Princeton. In 1779 he became a member of the Pennsylvania legislature, and there advocated the gradual emancipation of the slaves. Died in Philadelphia, Feb. 22, 1827. G. J. H.

PEALE, REMBRANDT, artist; born in Bucks County, Pa., Feb. 22, 1778, son of Charles Wilson Peale; studied under his father and later under Benjamin West in London. Returning to Philadelphia he entered on a career of notable success. About 1812 he removed to Baltimore, where he remained for nine years. While there he executed the famous painting *The Court of Death*. This was painted on a canvass measuring 24 by 13 feet. His portrait of Washington, which was of equal fame, was exhibited in London, Rome and Florence, and afterward was purchased by the United States government and hung in the Vice-President's room in the capitol at Washington. His other paintings include *Song of the Shirt; Wine and Cake; The Babes in the Woods; Italian Peasant; Errina*, and portraits of many famous men. He died in Philadelphia, Oct. 3, 1860. G. J. H.

PEANUT AND PEANUT-OIL. See GROUNDNUT, Vol. XI, p. 196.

PEAR. The fruit of the pear tree (*Pyrus communis*) tapers toward the stem, and is not sunk in a cavity at the base, as in the apple. It has not the firmness of the apple, but it is more sugary and melting. Near its core the pear has a hard concretion composed of indurated cells. The pear is an ancient fruit. At the present day more than 3,000 varieties of pears are enumerated in the catalogues, though only about twenty of these are in practical cultivation. Among the varieties widely cultivated for sale, the greatest favorite is the Bartlett, which is notable for its size, lusciousness and abundant bearing. Ninety per cent of the pears grown in the United States for sale are of this variety. Another smaller pear is the Seckel. This variety is traced to a single tree in the suburbs of Philadelphia. It is of unsurpassed flavor. As a rule, pears are better if picked when just mature, and then ripened in the house.

The pear has a wide range of distribution. It flourishes equally on the shores of the South Atlantic and on the highlands of the interior. Pear trees are most largely cultivated in New York and California. The latter state is best adapted to their culture, and produces pears in large quantities and of extraordinary sizes. Many California pears are shipped to the East, and still greater quantities are preserved by canning, for which they are excellently suited, since canning preserves much of their original flavor. According to the census report for 1890, there were, that year, 5,115,055 bearing trees in the United States, which produced 3,064,375 bushels. New York headed the list of states, with 588,767 bushels, followed by California, Ohio, Michigan, Indiana, and Pennsylvania. See also PEAR, Vol. XVIII, pp. 456, 457, and HORTICULTURE, **Vol. XII, p. 284.**

PEARCE, CHARLES SPRAGUE, an American artist; born in Boston, Mass., Oct. 13, 1851. He studied under Bonnat in Paris, and traveled extensively in Europe and Algiers. Among his works, in recognition of whose merit he received many honors, are *Death of the First-Born of Egypt* (1877); *Decapitation of John the Baptist* (1881); *Toilers of the Sea* (1884); *St. Genevieve* (1887); and *The Family*, a series of mural paintings in the Library of Congress.

PEA RIDGE, Arkansas, the scene of a battle fought March 6 to 8, 1862, in which the Confederates, under General Van Dorn, were defeated by the Union forces under General Curtis. The Union troops numbered about 10,000, while the Confederates had 20,000, inclusive of 6,000 Cherokee Indians. The engagement was begun by an advance on the part of the Confederates toward Sugar Creek, where the Union army was encamped. The Union left, under the immediate command of Sigel, was first attacked, but succeeded in repulsing the Confederates. The Union right, under Carr, was, however, driven back. A movement by Sigel placed the Confederates in a cross-fire and compelled them to retire. Both forces lost heavily.

PEARL–ASHES OR CARBONATE OF POTASH. See POTASSIUM, Vol. XIX, p. 606.

PEARL–FISHERIES. See PEARL, Vol. XVIII, pp. 457–459.

PEARL RIVER. See CANTON, Vol. V, p. 33.

PEARL RIVER, a river formed by the union of several small streams in Neshoba County, eastern central Mississippi; flows southwesterly to Jackson, where it begins a southerly course, in its southern part forming a part of the boundary between Mississippi and Louisiana. It empties into the Gulf of Mexico, east of Lake Pontchartrain, after flowing a distance of 400 miles, the distance being so great on account of the winding course. It is navigable for flatboats through a fertile cotton region as far as Jackson. The river is subject to overflows in the lower portions.

PEARL RIVERS, the pseudonym of NICHOLSON, MRS. ELIZA JANE; q.v., in these Supplements.

PEARL–SHELL FISHERIES. See MOTHER-OF-PEARL, Vol. XVII, p. 8.

PEARL–WHITE. See BISMUTH, Vol. III, p. 687.

PEARLYTE. See IRON AND STEEL, in these Supplements.

PEARSALL, a town and the capital of Frio County, southern Texas, 54 miles S.W. of San Antonio and about 100 miles N.N.E. of Laredo, on the International and Great Northern railroad. It is the trade center for a district devoted to grazing and farming. Population 1900, est'd, 800.

PEARSON, JOHN LOUGHBOROUGH, R. A., a British architect; born at Brussels, July 5, 1817, and died in England, Dec. 10, 1897. He studied architecture in Durham, and later established himself in London. His first work to attract attention was Holy Trinity Church, Westminster, erected in 1850. He designed the schools of St. Peter's, Vauxhall, in 1860; was elected a member of the principal British architects' societies, and made a knight of the Legion of Honor. In 1870 he became architect to Lincoln Cathedral, and eight years later began the great monument of his art—Truro Cathedral. He also restored the west side of Westminster Hall, and was architect for Westminster Abbey.

PEARSONS, DANIEL KIMBALL, philanthropist; born in Bradford, Vt., April 14, 1820; was graduated in medicine in Woodstock, Vt. He settled in Chicopee, Mass., where he practiced till 1857. He then removed to Ogle County, Ill., and there carried on farming for three years. In 1860 with $5,000 he established himself in the real estate business. During the first ten years of his business career he was engaged in selling farm lands, and in that time had disposed of over a million acres on which he received a five per cent. commission. The money thus acquired was invested in pine lands in Michigan from which he sold lumber at large profit. He retired from active business in 1887, with the exception of remaining a director in the Chicago City Railway Company and a few other corporations. During 1890–1900 he gave away $2,500,000, principally to the cause of college education in the West, South, and Southwest. It is estimated that his entire benefactions aggregate $4,000,000.

G.J.H.

PEARY, ROBERT EDWIN, an American Arctic explorer; born in Pennsylvania in 1854; removed with his parents to Maine; graduated at Bowdoin College; in 1885 was selected, by competition, as a civil engineer for the United States navy, with the rank and pay of lieutenant. In 1886, 1891 and 1893 he made expeditions to the polar regions, which are noted in the article, POLAR EXPLORATIONS, in these Supplements. From the last expedition he returned with the "Peary relief expedition," in the steamer *Kite*, to St. John's, Newfoundland, Sept. 21, 1895. The relief expedition was in charge of Emil Diebitsch, brother of Mrs. Josephine Peary, who accompanied her husband in his expeditions, and published an account of the first in *My Arctic Jour-*

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LIEUT. R. E. PEARY.

nal (1893). In May, 1896, Lieutenant Peary made a very successful expedition to Greenland for the purpose of collecting natural history specimens, returning to Sydney, Cape Breton, September 27th. In 1906 he reached 87° 6′, the highest point of northern latitude so far attained. In 1908 he set out on another expedition.

PEARY EXPEDITION. See POLAR EXPLORATIONS, in these Supplements.

PEASANTS' WAR. See GERMANY, Vol. X, p. 447; and LUTHER, Vol. XV, p. 80.

PEAT. See FUEL, Vol. IX, pp. 709, 710; and GEOLOGY, Vol. X, pp. 212, 213.

PEA-WEEVIL. See WEEVILS, Vol. XXIX, p. 514.

PECAN (*Carya olivæformis*), a North American tree, being one of the hickories. It is a handsome, lofty tree, growing to the height of 70 feet, with a straight trunk and leaves of from 13 to 15 leaflets. It abounds on the rich bottom lands from Indiana and Illinois southward to Mississippi, and thrives especially in Arkansas and the Indian Territory. It is the largest of the hickory trees; but its wood is of little use except for fuel. The fruit of the pecan-tree is the most palatable of all the hickory nuts. It is sweet, of an agreeable flavor, and has a thin, easily-broken, yellowish-brown shell, without the internal partitions of the ordinary hickory-nut. The pecan is extensively raised for sale in the Southern states. See also HICKORY, Vol. XI, pp. 705, 706.

PECATONICA, a village of Winnebago County, northern Illinois, on Pecatonica River, and on the Chicago and North-Western Railroad, midway between Freeport and Rockford. It is in an agricultural and stock-raising district; is engaged in pork-packing, and has a large shoe factory. Population 1890, 1,059; 1900, 1,045.

PECCHIO, GIUSEPPE (1785–1835). See POLITICAL ECONOMY, Vol. XIX, p. 375.

PECH, HENRIETTA, or in Bohemian, JINDRISKA PECHOVA, a Bohemian poetess; pseudonym ELISKA KRASNOHORSKA. See SLAVS, Vol. XXII, p. 162.

PECHI-LI, GULF OF, a wide, shallow basin forming an arm of the Yellow Sea, surrounded on three sides by the provinces of Shan-tung, Pechi-li and Shing-king, in northeastern China. The Hwang-ho enters the gulf on its southwestern shore. With its northern extension, known as the Gulf of Liau-tung, the Gulf of Pechi-li has a length of about 290 miles. See CHINA, Vol. V, p. 550.

PECK, HARRY THURSTON, educator and man of letters; was born at Stamford, Connecticut, on November 24, 1856, was graduated from Columbia College, New York, in 1881, and also studied at Berlin. He became connected with the Columbia College faculty in 1882, and has for many years been professor of Latin there, as well as a lecturer in Barnard College, secretary of the faculty, etc. He was one of the organizers of the Columbia University Press. He has contributed much in poetry and prose to current literature, and has done much editorial work on dictionaries, encyclopædias, atlases, etc. Since 1895 he has edited *The Bookman* magazine. His published volumes include *The Personal Equation; The Semitic Theory of Creation; Latin Pronunciation; What Is Good English?* and *Greystone and Porphyry*, the last named being a volume of poems. He has also made many addresses on educational and other topics, which have been published. Some of his short poems in magazines have won much popularity. W.F.J.

PECK, JESSE TRUESDELL, an American clergyman and author; born in Middlefield, N. Y., Aug. 4, 1811. He was educated at the Cazenovia, N. Y., Seminary, and was licensed to preach in 1829. He was made a member of the Oneida Conference in 1832. From 1848 to 1852 he was president of Dickinson College. In 1856 he became pastor of the Greene Street Methodist Church, New York City, and in 1860 was transferred to California. In 1872 he returned to the East and was elected bishop. Among his works are *The Central Idea of Christianity* (1855); *The True Woman* (1857); *The History of the Great Republic* (1868). He died in Syracuse, N. Y., May 17, 1883. W.M.C.

PECK, JOHN MASON, clergyman; born in Litchfield, Conn., Oct. 31, 1789. He became a Baptist preacher at New Durham, N. Y., in 1811; was ordained in the ministry in 1813, and from 1822 to 1826 preached as a missionary in St. Louis and in parts of Missouri and Illinois. He established in 1826 a seminary at Rock Spring, Ill., for the instruction of theological students, which in 1835 developed into Shurtleff College, Upper Alton, Ill. In his efforts to endow this institution he traveled widely through the country, collecting $20,000. The *Western Pioneer and Baptist* was founded by him in 1828, the Illinois *Sunday School Banner* later, and from 1843 to 1845 he was the financial agent of the American Baptist Publication Society. He died in Rock Spring, Illinois, March 15, 1858. G.J.H.

PECOS, a town and the capital of Reeves County, western Texas, on the Pecos River, at the junction of the Pecos Valley with the Texas and Pacific Railroad, 135 miles W. of Big Springs. It is the trade center for an extensive district devoted to agriculture, and sheep and cattle raising. Population 1890, 393; 1900 (12th census), 630.

PECOS RIVER. See NEW MEXICO, Vol. XVII, pp. 410, 411; and IRRIGATION in these Supplements.

PECQUET, JEAN (1620–74). See HARVEY, Vol. XI, p. 451.

PECTIN AND PECTOSE. See JAMS AND JELLIES, Vol. XIII, p. 573; and BOTANY, Vol. IV, p. 78.

PECTOSE AND PECTIC ACID. A ferment substance found in ripening plants, as in the carrot, the character of which is somewhat obscure. It acts upon the pectose of unripe fruits and vegetables and produces *pectin*, or plant-jelly. It is a semi-solid, and is not known to crystallize. Pectin, under alkaline reaction, give rise to two gelatinous acids, with these probable chemical formulas;

namely, *pectosic acid* ($C^{32}H^{40}F^{28}+3H^2O$) and *pectic acid* ($C^{16}H^{22}O^{15}$).

PEDAGOGICS. See EDUCATION, Vol. VII, pp. 687, 688.

PEDEE, the general name given to two rivers, distinguished as the Great Pedee and Little Pedee. The former rises in southern North Carolina, and is known as the Yadkin until it enters South Carolina, flowing in a southeasterly direction. Continuing in the same direction through South Carolina, it empties into Winyaw Bay, in Georgetown County. It is about 415 miles long, and is navigable for small vessels for about 200 miles. The principal tributaries of the Great Pedee are the Waccamaw and Little Pedee. The latter rises in North Carolina, flows southerly through Robeson County, in the latter state, forms the western boundary of Harry County, South Carolina, and joins the Great Pedee at the southern extremity of Marion County.

PEDERSEN, CHRISTIAN. See DENMARK, Vol. VII, p. 79.

PEDICULATI. See ICHTHYOLOGY, Vol. XII, p. 728.

PEDIGREES AND PEDIGREE-TRACING. See GENEALOGIES, AMERICAN, in these Supplements.

PEDIMENT. See ARCHITECTURE, Vol. II, p. 412.

PEDIPALPI, an order of arachnids, found in the warmer regions of the earth. They are often called scorpion-spiders or whip-scorpions. Their habits are not well known. There are two genera, *Phrynus* and *Thelyphonus*, the latter occurring within the United States.

PEDRARIAS OR DANILA. See BALBOA, Vol. III, p. 237.

PEDRO I (1798–1834). See BRAZIL, Vol. IV, pp. 208, 209.

PEDRO II, DE ALCANTERA, emperor of Brazil; born in Rio de Janeiro, Dec. 2, 1825. He was the only son of Emperor Pedro I. and of Leopoldina, archduchess of Austria. He succeeded to the throne on the abdication of his father, April 7, 1831. The affairs of the government were placed in the hands of regency until July 23, 1840, when Pedro was declared of age, and he then assumed sovereign power of the state. In 1843 he married the Princess Theresa Christina Maria, sister of Francis I., king of Naples She died in 1889. Brazil prospered greatly under the rule of Pedro II. He was an enlightened ruler and never sought to employ aggressively even the restricted powers which the constitution permitted him. He was very scholarly in his tastes. In 1862 a quarrel arose between Brazil and Great Britain, which was settled in Pedro's favor by arbitration, which did much to increase his power. During his reign several wars occurred with other nations. These include a war with the dictator Rosas of Buenos Ayres in 1851, with Uruguay in 1854 and 1864, and with Lopez of Paraguay in 1865. In 1871 and 1872 Dom Pedro made an extended tour of Great Britain and the Continent and in 1876 attended the Centennial Exposition in Philadelphia, being present and assisting at the opening ceremonies. In 1871 he issued an important decree abolishing slavery in Brazil. In 1889 Brazil became a republic and the emperor withdrew from the country, taking up his residence in France, where he remained until his death in Paris, December 5, 1891. (See also BRAZIL, Vol. IV, pp. 209, 210.) W.M.C.

DOM PEDRO II.

PEEKSKILL, a manufacturing village in Cortlandt township, Westchester County, southeastern New York, lies on the east bank of the Hudson, 43 miles above New York City, and on the New York Central and Hudson River railroad. The village has twelve churches, good public school, a military academy, St. Gabriel's (Protestant Episcopal), a boarding-school for young ladies, charitable institutions, a public library, banks, water-works and electric lights. A church dating from 1767, and the Van Cortlandt mansion, are among its principal buildings. The important industries are iron foundries, machine-shops, flour-mills, blank-book establishments, stove-works and cigar factories. Population 1890, 9,676; 1900, 10,358.

PEEL, ARTHUR WELLESLEY, VISCOUNT, statesman; born in England, Aug. 3, 1829, son of Sir Robert Peel, baronet; was educated at Eton and at Oxford University. He represented Warwick in Parliament in 1865–85, and Warwick and Leamington in 1885–95. He was Parliamentary secretary to the Poor Law Board in 1868–71, and to the Board of Trade in 1871–73; was Patronage Secretary to the Treasury in 1873–74; Under Secretary to the Home Office in 1880, and Speaker of the House of Commons in 1884–95. He was elected a trustee of the British Museum in 1898, and for a time was chairman of the National Portrait Gallery. G.J.H.

PEEPUL, PIPPUL OR BO, a tree. See FIG, Vol. IX, p. 135.

PEET, HARVEY PRINDLE, an American educator; born in Bethlehem, Conn., Nov. 19, 1794. From the age of 16 he was engaged in teaching school, meanwhile fitting himself for college at Phillips Andover Academy. He graduated at Yale in 1822, and became instructor and later steward at the deaf and dumb asylum at Hartford, Conn. In 1831 he was appointed principal of the deaf and dumb institution in New York, where he filled the offices of steward, teacher, chaplain, and secretary and managed the institution single-handed. He also prepared a series of elementary books for use in such schools, investigated the methods of instruction pursued in other countries, and wrote many works on the education of the deaf and dumb. He died in New York, Jan. 1, 1873. E.E.T.

PEEWIT. See GULL, Vol. XI, p. 243; and LAPWING, Vol. XIV, p. 308, note.

PEGMATITE. See GRANITE, Vol. XI, p. 44.

PEH-CHELE OR CHIH-LI, a province. See CHINA, Vol. V, p. 650.

PEHLEVI. See PAHLAVI, Vol. XVIII, pp. 139–140.

PEIHO, a river. See CHINA, Vol. V, p. 549.

PEINE FORTE ET DURE. See TORTURE, Vol. XXIII, p. 494.

PEIPUS, a Russian lake. See PSKOFF, Vol. XX, p. 40.

PEIXOTO, FLORIANO VIERIA, statesman; born in the province of Alagoas, Brazil, April 30, 1826; was educated at the military school in Rio de Janeiro in 1858–64. He was then appointed first lieutenant in the Third Artillery battery. Early in 1865 he accompanied this battery against a Paraguayan army which had invaded the province of Rio Grande do Sul. While in command of the Brazilian artillery he prevented the enemy from crossing the Uruguay River and the whole army of 8,000 men was forced to surrender. Peixoto, like many other officers, returned from the war against Paraguay imbued with republican ideas. When the revolution against the empire broke out in 1889 he was adjutant-general of the army. He retained this position under the republic till 1890 when he was appointed minister of war. A year later he succeeded Marshal Fonseca as president. He died June 29, 1895. G.J.H.

GEN. F. PEIXOTO.

PEKIN, a city and the capital of Tazewell County, northern central Illinois, on the left bank of the Illinois River, 160 miles S.W. of Chicago, 56 miles N. of Springfield, and 10 miles below Peoria. It is a prominent railroad center, being located on the Atchison, Topeka and Santa Fé, Chicago, Peoria and St. Louis, Cleveland, Cincinnati, Chicago and St. Louis, Peoria, Decatur and Evansville, Peoria and Pekin Union railroads, all of which have made large and costly improvements, including depots, warehouses, etc., and add greatly to the amount of business annually transacted there. The city has 9 churches, 2 national banks, 3 daily and 4 weekly papers, a courthouse and jail, a high school and electric lights. It also contains foundries and machine-shops, cigar manufactories, hominy-mills, saw-mills, sash, door and blind factories, carriage factories and farming implement manufactories, distilleries, rolling-mills, marble-works, lumber-yards and soda-water factories. Large invoices of highwines, grain, coal and other products are shipped to Pekin, thence to the South and Southwest by rail and river, and to other points in the United States. Population 1890. 6,347; 1900. 8,420.

PE LA. See WAX, Vol. XXIV, pp. 485, 486.

PELAGIANISM. See PELAGIUS, XVIII, 483.

PELARGONIC ACID AND ETHER. See ŒNANTHIC ACID, Vol. XVII, p. 752.

PELARGONIUM. See HORTICULTURE, Vol. XII, pp. 272, 273.

PELASGIANS. See GREECE, Vol. XI, p. 81; ITALY, Vol. XIII, p. 453.

PELECANIDÆ. See PELICAN, Vol. XVIII, 485.

PELEE, MT., ERUPTION OF. See St. PIERRE, in these Supplements.

PELEUS. See ACHILLES, Vol. I, p. 89.

PELION, a lofty range of mountains in Thessaly in the district of Magnesia, Greece. Its sides were covered with forests of oak, chestnut, beech, elm, plane and pine. On its summit was a temple of Jupiter Actæus, whose worshipers went in procession once a year to the temple, covering themselves with thick skins on account of the severe cold. Near the summit Mount Pelion, Chiron, the wisest of all the centaurs, resided in a cave, where he stored the rare medicinal plants that grew thickly on the mountain's sides. From the timber grown on Mount Pelion was built the ship that went forth with its adventurers to search for the golden fleece. In Greek mythology, the giant sons of Aloeus (the son of Neptune and Canace) in their wars with the gods in their attempt to scale heaven are said to have essayed to pile Ossa and Olympus on Pelion, or Pelion and Ossa on Olympus. Mount Pelion, the highest peak of the range, is 5,310 feet high. The modern name of the range is Plessidi.

PELLA. See MACEDONIA, Vol. XV, p. 138.

PELLA, a city of Marion County, south central Iowa, 47 miles E.S.E. of Des Moines, on the Chicago, Rock Island and Pacific railroad. It is in an agricultural region and the center of a variety of manufacturing interests, among the important industries being stone-quarrying, grape-culture and the manufacture of flour and lime. Pella is the seat of Central University of Iowa (Baptist), a co-educational institution established in 1853. It had in 1907, 16 instructors, 178 students and a library of 6,000 volumes. Population 1890, 2,408; 1900, 2,623.

PELLITORY, the common name of species of *Parietaria*, a genus of weedy plants of the family *Urticaceæ*, or nettles. *P. Pennsylvanica* is the American representative of the genus, while *P. officinalis* of Europe has a certain medical reputation. *Anacyclus pyrethrum*, a plant of the eastern Mediterranean region, of the family *Compositæ*, is the ordinary pellitory of commerce, used in benumbing nerves.

PELOPONNESIAN WAR. See GREECE, Vol. XI, pp. 91, 92.

PELOPONNESUS. See GREECE, Vol. XI, pp. 74, 84, et seq.

PELOTAS, Brazil, a seaport town in the southern state of Rio Grande do Sul, at the mouth of Rio São Gonçalo, in the southwest corner of the Lagoa dos Patos. It is connected by the Brazilian railway system with the city of Rio Grande do Sul, 20 miles to the southeast, and with other

important centers, and is an attractive town with fine buildings and modern improvements. The entrance to the harbor from the Atlantic is obstructed by the bar of the Rio Grande across the entrance to the Lagoa dos Patos; large vessels are unable to enter and have to be loaded from boats. Preserved beef and animal products are largely exported. Population, 10,000. C.L.S.

PELS, ANDRIES, a dramatist. See HOLLAND, Vol. XII, p. 99.

PELVIS. See ANATOMY, Vol. I, pp. 668–*668.

PEMBERTON, JOHN CLIFFORD, military officer; born in Philadelphia, Pa., Aug. 10, 1814; was graduated at the United States Military Academy in 1837; commissioned first lieutenant March 19, 1842; promoted captain, Sept. 16, 1850; resigned April 29, 1861. During the war with Mexico he greatly distinguished himself in the actions of Monterey and Molino del Rey. At the outbreak of the Civil War he accepted the commission of a lieutenant-colonel in the Virginia State Militia; was promoted colonel, May 8, 1861, and brigadier-general, June 17, following. In February, 1862, he was placed in command of the department including Florida, Georgia and South Carolina, and had his headquarters at Jackson, Miss. He conducted the campaign around Vicksburg from May till the surrender of that city July 4, 1863. After the war he settled in Virginia. He died July 13, 1881. G.J.H.

PEMBINA, a city and the capital of Pembina County, northeastern North Dakota, on the Red River of the North, at the mouth of the Pembina River, about 70 miles below Winnipeg, Manitoba, with which it has steamboat communication, and on the Northern Pacific railroad. It is situated in a wheat-raising district, and is an important grain-shipping point. Population 1900, 929.

PEMBROKE, a village of Pembroke township, Washington County, southeastern Maine, 10 miles N.W. of Eastport, and 20 miles S.E. of Calais, on Passamaquoddy Bay. Its nearest railroad station is Calais, on the St. Croix and Penobscot railroad, but it has water communication with coast towns. It is the seat of an extensive iron and nail manufactory. Population of the township in 1890, 1,514; 1900, 1,652.

PEMBROKE, a village of Pembroke township, Merrimac County, southeastern central New Hampshire, on the Merrimac River, at the mouth of the Suncook River, five miles S.S.E. of Concord. It is the seat of an academy. The township contains the villages of East and West Pembroke, is intersected by the Boston and Maine railroad. Population 1890, 3,172; 1900, 3,183.

PEMBROKE, a town and the capital of Renfrew County, northeastern Ontario, Canada, on the right bank of the Ottawa River, 96 miles above Ottawa, and on the Canadian Pacific railroad. The town is the center of a rich lumber district, and is furnished with excellent water-power by the Indian River, which enters the Ottawa at this point. The industries of the town include saw, grist and flour mills, an axe factory and a foundry. Population 1891, 4,401; 1901, 5,156.

PEMBROKE, a Welsh borough. See Vol. XVIII, p. 493.

PEMMICAN, as made by the American Indians, consisted originally of buffalo-meat dried by the sun or wind, and then pounded into a paste and tightly pressed into cakes; sometimes the fruit of the juneberry (*Amelanchier ovata*) was added to improve the flavor. It could be kept for a very long time uninjured. That made for the Arctic voyagers consists chiefly of beef.

PEMPHIGUS. See SKIN DISEASES, Vol. XXII, p. 131.

PENALTY, a punishment annexed by law or judicial decision to a violation of law; usually a sum of money to be paid, as in the case of a fine. But the expression "death penalty" is also often used. The term is also used to describe a penalty provided by contract as a forfeit which an obligor agrees to pay if he shall fail to fulfill his part of the agreement. The most ordinary form of penalty is that named in a bond. In a common money bond the obligor often binds himself in absolute terms to pay the obligee a certain sum which is the "penalty"; but in a subsequent clause, called the condition, it is provided that if he shall pay another and smaller sum with interest at a specified time the entire obligation shall be void. A penalty thus inserted in a contract is a mere matter of form. Its legal effect was long established by equity; and this equitable doctrine has been fully accepted by courts of law. The party who fails to perform his agreement does not thereby forfeit the whole sum mentioned as the penalty, but is liable only for the amount of damages actually sustained by the other party, and upon payment of such damages, or the principal and interest of the debt if the instrument is a penal bond, he is discharged from all other obligation. Under certain circumstances, however, such a clause is treated as any other promise to pay and is binding according to its terms, so that the exact amount named in the contract can be recovered from the obligor. Thus, in a bail-bond, a bond conditioned upon the performance of an act and other similar bonds, the penalty is generally required to be paid in full upon a breach of the condition thereof. See also FINE, Vol. IX, p. 168.

PENANG. Same as PRINCE OF WALES ISLAND, Vol. XIX, pp. 760, 761.

PENDENTIVE. See ARCHITECTURE, Vol. II, p. 412.

PENDER, SIR JOHN, an English cable magnate; born in Dumbartonshire, Scotland, in 1816; educated at the high-school, Glasgow, where he was awarded a gold medal for drawing; entered the counting-room of a local factory, and in a few years was its general manager; accumulated a fortune in business in Glasgow, Manchester and London. When the Atlantic cable project was broached he was one of 345 who contributed $5,000 to the experiment, with which enterprise he was thenceforward identified. He occupied in Britain the same position that Cyrus W. Field did in the United States. When cable after cable had failed and the *Great Eastern* parted with her

cable in mid-ocean, John Pender stood almost alone in Britain in his faith in the eventual success of the project. He again interested others, and aided in forming the Anglo-American Company, with a capital of $3,000,000. He gave his personal guaranty to the Cable Construction and Maintenance Company, and the cable was laid, the old cable being recovered during the second undertaking. He developed the Mediterranean, Eastern (Indian and China), Australian, South African and direct African cables. He was a member of Parliament for Totness from 1862 to 1866, and for Wick from 1872 until his death. He received the Grand Cordon of the Order of the Medjidieh from the Sultan of Turkey; was a Knight Commander of the St. Saviour Order of Greece and of the Order of the Rose of Portugal, and a Grand Cross of the Order of St. Michael and St. George of Britain. He published *Statistics of the Trade of the United Kingdom with Foreign Countries from 1840* (1869). His eldest son, J. Pender, was elected Conservative member of Parliament for Northamptonshire, England, in 1895. Sir John died in London, July 7, 1896.

PENDER, William Dorsey, an American soldier; born in Edgecombe County, N. Car., Feb. 6, 1834. He was graduated from the United States Military Academy in 1854, and entered service on the Western frontier. He resigned in 1861 to enter the Confederate army. While leading a brigade in the battle of Gettysburg he was mortally wounded, and died at Staunton, Va., July 18, 1863. W.M.C.

PENDLETON, a township of Lancashire, England, with a station on the Lancashire and Yorkshire railway. It is a suburb of Manchester, and is 2½ miles W.N.W. of the town of that name; has collieries and manufactories of cotton and silk. Population 1901, est'd, 60,000.

PENDLETON, a town and the county seat of Umatilla County, Oregon, in the northeastern part of the state. It lies on the Umatilla River, and 25 miles from the Columbia, at the northwest of the Blue Mountains, and at the edge of the Umatilla Indian Reservation. It was founded in 1867, and is now reached by the Washington and Columbia River and the Union Pacific railroads, and is one of the most rapidly growing towns of the state. The river furnishes it with a fine water-power for its flour mills, paper mills and machine shops and other industries, and the region around the town is rich in agriculture and lumbering. Pendleton is the seat of several academies, and has most of the public institutions of a considerable city. Its population was 730 in 1880, 2,506 in 1890, and 4,406 in 1900, and is still rapidly growing. W.F.J.

PENDLETON, Edmund, an American public man; born in Caroline County, Va., Sept. 9, 1721. In 1741 he was licensed to preach. In 1751 he became a county justice, and in 1752 was a member of the House of Burgesses. He was county lieutenant and a member of the Colonial convention in 1774, and of the Continental Congress, 1774–75, being its president, and president of the committee of safety, in the latter year. In 1777 he was crippled for life by injuries resulting from a fall from his horse. and was elected speaker of the House of Burgesses and president of the court of chancery. In 1779 he became president of the court of appeals, a position he held till his death. He was president of the Virginia Constitutional Convention of 1787, and died in Richmond, Va., Oct. 23, 1803. E.E.T.

PENDLETON, George H., an American public man; born in Cincinnati, Ohio, July 25, 1825. He studied law, was admitted to the bar, and began practice in Cincinnati. He was a member of the Ohio Senate, 1854–55; Representative in Congress from Ohio from December 7, 1857, to March 3, 1865; Democratic candidate for Vice-President on the McClellan ticket in 1864; United States senator from March 18, 1879, to March 3, 1885; and minister to Germany, 1885. He died in Brussels, Belgium, Nov. 24, 1889. E.E.T.

GEORGE H. PENDLETON.

PENDULUM. See Clocks, Vol. VI, pp. 14–17.

PENELOPIDÆ or PENELOPINÆ. See Guan, Vol. XI, p. 206.

PENINSULAR WAR. See Wellington, Vol. XXIV, pp. 523, 524.

PENN, John, an American patriot and statesman, a signer of the Declaration of Independence; born in Caroline County, Va., May 17, 1741. He studied law and was admitted to the bar in 1762. In 1774 he removed to Greenville County, N. C., and in 1775 was elected to the Continental Congress, where he signed the Declaration of Independence. He was re-elected in 1777 and upon the invasion of Lord Cornwallis, was placed in charge of the affairs of the state with almost unlimited powers. In 1784 he was made receiver of taxes for North Carolina. He died in Sept., 1788, near Greenville, N. C. W.M.C.

PENN, John, an American colonial governor, grandson of William Penn; born in London, England, July 14, 1729. He was educated in the University at Geneva, removed to Philadelphia in 1753 and served in the colonial council until after Braddock's defeat, when he returned to England. In 1763 he came back as lieutenant-governor. His administration was much disturbed by the Indians, with whom he succeeded in forming the treaty of Fort Stanwix in 1768. He was called to England in 1771 but returned as governor during the early portion of the Revolutionary period. In 1775 his council was supplanted by the committee of safety. He was imprisoned in

1777, but was released after a few months; the family was allowed £130,000 by the legislature for lands transferred to the possession of the state. He died in Bucks County, Pa., Feb. 9, 1795.

W.M.C.

PENN, RICHARD, an American colonial governor, grandson of William Penn; born in England, 1735. He was educated at St. John's College, Cambridge, and in 1763 accompanied his brother, John Penn, to Pennsylvania. In 1764 he became a member of the Colonial Congress. In 1771, during his brother's absence in England, he acted as lieutenant-governor of the colony, and while in that office entertained Washington and the members of the Continental Congress at his residence. At the outbreak of the Revolution he sympathized with the colonists, and in 1775 went to England with a petition for various concessions. In 1784 he was elected to the British Parliament, retaining his seat until 1794, after which he retired to private life. He visited Philadelphia in 1796. He died in Richmond, Surrey, England, May 27, 1811. W.M.C.

PENNELL, HENRY CHOLMONDELEY, author; born in London, in 1837; son of Sir Henry Pennell; received a private education and in 1853 entered the service of the British Government. In 1866–75 he was inspector of sea fisheries. In the latter year he was sent to Egypt by the British Government to initiate commercial and other reforms, and afterward was appointed director-general of interior commerce in that country. His publications include *Modern Babylon; Muses of Mayfair; Pegasus Re-saddled; From Grave to Gay; How to Spin for Pike; The Angler-Naturalist; The Book of the Pike; Fishing Gossip; Modern Practical Angler; Fly and Worm Fishing for Salmon, Trout and Grayling; Float Fishing; Trolling for Pike, Salmon and Trout; The Sporting Fish of Great Britain; Oyster Fisheries and Legislation; The Oyster and Mussel Fisheries of France*, etc. He also wrote numerous pamphlets and reports on sea fisheries, and edited the *Fisherman's Magazine and Review*. He is the owner of the Rossetti Mansions in Chelsea and the Palace Mansions in Kensington.

G.J.H.

PENNELL, JOSEPH, an American etcher and illustrator, born in Philadelphia, Pennsylvania, in 1860. He and his wife, Elizabeth Robins, as a result of their travels on the continent of Europe, illustrated and wrote a series of charming works. In 1887 appeared *Two Pilgrims' Progress*, by both, in France and Italy; which was followed by *Our Sentimental Journey Through France and Italy*, covering the route taken in Sterne's *Sentimental Journey* (1888); *Pen-Drawings and Pen-Draughtsmen*, in which the author vindicated the use of the pen in illustrative work (1889); *Our Journey to the Hebrides* (1889); *Charing Cross to St. Paul's*, the text by Justin McCarthy and the illustrations by Joseph Pennell (1891); *The Stream of Pleasure*, by himself and wife (1891); *Play in Provence*, by both (1892); *The Jew at Home*, in southeastern Europe (1892); *To Gypsysland*, by both (1893); *Modern Illustrations*, with examples in many different processes (1896). In 1891 he was arrested in Russian Poland while photographing scenery, being suspected of securing pictures of forts. He wrote an introduction (in which he assailed Raphael) to Dante Vierge's illustrations of Q. Villega's *Pablo de Segovia* (1892); and in 1894 an exhibition of his drawings was made at Keppel's gallery in New York.

JOSEPH PENNELL.

PENNSYLVANIA had a population in 1900 of 6,302,115, that of 1890 having been 5,258,014.

STATE SEAL OF PENNSYLVANIA.

The gain for the ten years amounted to 19.9 per cent, a falling off from the increase between 1880 and 1890, which was 22.8 per cent. In 1900, the density of population to the square mile was 140.1, an increase from 116.9 in 1890. The twelfth census report placed 25 of the cities of Pennsylvania in the list of places having a population of 15,000 or more, in which resided 2,570,667 of the people of the state, constituting 46.93 per cent of the entire number of inhabitants. The number of males was 3,204,541; of females, 3,097,574; the percentage of native-born population was 84.4; the number of negroes was 156,845, an increase of 49,249 within the ten years preceding; the Chinese numbered 1,927, the Japanese 40, and the civilized Indians 1,639.

The latest surveys of the state show the gross area to be 45,215 square miles, of which 230 square miles are water surface.

The census reports of 1900 show Pennsylvania standing high among the states in the area devoted to the cereals and in production. Of the entire acreage under the six crops classed as cereals, 31.2 per cent was under corn, 32.0 under wheat, 24.8 under oats, 0.2 under barley, 6.5 under rye, and 5.3 under buckwheat.

This table shows the area devoted to each crop:

ITEM.	ACRES.	BUSHELS.
All cereals	4,738,194	117,810,178
Corn	1,480,833	51,869,780
Wheat	1,514,043	20,632,680
Oats	1,173,847	37,242,810
Barley	9,583	197,178
Rye	310,048	3,944,750
Buckwheat	249,840	3,922,980

Stock-raising has long been an important branch of agriculture in Pennsylvania. The number of colts foaled in 1889 was 59,532. In

1900 the mules in the state numbered 38,635, constituting 68.09 per cent of the entire number in the North Atlantic division. More than one-half of the swine on farms at the time of the enumeration were slaughtered for home use. The work-oxen on farms were materially increased between 1890 and 1900, and the gain in the number of milch cows during the same period amounted to 16,518. Other cattle on farms were increased in the same time by 173,910. Pennsylvania stood ninth in the average value of flax products per acre, but 16th among the 28 states reporting a production of either fiber or seed or both. The standing in the area devoted to tobacco was that of 6th, the acreage being 27,760; the production of 41,502,620 pounds giving the same position, that of 6th. The leading tobacco-producing county of the entire United States was Lancaster County, Pennsylvania, which in 1889 yielded 19,217,800lbs., in 1900 28,246,160 lbs.

Every state of the nine composing the North Atlantic division suffered a loss of number of farms during the decade 1880 to 1890. In Pennsylvania this decrease was almost two thousand, while the loss of the group exceeded 37,000.

The following table gives the relative sizes of the farms in Pennsylvania in 1900, as well as information in regard to the tenure under which they were held:

Total number of farms	224,248
Under 10 acres	17,156
10 and under 20 acres	17,882
20 and under 50 acres	41,575
50 and under 100 acres	69,670
100 and under 500 acres	77,039
500 and under 1,000 acres	688
1,000 acres and over	238
Cultivated by owners	153,031
Rented for fixed money value	23,737
Rented for share of products	34,529

At each decennial census since the eighth, Pennsylvania has held the rank of second among the states in the gross value of manufactured products, net value of the same, average number of employees, and the total wages paid. The census of 1900 gave the number of establishments at 52,185, the aggregate capital invested $1,551,548,712, the number of employees 781,273, the cost of material $1,042,434,599, and the value of the finished products $1,834,790,860. The following table gives the products whose value was above, or near to, twenty millions:

Industry.	Number.	Capital.	Workers.	Wages.	Product.
Boots and shoes	146	$ 6,860,480	9,144	$ 3,111,113	$ 13,235,933
Carpets and rugs	93	17,957,607	12,919	5,330,643	23,113,058
Clothing, men's factory product	481	10,446,107	10,497	4,422,074	23,389,043
Flouring and grist-mill products	2,719	19,516,993	2,195	1,061,869	36,639,423
Foundry and machine-shop products	1,268	154,958,750	62,828	33,199,521	127,292,440
Iron and steel	291	309,729,222	110,864	61,908,405	434,445,200
Leather, tanned, curried, etc	254	57,320,227	13,396	5,457,518	55,615,009
Lumber and timber	2,338	47,832,548	13,510	5,550,163	35,749,965
Petroleum, refining	38	26,580,504	3,299	1,681,603	34,977,706
Silk and silk goods	121	20,894,023	21,028	4,629,626	31,072,926
Sugar and molasses, refining	7	23,992,552	1,249	647,592	36,163,817
Woolen goods	193	19,405,505	13,721	5,091,932	25,389,344

The following statistics are from the census report of 1900:

Item.	1890.	1900.
Total number of farms	211,557	224,248
Average size of farms, acres	87	86.4
Total acres in farms	18,364,370	19,371,015
Improved acres in farms	13,210,597	13,209,183
Unimproved acres in farms	5,153,773	6,161,832
Valuation of land, fences, buildings, implements and machinery and live-stock	$1,062,939,846	$1,051,629,173
Estimated value of farm products	$121,328,348	$207,895,600
Number of horses	618,660	590,981
Number of mules and asses	29,563	38,635
Total number of neat cattle	1,706,418	1,896,847
Total number of swine	1,278,029	1,107,981
Total number of sheep	1,612,107	959,483
Pounds of wool sheared	6,441,164	6,732,226
Pounds of maple-sugar	1,651,163	1,429,540
Gallons of maple-syrup	.....	160,297
Gallons of sorghum-syrup	5,051,553	6,514
Acres of meadow-land mown for hay	3,323,689	3,269,441
Tons of hay produced	4,331,582	4,020,388
Acres under tobacco	26,955	27,760
Pounds of tobacco raised	28,956,247	41,502,620
Acres under Irish potatoes	191,992	227,867
Bushels of Irish potatoes raised	12,899,315	21,767,472

In addition to the above, the manufacture of tobacco in its different forms aggregated $33,335,932, printing and publishing $36,455,629; cotton goods, $25,447,697; worsted goods, $22,109,392; hosiery and knit goods, $21,896,063; liquors, malt, $29,162,743; and glass $22,011,130.

Pennsylvania stands at the head of all of the states in the value of mineral products, the census reports giving the production of 1889 at $150,876,649. The next three states in order of production, Michigan, Colorado and Montana, do not reach this amount with the combined value of their mineral products, which aggregate but $145,744,909. This value of mineral products embraces only raw material, manufactured articles not included. None of the precious metals are mined, the chief products being iron and its products, coal, petroleum, natural gas, and stone. The number of coal mines reported was 3,474, the number of tons produced 36,174,089 and the value of the same $27,953,315. The coal-fields of Pennsylvania are divided for state supervisory purposes into eight anthracite districts, embracing some ten different counties, and ten bituminous districts, which cover about thirty counties. The following table shows the production of coal and coke, and facts connected therewith·

Item.	1893.	1894.	1895.
Tons of anthracite	47,179,563	45,506,179	50,847,104
Employees, anthracite region	138,021	139,695	143,605
Tons of bituminous	43,421,898	39,800,210	51,813,112
Employees, bituminous region	81,800	86,177	84,904
Tons of coke	5,549,296	5,729,244	8,922,329

Of the anthracite-producing counties, Luzerne heads the list with 19,143,101 tons; in bituminous, Westmoreland leads with 10,325,245 tons. Among the employees of the coal-mines in 1895 there were 155 fatal accidents and 419 non-fatal. More than one hundred of the fatal accidents were caused by the falling of coal, roof, rock and slate. The ratio of fatal accidents to the number of workmen was 1 to each 544, and of non-fatal accidents 1 to every 202. The amount invested in iron-ore mining in 1889 was $16,249,313; the number of employees, 4,410; the total wages paid amounted to $1,141,239, all expenditures to $1,711,129, and the value of the output of the mines, $3,063,534. As to the value of the manufactured products of iron ore, see the table of manufactures, in this article. In the matter of petroleum the statistics of Pennsylvania are combined with those of New York in the census of 1890. The amount produced was 21,487,435 barrels of the crude oil, of the value of $23,475,163, as against $26,963,340, the total value of the product of the United States for the year. Of illuminating oil 21,393,159 barrels were produced, of the value of $23,225,453, as against $24,569,190, the value of the product made in the United States during the year. Lubricating and fuel oil combined yielded a return of about $2,395,000. Of the $11,044,858 worth of natural gas consumed during the year mentioned, through the states, Pennsylvania furnished the same to the amount of $8,287,383. The investment in the business represented a capital of $34,398,832, and of the total wages paid in all sections producing gas, amounting to $1,736,389, Pennsylvania paid $1,092,709. First in the production of stone of all kinds, Pennsylvania reported 776 quarries and a total output of $7,319,199. The products included granite, slate, limestone, sandstone, bluestone, millstones, graphite, soapstone, ocher and metallic paint.

The value of the fisheries of Pennsylvania in 1889 was $903,095; 2,631 persons were employed, as against 552 ten years previous, and 154 vessels and 1,046 boats were used in prosecuting the industry. The main branch of business was that of the oyster fishery, which produced about one half of the entire receipts. From 1890 a great interest came to be taken in the matter of inland fisheries, and large amounts of money were expended in stocking the waters of the state with the kinds of fish best adapted to the localities. Strict legal protection was thrown around the millions of young fish placed in the streams and lakes, and the benefits to the people became very apparent by 1895, when almost every portion of the state had fish in abundance.

The real estate of Pennsylvania was assessed for taxation in 1900 at $3,069,371,624. In 1900,

THE CAPITOL BUILDING, HARRISBURG.

the revenue commissioners fixed the value of the personal property of the state at $725,165,000. This, with other taxable interests would make the total assessable property amount to $3,831,127,517. The state receipts for the year ending Nov. 30, 1901, were $23,125,503, the balance on hand at the beginning of the fiscal year $5,081,325, making the total amount in the treasury during the year $26,111,355. Among the chief sources of revenue were tax on capital stock, amounting to $3,537,840; tax on personal property, $2,307,936; tax on collateral inheritances, $1,091,993; tax on corporation loans, $822,381; tax on gross receipts of corporations, $598,548; tax on bank stocks, $514,074; tax on foreign insurance companies, $513,616; mercantile licenses, $532,294; wholesale liquor licenses, $446,136; bonus on charters, $241,789; fees of public officers, $172,642. The payments for the year amounted to $12,684,871, leaving the balance on hand Dec. 1, 1901, $3,429,654. The public debt amounted at the time mentioned to the sum of $6,816,309, but the assets of the sinking-fund were sufficient to have reduced in 1901 this amount to $800,000. The biennial appropriations for 1901–02 amounted to $13,999,944 for the former year and $12,948,812 for the latter.

The following table shows the purposes for which the different appropriations were made, for the years mentioned, and the amount of the same:

	1896.	1895.
Educational	$ 6,879,081	$ 6,911,015
Charitable institutions	827,400	871,373
Care and treatment of indigent insane and for buildings	559,500	667,181
Penitentiaries and reformatories	322,127	367,127
Departments	537,450	558,041
Judiciary	667,300	667,300
Legislature	15,370	601,871
Interest on public debt	269,371	269,371
Public printing and binding	215,645	256,711
National Guard	350,000	350,000
Miscellaneous	305,568	449,953
Totals	$10,948,812	$11,969,943

The following table shows statistics regarding the state charitable, correctional and penal institutions of Pennsylvania:

Institutions.	Maintenance.	Inmates.
Hospitals for Insane.		
State Hospital, Harrisburg	$100,437	845
State Hospital, Danville	75,454	1,014
State Hospital, Norristown	164,240	1,813
State Hospital, Warren	76,277	908
Insane Hospital, Dixmont	48,101	743
Friends Asylum, Philadelphia	---- (*a*)	130
Pennsylvania Hospital, Philadelphia	---- (*a*)	418
State Asylum, Wernersville	128,251	764
Deaf and Dumb Institutions.		
Pennsylvania Institution, Phila.	138,339	502
W. Penn'a Institution, Allegheny Co.	42,631	195
Home for Young Deaf Children, Bala	19,576	43
Pennsylvania Oral School, Scranton	29,928	60
Blind Asylums.		
Pennsylvania Institution, Phila.	27,868	185
W. Penn'a Institution, Pittsburg	14,694	77
Institution for Feeble-Minded Children, Elwyn	96,250	982
State Penitentiary, Philadelphia	50,003	1,380
State Penitentiary, Allegheny	121,530	1,151
Indust'l Reformatory, Huntingdon	130,757	489
House of Refuge, Philadelphia	63,750	410
Reform School, Morganza	43,393	304

In addition to the foregoing, the state extended partial support to 103 hospitals, asylums, homes, societies and missions. The total expenditures for 1895 for charitable, correctional and penal institutions by the state was considerably in excess of $2,000,000. This amount did not include any part of the sums expended by counties for the care of paupers and prison expenses.

In 1900 there were operated within Pennsylvania 10,400 miles of railroad, an increase of about 277 miles over 1899, and 660 miles more than in 1893; the number of employees was given as 193,161, their total yearly compensation $102,959,434. Up to 1896 the actual cost of road and equipment of the different lines aggregated $1,579,857,035, and the total amount of funded debt and current liabilities aggregated $1,086,192,221. The report of all earnings and income showed the amount to be $277,454,035, the operating expenses and other expenditures reaching the sum of $250,094,248. In the report of the secretary of internal affairs is also included a statement relative to the street-railways of the state, the number of which in 1895 was 489, as compared with 60 lines in 1888. The canals of the state reported a mileage of 601, the cost of construction and fixtures amounting to $31,454,892. Almost one thousand boats ply the waters of the canals of the state, which carried in 1895 2,056,232 tons of freight, received the sum of $2,321,344, and expended for maintenance and operation $787,649. The different lines of telegraph and telephone in Pennsylvania reported a total of 13,643,704 messages sent during 1895, for which service they had received the sum of $2,238,684, and met gross expenses to the amount of $1,103,562.

But once during a period of fifty years has the legislature of Pennsylvania appropriated for the maintenance of the public schools a less sum than the amount appropriated by the preceding legislature. From the sum of $200,000 to $5,500,000 the appropriation has gradually kept pace with the demands of increase in population and educational methods. In addition to the $5,500,000 appropriated to the public schools for the year ending June 3, 1895, the legislature also aided the state college to the amount of $212,000, the post-graduate department of the University of Pennsylvania $200,000, and gave $50,000 to aid in establishing a school of mining in connection with the Western University. The following report of the public schools of Pennsylvania for the fiscal year (June 30, 1901) also includes the schools of the city of Philadelphia: Number of school districts in the state, 2,516, an increase of 31 within the year; number of schools, 29,046, an increase of 807; number of graded schools, 16,625, an increase of 1,041; number of male teachers, 9,194; number of female teachers, 20,850 — an increase of 164 males and an decrease of 317 females; average salary of male teachers per month, $44.14, an increase of $0.36; average salary of female teachers, $38.23, an increase of $5.29; average length of school term in months, 7.91, a very slight decrease. The totai number of pupils was 1,161,524, an increase of 29,933; the average number of pupils was 847,445. The cost of schoolhouses, purchasing, building, renting, etc., for the year, amounted to $3,724,558. The item of teachers' wages reached $11,355,334; cost of school text-books was $766,987; fuel, contingencies, etc., amounted to near $5,700,000, and the total expenditures footed $22,813,395. The estimated value of the school property of the state was $50,000,000. In 1895 the legislature passed a bill providing for compulsory education, by the terms of which all children within the state between the ages of eight and thirteen years were compelled to attend school, the minimum limit being twelve weeks, of which six weeks must be consecutive. To provide for the enforcement of this law, districts were to be deprived of a pro rata amount of the school revenue for each child not attending in accordance with law. In the 13 districts of the state in which normal schools are maintained, the legislature appropriated $118,467. Since the organization of these schools the state has, by direct legislative appropriation, donated to the 13 the aggregate sum of $2,534,991. Among the institutions of higher education in Pennsylvania were 5 universities, 32 colleges, 14 seminaries, 16 academies, 8 institutes, 20 schools and 3 homes, in which 1,293 instructors were employed, and which had a total enrollment of 19,855. The whole number of students in these institutions since their foundation amounted to 157,439, but in this report many did not join. At the last commencement exercises of the several institutions the number of female graduates was 732; the number of male graduates, 1,499.

The following is a list of the denominational educational institutions of Pennsylvania, their location, and the church organization under whose auspices they were managed (1896):

Location.	Institutions.	Religious Denomination.
Allentown	Muhlenberg College	Lutheran.
Annville	Lebanon Valley Coll	U. Brethren.
Beatty	St. Vincent College	Roman Cath.
Beaver Falls	Geneva College	Ref. Pres.
Bethlehem	Moravian College	U. Brethren.
Carlisle	Dickinson College	Meth. Epis.
Collegeville	Ursinus College	Reformed.
Easton	Lafayette College	Presbyterian.
Gettysburg	Pennsylvania College	Lutheran.
Greenville	Thiel College	Lutheran.
Haverford	Haverford College	Friends.
Jefferson	Monongahela College	Baptist.
Lancaster	Franklin and Marshall College	Reformed.
Lewisburg	Bucknell University	Baptist.
Lincoln Univers'y.	Lincoln University	Presbyterian.
Meadville	Allegheny College	Meth. Epis.
New Berlin	Central Pennsylvania College	Evan. Ass'n.
New Wilmington	Westminster College	United Pres.
Philadelphia	La Salle College	Roman Cath.
Pittsburg	Holy Ghost College	Roman Cath.
Swathmore	Swathmore College	Friends.
Villanova	Villanova College	Roman Cath.
Washington	Washington and Jefferson College	Presbyterian.

The following is a list of the nonsectarian institutions of the state:

Location.	Institutions.
Allegheny	Western University of Pennsylvania.
Chester	Pennsylvania Military College.
Grove City	Grove City College.
Philadelphia	Central High School.
Philadelphia	University of Pennsylvania.
Pittsburg	Duquesne College.
Volant	Volant College.

The following are the educational institutions for women in Pennsylvania, their location, and the auspices under which they are controlled:

Location.	Institutions.	Management.
Allentown	Allentown College for Women	Reformed.
Bethlehem	Moravian Seminary for Young Ladies	Moravian.
Carlisle	Metzger College	Non-sect.
Chambersburg	Wilson College	Presbyterian.
Lititz	Linden Hall Seminary	Moravian.
Mechanicsburg	Irving College for Young Women	Lutheran.
Ogontz School	Ogontz School	Non-sect.
Pittsburg	Penn'a Coll. for Women.	Presbyterian.
Pittsburg	Pittsburg Female Coll.	Meth. Epis.

In 1890 there were 10,175 church organizations in Pennsylvania, 9,624 edifices, a membership of 1,726,640, which constituted 32.84 per cent of the entire population, and church property of the value of $85,917,370. In the number of organizations and edifices Pennsylvania ranks first among the states and is second in the number of communicants and the value of church property. Fifty-two denominations and 17 independent congregations were enumerated. All Baptist bodies numbered 720; the Roman Catholics, 654; the Church of God, 162; Congregationalists, 108; Disciples of Christ, 125; Dunkards, 134; Evangelical Association, 662; Friends, 108; Lutherans, all bodies, 1,292; Methodists, all bodies, 2,536; Presbyterians, 1,365; Protestant Episcopal, 382, Reformed, 762; and United Brethren, 526.

Pennsylvania stands first among the states in the number of church organizations, first in the number of edifices and first in the approximate seating capacity of the church buildings. In the value of church property Pennsylvania stands second only to New York and occupies the same relative position as to the number of communicants or members.

The National Guard of Pennsylvania, according to the report of the adjutant-general of the state made at the close of 1895, numbered 8,934 officers and enlisted men. The force consisted of 1 division, divided into 3 brigades, and comprising 140 companies divided into 15 regiments of infantry (3 of 10 companies and 12 of 8 companies each), 1 battalion of infantry of 4 companies, 1 independent company of infantry, 3 batteries of artillery, 3 troops of cavalry and 3 divisions of naval militia (each division being equivalent to a company of infantry.) The expenditures made in 1895 on state account amounted to $339,719, to which the United States added $41,533, mainly in equipments and accouterments.

March 30, 1905, there were 1,474 newspapers and other periodicals published in Pennsylvania, of which 214 were daily, 7 triweekly, 33 semiweekly, 926 weekly, 4 fortnightly, 12 semimonthly, 245 monthly, 10 bimonthly, and 23 quarterly. Papers were published in all of the 67 counties, and in 460 of the cities, towns, and villages, of which 67 were county seats.

Of the date of Nov. 30, 1900, the commissioner of banking reported as follows:

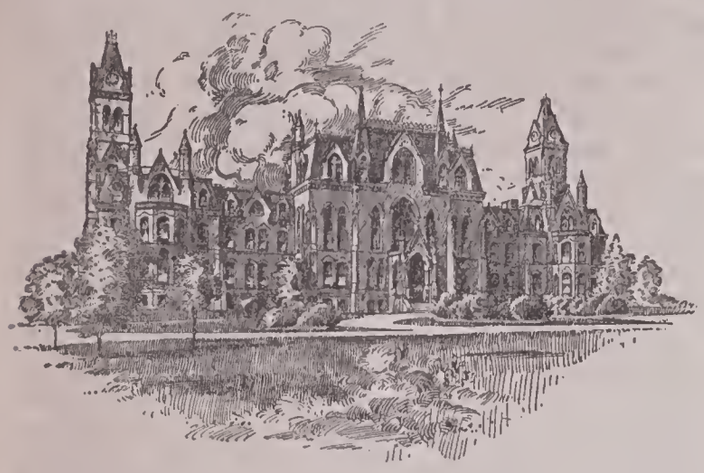
Institution.	No.	Capital.	Surplus.	Deposits.
Banks	101	$ 8,774,380	$ 6,517,978	$ 79,031,08[illegible]
Savi'gs instit's	17	110,200	7,758,754	107,621,38[illegible]
Trust Co's	111	41,682,615	21,932,994	168,824,96[illegible]
Total	229	$50,567,195	$36,209,726	$355,477,43[illegible]

The following is a list of the principal cities and towns of Pennsylvania, with the population as given in the census reports of 1900: Philadelphia, 1,293,697; Pittsburg, 321,616; Allegheny, 129,896; Scranton, 102,026; Reading, 78,961; Erie, 52,733; Harrisburg, 50,167; Wilkesbarre, 51,721; Lancaster, 41,459; Altoona, 38,973; Williamsport, 28,757; Allentown, 35,416; Johnstown, 35,936; York, 33,708; McKeesport, 34,227; Chester, 33,988; Norristown, 22,265; Shenandoah, 20,321; Lebanon, 17,628; Easton, 25,238; Shamokin, 18,202; Pottsville, 15,710; Pottstown, 13,696; Hazelton, 14,230; Newcastle, 28,339; Mahanoy, City, 13,504; Oil City, 13,264.

The following is a list of the governors of Pennsylvania, with their respective terms of office: Thomas Mifflin, 1788–99; Thomas McKean, 1799–1808; Simon Snyder, 1808–17; William Findley, 1817–20; Joseph Heister, 1820–23; J. Andrew Schulze, 1823–29; George Wolf, 1820–

37; Joseph Ritner, 1837–39; David R. Porter, 1839–45, Francis R. Shunk, 1845–49; William F. Johnston, 1849–52; William Bigler, 1852–55; James Pollock, 1855–58; William F. Packer, 1858–61; Andrew G. Curtin, 1861–67; John W. Geary, 1867–73; John F. Hartranft, 1873–79; Henry M. Hoyt, 1879–83; Robt. E. Pattison, 1883–87; Jas. A. Beaver, 1887–91; R. E. Pattison, 1891–95; D. H. Hastings, 1895–99; Wm. A. Stone, 1899–1903; S. W. Pennypacker, 1903–07; E. S. Stuart, 1907. See PENNSYLVANIA, Vol. XVIII.

PENNSYLVANIA, UNIVERSITY OF. This institution owes its existence to the efforts of Ben-



COLLEGE HALL, UNIVERSITY OF PENNSYLVANIA.

jamin Franklin, who organized a board of trustees in 1749, and who, after obtaining $2,000 by subscriptions, was elected a trustee of a building in Philadelphia, on Fourth Street, near Arch. Instruction began in 1751, and in 1753 the institution was incorporated as "The Trustees of the Academy and Charitable School in the Province of Pennsylvania." Under a second charter, obtained in 1755, under the style of "The College and Academy of Philadelphia," the first class was graduated in 1757. In 1762 William Smith, the provost of the college, added £6,000 to the endowment, which sum he obtained in England. With this and an added sum, obtained by means of a lottery, another building was especially prepared for the accommodation of students from the West Indies. The medical school was opened in 1765. Upon the outbreak of the Revolution Dr. Smith, who was regarded as a friend to Great Britain, was imprisoned; but he continued to hear recitations from his cell. The charter of the college was revoked by the legislature in 1779, and its franchises were conferred upon a new organization, "The University of the State of Pennsylvania"; but ten years later the old faculty and trustees of the College of Philadelphia were reinstated, and in 1791 the sundered interests of the two corporations were compromised by their uniting under the style of the "University of Pennsylvania."

In 1828 the university acquired title to the property where now stands the Philadelphia post-office, and added two new buildings for departments in law, medicine and the arts, where its work was carried on until 1872, when the institution entered on a new career. In 1896 the university plant embraced nearly fifty acres of land, together with a half-dozen buildings, the main structure, a beautiful half-Gothic, having a frontage of 260 feet and overlooking the Schuylkill River; also a library building containing 200,000 volumes and a fine collection of antique and historical engraved gems gathered by Maxwell Sommerville, professor of glyptography, and valued at $200,000; also a medical hall, a hospital, a laboratory building, a veterinary college, and a biological hall. The entire plant was valued at $3,500,000. In 1904, the total productive funds were $4,360,347. In 1907, there were 400 instructors and 4,384 students; and the total income was $1,210,728. An expedition to Babylonia, sent out by this university in 1889, discovered (1895–96) the ancient city of Nippur, which is alleged to antedate Babylon by thousands of years. See NIPPUR, in these Supplements.

PENNSYLVANIA COLLEGE, an educational institution for the instruction of both sexes,

RECITATION HALL, PENNSYLVANIA COLLEGE.

located at Gettysburg, Pa., where it was founded in 1832 under the direction of the Lutheran Church. At its start it was without endowment, but in 1834 an appropriation of $18,000 was granted by the legislature of Pennsylvania for its support, with an additional grant of $1,000 annually to continue for a specified number of years. Also, by an act of the legislature in 1850 one-third of the funds of Franklin College at Lancaster, Pa., were granted to Pennsylvania College for the purpose of enabling it to found a Franklin professorship. The productive funds of the college amount to $200,000, and its annual income to about $26,000. It has departments of German and English languages and literature, natural science, hygiene and physical culture, and the English Bible, and possesses chemical and philosophical apparatus, a laboratory of practical chemistry, a cabinet of mineralogy, and an observatory for astronomical research. G.J.H.

PENNSYLVANIA DUTCH, a name in common use for the descendants of the German religious sects that settled in Pennsylvania early in the eighteenth century, chiefly between the Susquehanna and

Schuylkill rivers. They form the body of the Dunkers, of the various branches of the Mennonites, and of kindred exclusive sects. Their professed withdrawal from the world has led to their living in secluded communities, and even where they are mingled parts of a diversified and American population they go in and out with little attention to general interests. They maintain their modes of distinctive dress; they intermarry among themselves; they are wealthy, for an agricultural community; their farms are in superb tilth, and are notable for their great barns standing picturesquely on the summit of some gentle slope, and for their tiny, plain brick houses. Among them are many persons who do not understand English at all, and who communicate with each other only in the tongue called "Pennsylvania Dutch." The original immigrants came from the Palatinate, Bavaria, German Switzerland, and even from Alsace. They spoke the provincial German characteristic of those localities, and the speech of their descendants has arisen from the mingling of those related dialects, influenced in some measure by the incorporation of useful English words and the natural modifications that take place in oral language. This speech has been investigated by S. S. Haldeman and Henry Harbaugh, whose publications have made its study practicable for the curious. It seems to be related to the Pfälzisch, and preserves many old German words used by the peasantry in the home countries, interspersed more or less, according to locality, with Germanized English words. In parts of Pennsylvania are newspapers printed in this tongue. To give some idea of it, the following four lines from a poem by Dr. H. Harbaugh are given, together with the corresponding German:

"Ich seh sei rothe fligle plehn,
Wann er di feddere wescht:
Will wette, das de fraale hot
Uf sellem baum 'n nescht!"

The high German for the same is the following, with the exception of the last word of the first line, which is a re-spelt English word unaltered in pronunciation:

Ich sehe seine rothen Flügel PLAIN,
Wenn er die Federn wäscht:
Will wetten dass das Fräulein hat
Auf demselben Baum ein Nest!

A literal translation in English is as follows:

I see his red wings plainly,
When he washes his feathers:
(I) will wager that the female has
In the self-same tree a nest!

PENNSYLVANIA STATE COLLEGE, located at State College, Centre County, was organized in 1859 as the Farmers' High School, its name being changed in 1862 to the Agricultural College of Pennsylvania. The legislature having appropriated to the college the income from the proceeds of the national land-grant and its scope having been enlarged, its name was in 1874 again changed to the Pennsylvania State College. It is especially an industrial school, giving particular attention to practical and scientific agriculture, while it also provides instruction in mathematical, natural and physical sciences. The agricultural experimental station, in connection with the college, receives from the United States government an appropriation of $15,000 yearly. The state holds the proceeds of the national land-grant in trust, for which it has given its bond for $500,000, on which it pays interest to the college at the rate of six per cent per annum. Congress in 1890 passed a law appropriating to agricultural colleges $15,000 a year, to be increased annually $1,000 until it reaches $25,000. These appropriations enabled the institution to be well equipped in buildings, laboratories, libraries, museums, etc. It is under the control of a state board of 9 *ex-officio* and 15 elected members. There is an elementary course in mechanic arts. In 1907, there were 60 instructors and 1,049 students; the library had 27,000 volumes; the productive funds were $517,000; and the total income was $[illegible]27,102.

PENNY, a coin. The precise etymology of the word is obscure. The early Anglo-Saxon form was *penning* or *penig*, and the Icelandic form *penningr* ("cattle" "money") may, presumably, have been derived from the same source; while the German form, *pfennig*, is perhaps only another variation of the same word, which may have had its birth in a common locality; but whence came the word itself, or what it originally meant, cannot be told. The earliest English, as well as the Continental use of the word *penny*, was as an equivalent of the Roman *denarius*, which had some circulation in northern Europe in the early centuries. Charlemagne, who formulated a medium of exchange for the Franks in the latter part of the eighth century, retained the Roman division of the *libra* (or pound of silver) into twenty *solidi*, and the *solidus* into twelve *denarii*, making the denarius or penny $\frac{1}{240}$ part of a pound-weight of silver. From this usage the entire coinage system of modern Europe has been derived. The application of the word which reaches farthest into the past is the modern English translation of Matthew xx: 2; but the *penny* here referred to was the denarius, which was coined by the Romans into both a silver and a large copper piece, and used in the latter shape in Judea. In the English currency the penny was originally a silver coin, and the only one current before the Norman Conquest. The first copper pennies (the twelfth part of the shilling) were struck in 1797, although copper half-pennies and farthings had been in use since 1672. In 1860 the metal was changed from copper to bronze, which form still remains, and consists of 95 parts copper, 4 of tin and 1 of zinc. Its weight is 145.833 grains troy. The letter "d," used as the sign of the penny, is from the Roman *denarius*. The name has also (although improperly) been applied to the United States *cent*.

PENN YAN, a village and the county seat of Yates County, New York, in the west-central part of the state. It lies at the head of Keuka Lake, 55 miles southeast of Rochester, and is reached by the Northern Central and the Fall Brook Coal Company's railroads, and by steamer from Hammondsport at the other end of the lake. It has some manufacturing industries, and, being in a grape-growing country, is one of the greatest wine-making places in the eastern states. It also

ships many grapes to market. Its population in 1900 was 4,650. W.F.J.

PENNYROYAL. For the English herb, see MINT, Vol. XVI, p. 515.

PENOBSCOT BAY AND RIVER form one of the chief topographical features of the state of Maine. The Penobscot River, the largest in the state, rises in the chain of hills which divides Somerset County, Maine, from the Canadian province of Quebec, and flows east and south across the state, traversing Piscataquis and Penobscot counties and forming the boundary between Waldo and Hancock counties. It flows through several lakes, the largest of them being Chesuncook and Pamedecook. The principal places along its course are Mattawamkeag, Lincoln, Oldtown, Orono, Bangor, Winterport and Bucksport. For many years an enormous trade in lumber has been conducted upon the river, to which has been added in recent years a very large trade in ice, especially for New York city. There are also considerable salmon and other fisheries on the river. Penobscot Bay is the huge tidal estuary of the river, about thirty miles long and the same width. It is bounded by or forms parts of Knox, Waldo and Hancock counties, and opens upon the Atlantic Ocean. It contains numerous islands, and some important cities and towns front upon it, including Castine, Rockland, Belfast and Searsport. Both the river and the bay abound in picturesque scenery, and are frequented by multitudes of tourists every year, and have been the theme of song and story. W.F.J.

PENOBSCOTS, a tribe of Indians of the Algonquin family, living on an island in Maine, near the mouth of the Penobscot River. They, with the Passamaquoddies, are members of the Abnaki branch of the Algonquins. For their services in the Revolution they received a large grant of land on the banks of the Penobscot, which they have mostly disposed of. The state controls a fund of fifty thousand dollars for their benefit. They number each about five hundred, and are Roman Catholics. These two tribes were originally called Malecites and Etechemins by the French settlers.

PENSACOLA, a city, port of entry and capital of Escambia County, extreme northwestern Florida, on Pensacola Bay, an inlet of the Gulf of Mexico, extending inland in a northeasterly direction about 35 miles, affording a deep and commodious harbor. Its entrance, about a mile wide, is defended by Forts McRae and Pickens. The city of Pensacola in 1890 had two railroads, the Alabama, Pensacola and Perdido and the Louisville and Nashville, and daily steamers running to Havana and New Orleans. The harbor is the finest on the Gulf of Mexico, and is the seat of a large commerce. During the year ending June 30, 1889, 622 vessels entered the port; and the exports for the same period were valued at $3,748,154; imports, $37,705. The principal shipments are of coal, fish, hides, tallow, wool, cotton, lumber and naval stores. Pensacola has gas and electric lights, water-works, street-railways, public parks, good school system, churches, banks, a number of fine buildings, including the United States government building, opera-house, courthouse, and state armory, and two daily and two weekly newspapers. Owing to its situation in a district liable to visitation from yellow fever, the sanitary and quarantine regulations of the port are most rigid. The assessed valuation of property in the city in 1893 was $2,303,400. Population 1890, 11,750; 1900, 17,747. See also PENSACOLA, Vol. XVIII, p. 515.

PENSIONS, UNITED STATES SYSTEM. A pension is a reward or allowance consisting of a periodical payment of a specified sum of money, granted by the government to a person retired from service, or to his widow and children, in consideration of his past services for the country. In the United States, pensions are paid to retired soldiers and sailors who have been wounded or disabled in the performance of their duty, and to their widows and dependent children.

The pension system of England, whereby allowances are paid to those who have been engaged for a long time in the service of the government in time of peace, whether as soldier or in a political capacity, and without regard to whether they have been injured or disabled, has never prevailed in the United States, though Congress may, and frequently does, grant special allowances in such cases, when one who has devoted his life to his country's service is left in indigent circumstances in his old age. In the United States, however, when a commissioned officer of the army has completed 40 years of service, and when he has reached the age of 65, and when a non-commissioned officer or private has completed 30 years of service, such persons may, upon application to the President, be placed upon the retired list with the rank held at the time retired, and for the remainder of life receive three fourths full pay.

Widows and children of deceased members of the life-saving service are entitled to receive pensions.

Except as above specified, pensions are not granted by the United States, except to soldiers and sailors who have received injury in the service, by wounds, sickness or otherwise, or who have since become mentally or physically disabled, or to those who served in the War of 1812 or the Mexican War, and to widows, children and dependent parents of deceased soldiers.

The system of pensions for disabled soldiers and sailors began by act of Congress of Aug. 26, 1776, which provided that every officer and private engaged in the Revolution, who should be rendered incapable of earning a livelihood by means of such service, should receive one-half pay during life, or the continuance of such disability. Pension laws have continually remained in operation since that time, but subject to such changes as the conditions required.

The substance of the pension laws in force at the present time are presented below.

The widow of a private, whose deceased husband's death resulted from injuries or disease which, under the existing laws, would entitle him to an invalid pension had he been disabled, receives $12 per month, and $2 additional for each child of the soldier under 16 years of age, to be paid to the widow dur-

ing her widowhood, and thereafter to his child or children until they reach the age of 16 years, or in case no widow or children under the age of 16 years, then the parents of such deceased soldier shall be entitled to $12 per month, if in dependent circumstances, during the continuance of such dependency.

Widows and dependent parents of commissioned officers received the "total of rank."

The act of June 27, 1890, commonly known as the Dependent Pension Act, provides that all persons who served for ninety days in the military or naval service of the United States during the War of the Rebellion, and who have been honorably discharged, and who were then or who might thereafter become unable to earn a support, through physical or mental disability not caused by vicious habits, whether such disability is the result of injury or disease brought about by such service or not, shall be entitled to be placed upon the list of invalid pensioners, and receive from $6 to $12 per month, according to the degree of their inability to earn a support.

This pension is to all ranks alike, and any one already receiving a pension may take advantage of this act to increase his pension, but shall not receive it in addition to that already allowed. The pension then allowed must be relinquished if this is claimed. This act also extends the right to receive a pension of $8 per month to the widow of any soldier who has served as above provided, and $2 per month, in addition, for each child under 16 years of age, without proving that the husband's death was the result of army service, such pension to be paid if such widow has no other means of support than her daily labor, and continues during her widowhood, and in case of her death or remarriage, such pension shall be paid to any child or children under 16 years of age. In case any child is insane or helpless, the pension shall continue to such child during such disability, or the life of the child.

The provisions as to soldiers' widows apply only to those who were married prior to the passage of the act. The fee of an attorney for presenting any claim under this act is limited to $10, and any greater charge is made a misdemeanor, punishable by fine not exceeding $500, or imprisonment at hard labor not exceeding two years, or both.

Widows or soldiers of the War of the Revolution receive $8 per month. Survivors of the War of 1812 receive one-half pay at the rate received at the time discharged, and in case of their death leaving a widow, she receives the pension to which her deceased husband was entitled at his death. The survivors of the Mexican War and the widows of deceased soldiers, if not remarried, receive $8 per month.

Before the name of any pensioner is placed upon the rolls, proof of the right to receive such pension is required, and false statements as to material facts render the person making them liable to indictment. Pensions are payable every three months, and agencies are established at different portions of the United States to distribute the vouchers to the proper persons. By statute of the United States, pension money due from the government is not subject to attachment or garnishment, and in many states pension money, and the property which has been wholly purchased by pension money, is exempt, in whole or in part, from the payment of the debts of the pensioner, and cannot be reached by any court process.

According to the report of the United States Commissioner of Pensions for the year ending June 30, 1896, the whole number of pensioners on the roll at that date was 970,678. This was a gain of only 154 over the total for 1895. As there were added 40,374 new pensioners and 3,873 were restored, making a total of 44,247, it can readily be seen that the death rate is very large. The amounts disbursed for pensions was $138,214,761.94,—a decrease of $1,592,575.36 as compared with 1895. The average annual value of each pension was $133.39; under the act of June 27, 1890, it was $109.55. There were, at the time of the report, 495,664 claims pending. On June 30, 1907, the list of pensioners was 967,371, with an amount disbursed of $138.030,894.

PENTATHIONIC ACID. See CHEMISTRY, Vol. V, p. 440.

PENTATHLON, a fivefold athletic "event" in the national games of the ancient Greeks. It included leaping, foot-racing, wrestling, throwing the discus and throwing the spear, which latterly took the place of boxing.

PENTELICUS. See ATTICA, Vol. III, pp. 51–52.

PENTHESILIA. See AMAZONS, Vol. I, p. 576.

PENTLAND FIRTH. See CAITHNESS, Vol. IV, p. 574.

PENTLAND HILLS. See EDINBURGH, Vol. VII, pp. 569, 570.

PENTLANDITE. See MINERALOGY, Vol. XVI, p. 409.

PENUMBRA. See LIGHT, Vol. XIV, p. 585.

PENZANCE, JAMES PLAISTED WILDE, BARON, jurist; born in London, England, July 12, 1816. He was educated at Winchester and Cambridge, was called to the bar at Inner Temple in 1839, and devoted himself to marine and commercial law. He was appointed queen's counsel in 1855, and in 1860 was knighted and made a baron of the exchequer. He was judge of the courts of probate and divorce in 1863–72, and in 1875 was appointed judge of the public warship regulation court and the provincial (ecclesiastical) courts. Sworn a privy councilor in July, 1864, and created a peer of the realm as Baron Penzance in 1869, he became a member of the final court of appeal in the House of Lords. He served on numerous Parliamentary commissions. He died in London in 1899. G. J. H.

PEONY. See PÆONY, Vol. XVIII, pp. 136, 137.

PEOPLE'S PARTY. This name was given to a political party in the state of New York in 1824, an offshoot of the Democratic-Republicans, who favored the choosing of electors by the direct vote of the people. The party supported William H. Crawford, the Congressional caucus nominee of the Democratic-Republican party, who received in the electoral college 41 votes.

The name was later adopted by a party that was

evolved through the Greenback, Labor and Granger political organizations from 1884 to 1892. These associations, weak in isolated issues, tended to coalesce, and their aims became more clearly formulated and were seen to have a common purpose. The Greenback party became the National Greenback party, and in 1876 nominated for President and Vice-President Peter Cooper of New York and Samuel F. Cary of Ohio, the ticket polling 81,740 votes. The latter party, in the next Presidential campaign, expanded into the National Greenback-Labor party, and nominated for President and Vice-President James B. Weaver of Iowa and B. J. Chambers of Texas, the ticket polling 307,306 votes. In 1884 the party was commonly styled the People's Party and had its antimonopolistic champion in Benjamin F. Butler of Massachusetts, the Vice-Presidential candidate being A. M. West of Mississippi. This ticket polled 133,825 votes. The various elements constituting these parties then united with the Farmers' Alliance, and formed themselves into the People's Party, familiarly called the "Populists," whose origin and history up to 1892, when it held its first national convention, is detailed in the article on FARMERS' ORGANIZATIONS, in these Supplements. The aim of the party is to combine the wage-earners and the agriculturists of the country for the advancement of their interests, as against the exploitations of capital, and its socialistic character is pronounced, as may be seen from its platform.

The second national convention of the People's Party was held at St. Louis, July 22, 1896, and nominated, as its candidate, for President, William J. Bryan of Nebraska, who had already been declared the nominee of the regular Democrats, and for Vice-President, Thomas E. Watson of Georgia, in opposition to Arthur Sewall of Maine, who was on the Democratic ticket with Mr. Bryan.

The platform of 1896 declared for "natural money issued by the general government without the intervention of banks of issue, to be a full legal tender for all debts, public and private"; for free and unlimited coinage of silver and gold at the ratio of 16 to 1; for a volume of the circulating medium adequate "to restore the just level of prices of labor and production"; for legislation to "prevent the demonetization of the lawful money of the United States by private contract"; for the payment of its obligations, by the government, in any kind of lawful money, at its option; for an income tax; and for postal savings banks. It denounced the sale of government bonds to replenish the Treasury, unless explicitly authorized by specific acts of Congress, and the surrender by the government, to its creditors, of the option to choose the kind of money in which they are to be paid.

The platform further favored government ownership and operation of railroads and telegraphs; legislation against trusts and monopolies; the election of President, Vice-President and Senators by the direct vote of the people; home rule in the territories, and their early admission to statehood.

The People's or Populist Party has broken its alliance with William J. Bryan. In their convention on April 2nd and 3rd, 1908, they renominated Thomas E. Watson, their standard bearer of 1904. The delegations from Nebraska and Minnesota tried to have the nomination postponed in Bryan's interest until after the Democratic Convention at Denver, and when they failed, they bolted. Samuel Williams of Indiana, was nominated for Vice-President. The Populist platform asks for the abolition of the Constitution by allowing Congress and the President to legislate to suit themselves without interference from the Supreme Court; the government ownership and control of railroads, telegraphs and telephones and other monopolies; public utilities, and work for the unemployed on public improvements in times of depression.

PEORIA, capital of Peoria County, northwestern central Illinois, is located on the west bank of the Illinois River, at the south end of Peoria Lake an expansion of the river, 159 miles south of Chicago. It is the second city in the state in population, with wide, regularly laid out streets and has all conveniences of a modern town. Among its parks Glen Oak Park is considered one of the handsomest in the United States. Peoria is a prominent railroad city, being the intersection of the Chicago, Alton and St. Louis; Lake Erie and Western; Chicago, Peoria and St. Louis; Peoria, Decatur and Evansville; Peoria and Pekin Union; Cleveland, Cincinnati, Chicago and St. Louis; Iowa Central; Toledo, Peoria and Western; Rock Island and Peoria; Chicago, Rock Island and Pacific; Chicago, Burlington and Quincy and Peoria Terminal railroads; also the terminus of a line of steamboats that ply between the city and St. Louis. It contains a court house, United States government building, city hall, 4 hotels, about 30 churches, a normal school, a high school, and a number of subordinate schools, 15 banks, between 200-300 stores, an opera house and 2 public halls with a seating capacity of 4,100. The returns for 1900 showed 90 industries in 871 establishments, having a combined capital of $27,971,613, giving employment to 8,789 persons, paying in wages $4,669,760, and having a product valued at $48,-871,596. The representative industries embrace the manufacture of engines and machinery, agricultural implements, trunks, glucose, brass fixtures, cigars, carriages, brushes, brooms, sashes, doors and blinds, soaps, highwines and bitters, patterns, safes, baskets, mantles, coal-drills, saws, metal rope, jewelry, cornices, elevators, stoves and hardware specialties, marble mantles, grain-registers, watches, etc. The distilling industry is the most important, being represented by 11 establishments having an annual product of about 30,000,000 gallons of spirits, and an annual government tax of about $21,000,000. Five daily newspapers, 2 of which are German, 11 weeklies and 2 monthlies are published here, and a heavy business is done annually in the shipment of bituminous coal taken from mines operated on the city's outskirts. The shipments of grain are very large, Peoria in 1890 ranking eighth in the United States in the amount of grain shipped. The population was in 1900 returned at 56,000.

PEPIN, a Carlovingian family. See PIPPIN, Vol. XIX, p. 122.

PEPIN LAKE, 25 miles long and from two to three miles broad, occurs in the course of the Mississippi River, at the boundary between Wisconsin and Minnesota. It extends from Red Wing in Goodhue County, to Wabasha, in Wabasha County, both in Minnesota, the Wisconsin border being formed by Pierce and Pepin counties. Limestone cliffs in some places 400 feet high fringe the lake which has great scenic beauty and is a boating and angling resort. C.L.S.

PEPPER, WILLIAM, educator; born in Philadelphia, Pa., Aug. 21, 1843; was graduated at the University of Pennsylvania in 1862, and at its Medical Department in 1864. He entered upon the practice of his profession immediately and gained great distinction, becoming known as one of the most expert physicians in the United States. He was lecturer on clinical medicine in the University of Pennsylvania in 1870–76, and professor of the same branch in 1876–87. In the latter year he succeeded Dr. Alfred Stillé as professor of theory and practice of medicine. In 1881 he was chosen provost of the university. Under his administration the institution greatly prospered. Just after his installation the Wharton School of Finances and Economy was founded. In 1882 the department of philosophy for post-graduates was organized, and in the same year the city of Philadelphia established fifty perpetual scholarships for graduates of its public schools. In 1883 the department of veterinary medicine was introduced, and in 1884 that of biology. In 1891 the school of American history was established and the following year the department of hygiene. When Dr. Pepper resigned in 1894 it was discovered that he had not only sacrificed a great deal of practice, but had refused to accept any salary during his incumbency. He, moreover, at the time of his resignation, donated $50,000 toward the University hospital. During his term as provost the students of the university increased from 981 to 2,180, the faculty from 88 members to 268. He died near Oakland, Cal., July 28, 1898. G.J.H.

PROFESSOR PEPPER.

PEPPERS, Old World spice. See PEPPER, Vol. XVIII, pp. 526–528.

PEPPERS, garden plants of the genus *Capsicum*. See CAYENNE PEPPER, Vol. V, pp. 243, 244; and HORTICULTURE, Vol. XII, pp. 291, 292.

PEPPERBRAND, a fungus. See AGRICULTURE, Vol. I, p. 315.

PEPPERIDGE, a tree. See BLACK GUM, CORNACEÆ, GUM-TREE, and TUPELO, in these Supplements.

PEPPERRELL, SIR WILLIAM, a British soldier; born in Kittery, Maine, June 27, 1696. At the age of 21 he was appointed captain of a company of cavalry, and at the age of 30 was advanced to a colonelcy. In 1730 Governor Belcher appointed him chief justice of the court of common pleas, which office he retained until his death. In 1745 Colonel Pepperrell was appointed to command the New England expedition against Louisburg on the island of Cape Breton, and, supported by the fleet of Commander Warren, on June 17th captured it. He was created a baronet in 1746, colonel in the British army (1749), major-general (1775). He was appointed lieutenant-general (1759) and was acting governor of the colony (1756–58). He published, in 1753, *Conference with the Penobscot Tribe*. He died at his native place, July 6, 1759.

PEPSIN. See NUTRITION, Vol. XVII, pp. 690 et seq.

PEPTONIZED FOOD is food treated with pancreatin and other substances with a view of rendering its nitrogenous elements more easily digestible, thus providing nourishment for those whose digestion is weak. The conversion of albumen, casein, fibrin, etc., is caused by trypsin which is similar to pepsin in the gastric juice. It is a process of great value in dietetics. Lean minced beef is peptonized by treating it with a solution of blood-warm water, containing 5 to 20 grains of pancreatin and 5 grains of bicarbonate of soda to each pint. The result is a granulated or spongy friable yellowish substance, of faintly animal smell and bitter relish, soluble in water. The peptonizing may be arrested by bringing the liquid to the boiling point, or by refrigeration, which stops fermentation. W.R.B.

PEQUODS OR PEQUOTS. See INDIANS, Vol. XII, p. 870.

PERA, a suburb of CONSTANTINOPLE; q. v., Vol. VI, pp. 273, 274.

PERÆA. See GILEAD, Vol. X, p. 531.

PERCEPTION. See PSYCHOLOGY, Vol. XX, pp. 56–62; and APPERCEPTION in these Supplements.

PERCHING BIRDS. See INSESSORES, in these Supplements.

PERCHLORIC ACID. See CHEMISTRY, Vol. V, p. 429.

PERCIDÆ. See PERCH, Vol. XVIII, p. 532; and ICHTHYOLOGY, Vol. XII, p. 726.

PERCIVAL, JAMES GATES, an American poet and geologist; born in Berlin, Conn., Sept. 15, 1795. He graduated at Yale in 1815, and, after teaching for a short time in Philadelphia, studied medicine and botany. He made two unsuccessful efforts to practise medicine; first in his native town, and later in Charleston, S. C. In 1824 he was appointed assistant-surgeon in the army and was detailed to duty at West Point as professor of chemistry. He soon resigned this position and was transferred to the recruiting-office in Boston. In 1827 he removed to New Haven and assisted in the preparation of *Webster's Dictionary*. He had meanwhile studied geology, and in 1835 was engaged on a geological and mineralogical survey of Connecticut. In 1853 he undertook a survey of mining property in Wisconsin, and in 1854 was appointed geologist of that State, a position

he held until his death. He was a philologist of no mean attainments. Among his publications are *Prometheus, and Other Poems* (1820); *Clio* (1822–27); a translation of Malte-Brun's geography (1833); *The Dream of a Day* (1843); and a posthumous collection of his poems in two volumes (1860). He died in Hazel Green, Wis., May 2, 1857. E.E.T.

PERCOPSIDÆ, the family of trout-perches. These fishes bear resemblances both to trout and perch. There are two genera, both North American. The sand-roller (*Percopsis*) is a small, valueless fish which lives near the shores of the Great Lakes, and is abundant near wharves. The genus *Columbia* is confined to rivers in the Columbia River region. It is a large fish and important as a food-fish.

PERCUSSION. See MEDICINE, Vol. XV, 824.

PERCUSSION FUSE. See AMMUNITION, Vol. I, p. 653.

PERCY, HENRY (HOTSPUR). See PERCY, Vol. XVIII, p. 534.

PERCY, JOHN, a British metallurgist; born in Nottingham, England, in 1817; educated in Paris and in Edinburgh, where he was a pupil of Sir C. Bell, and where he graduated M.D. For some years he was in medical practice at Birmingham. Dr. Percy was appointed, in 1851, professor of metallurgy in the Royal School of Mines, holding that office till December, 1879. He was the author of an important work on *Metallurgy; or, The Art of Extracting Metals from Their Ores and Adapting Them to the Various Purposes of Manufacture*, with illustrations (1861); *The Metallurgy of Gold, Silver and Lead* (1869); and *The Metallurgy of Lead, Including Desilverization and Cupellation* (1871). The Iron and Steel Institute, on Jan. 25, 1877, awarded their Bessemer medal to Dr. Percy for his works on metallurgy, especially those on iron and steel. He died June 19, 1889.

PERDU, a mountain. See PYRENEES, Vol. XX, p. 131.

PEREDA, JOSÉ MARIA DE, a Spanish novelist; born in Santander in 1833; early devoted himself to the study of the life he found around him, and gave it literary expression in the form of sketches, which began to appear about 1855 in a journal published in his native town. These sketches he collected in 1864, and published, with the title *Escenas Montañesas*. This was followed by *Tipos y Paisajes* (1871); *Bocetos al Temple* (1876); *Tipos Trashumantes* (1877); *El Buey Suelto*, a more ambitious attempt (1877); *Don Gonzalo González de la Gonzalera*, a political tale (1878); *De tal Palo, tal Astilla* (1879); *Esbozos y Rasguños* (1881); *Pedro Sánchez* (1883); *Sotileza* (1884); *La Montálvez* (1887); *La Puchera* (1888); *Nubes de Estío* (1891); *Al Primer Vuelo: Idilio Vulgar* (1891); etc. Died March 2, 1906.

PEREGRINE FALCON. See FALCON, Vol. IX, p. 4.

PÈRE HYACINTHE. See LOYSON, CHARLES, in these Supplements.

PEREIRA DA SILVA, JOÃO MANOEL, historian; born in Rio de Janeiro, Aug. 30, 1817. His publications include *History of the Founding of the Empire of Brazil; Portuguese Literature: Its Past and Present; Brazilian Plutarch; Jeronimo Corte-Real; Second Period of the Reign of Dom Pedro I in Brazil; History of Brazil during the Minority of Dom Pedro II, 1831–40*, and *Epic Poetry*. G.J.H.

PERE LA CHAISE. See CEMETERY, Vol. V, p. 287.

PERESKIA. See CACTUS, Vol. IV, 555, 556.

PEREZ, SANTIAGO, a Colombian statesman and diplomat; born in Cipaquira in 1830. He studied in Bogota and was admitted to the bar in 1851. In 1856 he was the editor of *El Tiempo*. He was elected to Congress in 1863 and in 1864 was appointed secretary of the interior and foreign affairs. From 1870 to 1872 he was minister to the United States. In 1873 he was elected president of Colombia, and later was appointed rector of the National University. W.M.C.

PEREZ GALDÓS, BENITO, a Spanish novelist; born in 1845, at Las Palmas, in the Canary Isles. As a writer of fiction he first distinguished himself by the publication of two historical romances relating to the state of Spain in 1820 and 1824, and entitled, respectively, *La Fontana de Oro* (1871) and *El Audaz*. Next, in imitation of MM. Erckmann-Chatrian, he published two series of *Episodios Nacionales*, the first dealing with subjects taken from the war of independence against Napoleon and the second describing the struggle of Spanish liberalism against the tyranny of Ferdinand VII. These novels achieved a great success in Spain and were also widely read in Spanish America. They include *Bailén* (1873–75); *Napoleón en Chamartin* (1874); *Cadiz* (1874); *La Batalla de los Arapiles* (1875); *El Terror de 1824* (1877); *Doña Perfecta* (1880); *El Amigo Manso* (1881); *Lo Prohibido* (1884); *Miau* (1888); *La Incógnita* (1890); *Angel Guerra* (1891).

PERFECTIBILISTS. See ILLUMINATI, Vol. XII, p. 745.

PERFECTING PRESSES. See PRESSES, in these Supplements.

PERFECTIONISM, the name of a doctrine of a mystical state in which the believer is freed from responsibility for sin in his members. In no case do those who claim to have reached perfection assume superiority for goodness over others, as their condition is purely the work of grace, so that they can lay no claim of merit to it, and because they are only free from imperfections and guilt in not consenting to it. The doctrine has had many phases of expression, from the rapture of a John Tauler or a Madame Guyon to the Oneida Brethren of New York, who bore the self-selected name of "Perfectionists" (see Vol. XVII, pp. 794, 795). Support for the doctrine is found in such passages as "whosoever is born of God sinneth not; but he that is begotten of God keepeth himself, and that wicked one toucheth him not" (1 John v, 18). The root of the corresponding experience is simply such complete self-consecration to God, that the soul rejects all estrangement, and wishes nothing but to do God's will. Of course, such a disposition is possible, though rare. It does not imply, however, that the soul realizes its ideal in performance, but only

in intent. Hence the perfected one may show the limitations of ignorance, prejudice and even of the surprises of passion. The whole experience is mystical, is peculiar to certain dispositions, and stands on the brink of antinomianism—sometimes fall over into the abyss.

Recognizing that all men have not equal capability of devotion, the Roman Catholic Church has its "Counsels of Perfection" for those who feel the vocation to a complete spiritual life. It distinguishes between the obedience necessary to salvation and the works which are counseled of God, but not commanded. There are mortal and venial sins, and the first are violations, of imperative law. Venial sins do not imperil salvation, and are not incompatible with works that may be done by those who "would be perfect." Hence arises a doctrine of works of supererogation, or that belong to the "Counsels of Perfection." Those who do them do so of divine grace, and hence acquire no personal merit in their performance. But these gifts of God are to the church, through the individual, and hence are susceptible of vicarious use.

Among Quietists, Friends, Plymouth Brethren and certain Methodists, as well as among other unworldly sects of mystic tendencies, perfection is the equivalent for a state of sanctification, and not for the complete achievement thereof. It is potential sanctification,—a keeping of God. They sometimes call it "entire sanctification," meaning a complete consecration of soul to God,—a dominant, all-pervading purpose to do God's will. The wrong they do they would not. In their state of grace they are not responsible for sin working in their members, or for the delusions and betrayals of the devil.

The achievement of consecration, even to utter self-effacement, is possible for weak, limited and tempted man. Too often those who think they have reached that state find, in the stress of trial, that they have been self-deluded; others, overcome by temptation, have claimed that for the pure in heart there is no law, and so have given themselves up to follow their own impulses.

Dogmatic Christianity allows scant place for entire sanctification or perfectionism on earth. The orthodox Protestant belief is that sanctification is a progressive process never completed this side of the grave, and that every Christian has daily need to pray for the forgiveness of sins.

PERIANTH. See Botany, Vol. IV, 113, 114.

PERICARDITIS. See Rheumatism, Vol. XX, p. 531.

PERICARDIUM. See Anatomy, Vol. I, 790.

PERICARP. See Botany, Vol. IV, pp. 134, 135.

PERICHÆTA. See Worms, Vol. XXIV, 718.

PERICLES, Age of. See *Third Period*, under Archæology, Vol. II, pp. 309–314.

PÉRIER, Auguste Casimer Victor Laurent, statesman; born in Paris, France, in 1811, son of Casimer Perier (1777–1832), minister of finance in 1828 and premier of France in 1831. Elected to the French Chamber of Deputies in 1846, M. Perier became a member of the Legislative Assembly under the republic of 1849. As such he voted with the majority and protested against Louis Napoleon's *coup d'état* of December, 1851. He died in Paris, June 6, 1876. G.J.H.

PERIER, Casimir. See Casimir-Périer, in these Supplements.

PERIER, Casimer, statesman; born in Grenoble, France, Oct. 21, 1777. He became a prosperous banker at Paris, was elected to the Chamber of Deputies in 1815, voted with the Opposition, actively supported the popular cause in the revolution of 1830, and became prime minister in 1831. As such he repressed all attempts at revolution and resisted the popular pressure to aid the Poles at the cost of war with the Allied Powers. He died in Paris, May 16, 1832. G.J.H.

PERIGEE. See Apogee, in these Supplements.

PERIHELION. See Astronomy, Vol. II, pp. 695, 696.

PERIM, a small island and since 1884 a British coaling station in the Strait of Bab-el-Mandeb, at the entrance to the Red Sea. It is about 1½ miles from the coast of Arabia, opposite Mocha, and about 10 miles distant from the coast of Africa. It rises to a height of 245 feet, a bleak, arid, and barren rock about 4 miles long and 1½ miles wide. Arab fishermen frequent its shores to catch turtles, but its value is purely strategic, and it was an object of British solicitude as early as 1799. It is fortified, has a small garrison and is administered from Aden, 95 miles to the east. C.L.S.

PERIODICALS. See Vol. XVIII, pp. 546, 556; and Magazines, in these Supplements.

PERIODIC RELATIONS OF THE ELEMENTS. See Chemistry, Vol. V, pp. 470, 471.

PERIŒCI. See Sparta, Vol. XXII, p. 384.

PERIOSTEUM and PERIOSTITIS. See Surgery, Vol. XXII, pp. 719, 720.

PERIPATUS. See Myriopoda, Vol. XVII, pp. 123, 124.

PERISCOPE, an instrument used on submarine boats for enabling a person inside to see about the horizon above. It consists of an upright telescope, with a mirror placed at the lower end, so that the observer can look in horizontally. At the top is placed a lenticular total-reflecting prism. The apparatus may be turned toward any part of the horizon. See Altiscope, in the Supplements.

PERISSODACTYLA. See Mammalia, Vol. XV, p. 433.

PERISTALSIS. See Nutrition, Vol. XVII, pp. 689, 690.

PERISTEROPODES. See Guan, Vol. XI, p. 206.

PERISTYLE. See Architecture, Vol. II, p. 413.

PERITONEUM. See Digestive Organs, Vol. VII, p. 194; and Peritonitis, XVIII, 558, 559.

PERIWINKLE, a plant. See *Vinca*, under Horticulture, Vol. XII, p. 260; and Mollusca, Vol. XVI, p. 673.

PERKIN, William Henry, an English chemist, and the discoverer of aniline; born in London,

March 12, 1838. He was educated at the City of London School; made phenomenal progress in chemistry under Dr. A. W. Hoffman, at the Royal College of Chemistry, becoming assistant to the latter in 1855. The following year, while conducting an experiment at home for the production of quinine synthectically, he discovered "aniline purple" or "mauve." This discovery led to the development of the industry of the production of colors from coal-tar products, which became, in his hands, in association with his father and brother, under their firm name of Perkin and Sons, an immense enterprise. He retired from the prosecution of technical work in 1873. During all the period of his active research he conducted many investigations in other lines, one of his more noted achievements being in connection with salicylic aldehyde, showing that this substance is not only an aldehyde, but a phenol. This resulted in the artificial production of coumarin and other odoriferous substances. A new reaction known as "Perkin's reaction" also resulted, by means of which other experimenters were able to produce cinnamic acid. His researches into the property of substances to rotate the plane of polarization when placed in the field of a magnet, by showing that it varies with bodies in a definite manner, was of the first importance as making available a new means of determining the constitution of bodies. In 1866 he was elected a fellow of the Royal Society; elected president of the Chemical Society in 1883; received the degree of Ph.D. from Würzburg in 1882; and that of LL.D. from St. Andrews in 1891. He received the royal medal and the Davy medals from the Royal Society, and the Albert medal from the Society of Arts.

PERKINS, Charles, an American art critic; born in Boston, March 21, 1823; graduated at Harvard in 1844; studied art in Paris and in Rome; he then took to etching and illustrated his own books; visited Europe frequently with the object of becoming an experienced art critic in his native country. The first work to bring him into notice was *Tuscan Sculptors* (2 vols., 1865), with over seventy of his own etchings. He also published *Italian Sculptors* (1868); *Art in Education* (1870); *Raphael and Michael Angelo* (1878); *Sepulchral Monuments in Italy* (1883); *History of the Handel and Haydn Society* (1883); and *Ghiberti et son École* (Paris, 1886). All these works exhibited his diligence in securing fresh biographical data. He annotated Jacob von Falke's *Art in the Household* (1879); and in collaboration with J. D. Champlin, Jr., brought out an *Encyclopædia of Painters and Painting* (4 vols., 1886–88). He died in Windsor, Vermont, Aug. 25, 1886.

PERKINS, Elisha, an American physician; born in Norwich, Conn., Jan. 16, 1741. He began the practice of medicine in Plainfield, Conn., and was very successful. About 1796 he brought forward an invention which he called "metallic tractors," consisting of two rods about three inches in length and pointed at the ends. One resembled brass, and the other steel, but the inventor claimed that they were made of a secret combination of metal. They were used chiefly in local inflammations, such as pains in the head, face, teeth, and side, in rheumatism, and diseases of a similar character, the points being applied to the affected part, and then drawn over it in a downward direction for about twenty minutes. For a time this method of cure enjoyed great reputation, not only in America, but in Europe. Five thousand cures by these instruments in London were certified to by eight professors, forty physicians, and thirty clergymen, and the claims of cures reached a fabulous number; but the tractors fell into neglect almost as speedily as they became famous. Dr. Perkins fell a victim to yellow fever in an attempt to utilize an antiseptic of his own invention against that disease, and died in New York, Sept. 6, 1799. E.E.T.

PERLIDÆ. See Insects, Vol. XIII, p. 158.

PERMANGANATES. See Manganese, Vol. XV, p. 488.

PERMEABILITY, Magnetic. See Electricity, § 57, in these Supplements.

PERMIAN SYSTEM. See Geology, Vol. X, pp. 311, 312.

PERMUTATION. See Algebra, Vol. I, pp. 493, 494.

PERNOFF. See Pernau, Vol. XVIII, p. 563.

PERONOSPOREÆ. See Fungus, Vol. IX, pp. 727, 729.

PÉROUSE, Jean François. See La Pérouse, Vol. XIV, p. 298.

PEROWNE, John James Stewart, theologian; was born at Burdwan, Bengal, on March 13, 1823, the son of an English missionary, of French ancestry, and was educated at Cambridge University, where he was one of the most brilliant scholars of his time. He was graduated in 1845 and became a fellow of Corpus Christi College in 1849. He was Hulsean lecturer in 1868; canon residentiary of Llandaff in 1869; lecturer in King's College, London; vice-principal of Lampeter College; prelector in theology and fellow of Trinity College, Cambridge, and dean of Peterborough Cathedral in 1878. In 1875 he became, also, Hulsean professor of divinity at Cambridge University. In 1891 he was made bishop of Worcester. He was a prominent and influential member of the committee on the revision of the Old Testament, and was the chief editor of the *Cambridge Bible for Schools*. His published works include also a *Commentary on the Psalms* (1864–68); a compilation of his Hulsean lectures at Cambridge on *Immortality* (1869); a volume of *Sermons* (1873) preached at Llandaff and at Lampeter College, and an edition of the *Remains* of Bishop Thirlwall (1878). W.F.J.

PEROXIDE OF HYDROGEN. See Bleaching, Vol. III, p. 713.

PERPETREA, Cape, a point of land on the Pacific Coast, in northern Lane County, central western Oregon. On it is situated a lighthouse with a fixed white light of the first order, 150 feet above sea-level. Lat. 44° 16′ 33″ N., long. 124° 5′ W.

PERPETUITY. See Annuities, Vol. II, pp. 65, 66.

PERRAULT, Claude (1613–88), a French archi-

tect, brother of Charles (Vol. XVIII, p. 568). See PARIS, Vol. XVIII, p. 298.

PERRON, stairs. See ARCHITECTURE, Vol. II, p. 413.

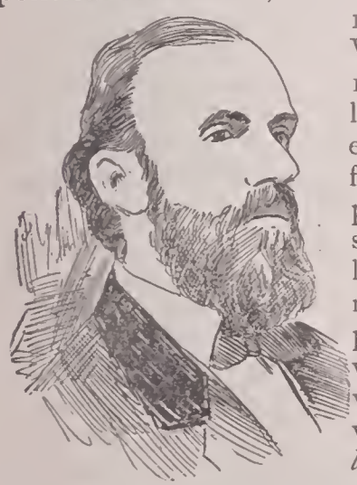
PERRON, DU. See ANQUETIL DU PERRON, Vol. II, p. 81.

PERROT, GEORGES, historian of art and archæologist; born in the village of St. George, France, Nov. 12, 1832. He early devoted his attention to archæology and art in which studies he became very proficient. In 1877 he was chosen professor of archæology in the Faculty of Letters. After several years of service in this capacity he was, in 1883, made director of the Upper Normal School. Later he went to Asia Minor to carry on archæological explorations. He was the first to make an entire copy of the famous inscription on the monument to Augustus in Ancyra. In conjunction with the architect, C. Chipiez, he published the *History of Art in Antiquity*, a work which treats of art in Asia Minor, Chaldea, Egypt, etc., and which has won world-wide recognition. G.J.H.

PERRY, a city of Dallas County, southwestern central Iowa, on the Raccoon River, and on the Chicago, Milwaukee and St. Paul and Chicago, Rock Island and Pacific railroads, 34 miles W.N.W. of Des Moines. It is in an agricultural, stock-raising and coal-producing region; has good public schools, electric lights, water-works, a daily and three weekly papers, foundries, flour-mills and machine-shops. Population 1890, 2,880; 1900, 3,986.

PERRY, a city and the capital of Noble County, northeastern Oklahoma, 34 miles N. of Guthrie, on the Atchison, Topeka and Santa Fé railroad. Settled in 1893, the growth of this place has been remarkable. It contains churches, public and private schools, banks, a board of trade, United States land-office, a daily and five weekly papers, and is an important trade center for a large surrounding territory. Population (1900), 3,351.

PERRY, ARTHUR LATHAM, an American political economist; born in Lyme, N. H., Feb. 27, 1830. He graduated at Williams College in 1852; was professor of history and political economy at Williams from 1853 to 1891, and professor emeritus of the same science from the latter date. After his retirement from active professional life he devoted much time to the writing of history. He was the author of *Political Economy*, which passed through 20 editions; *Williamstown and Williams College;* and of many public addresses in behalf of free trade. Died July 9, 1905. E.E.T.



ARTHUR L. PERRY.

PERRY, JOHN, an English electrician and physicist; born in Garvagh, a town in Ulster, Ireland, in 1850; graduated at Queen's University of Ireland, in 1870, as bachelor of engineering. In 1882 the university senate conferred upon him the honorary degree of master in engineering. From 1870 to 1874 he lectured on physics at Clifton College; was secretary of the A section, British Association, in 1874; and in the same year became the assistant and associate of Sir William Thomson (see KELVIN, in these Supplements). In 1875 he read a paper on *The Electric Conductivity of Glass as Dependent on Temperature*, before the Royal Society of London; and another paper, conjointly with Sir William Thomson, on *Capillary Surfaces of Revolution*, before the Royal Society of Edinburgh. In 1875 he went to Japan as instructor in the Imperial College of Engineering, returning home in 1879. In 1882 he became professor of mechanical engineering and applied mathematics in the Finsbury Technical College, conjointly with Professor William E. Ayrton (q.v., in these Supplements). He was inventor of a large number of practical electric appliances, among which are meters of various sorts, a dynamo, motors, accumulators, switches, an electric lamp, and many others. He became a fellow of the Royal Society in 1885; and the degree of doctor of science was conferred on him by the Royal University of Ireland. Perhaps his most valuable invention is the electric-supply meter. Besides the papers mentioned, he wrote upon *The Future Development of Electrical Appliances* (1881), and a number of others in partnership with Professor Ayrton.

PERRY, MATTHEW GALBRAITH, a commodore in the United States navy, was born in Newport, Rhode Island, April 10, 1794. He conducted the skillful negotiations which, without force or bloodshed, opened Japan to foreign commerce in 1854. He died in New York, March 4, 1858.

PERRY, NORA, author; born in Dudley, Mass., in 1832. Shortly after her birth her father settled in Providence, R. I., and she there spent her early life. She began to show her taste for literature as early as 1840, when she wrote a short story entitled *The Shipwreck*. She at first wrote entirely in verse. The poem which brought her public attention was entitled *Tying Her Bonnet under her Chin*. A year later she wrote *After the Ball*, which was published in the *Atlantic Monthly*. Longfellow called this poem very artistic and years after its publication said he would have been glad to have written it himself. Miss Perry was long correspondent for the Providence *Journal* and the Chicago *Tribune*. She also became known as a writer of girls' stories. She published *After the Ball and Other Poems; A Rosebud Garden of Girls; Hope Benham*, etc. She died May 14, 1896. G.J.H.

PERRY, OLIVER HAZARD, an American naval officer; born in South Kingston, near Newport, R. I., Aug. 23, 1785. He entered the United States navy as a midshipman in April, 1799, cruised among the West Indies, and served in the war against Tripoli. In 1807 he was promoted to the grade of lieutenant, and in 1809 was given command of the schooner *Revenge*, which in 1811 was wrecked on Watch Hill Reef off the coast of Rhode Island. An official court of inquiry ac-

quitted him of any neglect or carelessness. At the beginning of the War of 1812, he was in command of a division of gunboats at Newport, R. I., but in Feb., 1813, was transferred, at his own request, to Lake Erie under the command of Commodore Isaac Chauncey. At Presque Isle he superintended the building and equipment of a fleet of nine small vessels, and was placed in command. On Sept. 10, 1813, he encountered a British fleet under Barclay near Put-in-Bay, and after a hard-fought battle the British surrendered. Perry sent to General Harrison the despatch which has become famous in American history, "We have met the enemy and they are ours." Perry's victory was most important, giving the Americans the control of Lake Erie, and enabling Perry to cooperate with General Harrison and the land forces in the operations which resulted in the British evacuating Detroit. Perry became one of the heroes of the war. Congress gave him a gold medal and he was promoted captain. In 1814 he was appointed to command the *Java*, and took part in the defense of Baltimore. After the war he cruised in the Mediterranean with Decatur's squadron. He was appointed a commodore and in 1819 was given command of a squadron for the West Indies. In July he ascended the Orinoco River to Angostura, where he was seized with yellow fever and died at Port of Spain, Trinidad, August 23, 1820. In 1826 his remains, by an Act of Congress, were removed to Newport, R. I. The state of Rhode Island afterward reared a monument over his grave. There is a bronze statue of Perry in Newport and a marble statue in Cleveland, O. W.M.C.

COMMODORE O. H. PERRY.

PERRY, WILLIAM STEVENS, an American clergyman, bishop of the Protestant Episcopal Church; born in Providence, Rhode Island, Jan. 22, 1832; graduated at Harvard in 1854, and entered holy orders in 1857. He began as an evangelical, but in later years, became a recognized champion of the highest episcopal prerogative. He held rectorships and assistantships in Boston, in Portland, Maine, in Nashua, New Hampshire, and in other places. He became president of Hobart College in 1876, and bishop of Iowa and president of Griswold College in the same year. In 1891 he publicly refused to consent to Phillips Brooks's consecration as bishop of Massachusetts unless Dr. Brooks should retract his rejection of the dogma of apostolic succession. He compiled numerous works, and wrote the articles on points of rites, titles, ceremonial forms, and prelatical honors for a recent edition of an American cyclopædia. Died at Dubuque, Ia., May 13, 1898.

PERRYSBURG, a village of Wood County, northwestern Ohio, at the head of navigation on the Maumee river, nine miles S.W. of Toledo, and on the Cincinnati, Hamilton and Dayton railroad. It has good water-power and manufactures of flour and lumber. Ship-timber and staves are shipped in large quantities from this point. Population 1900, 1,766.

PERRYVILLE, a village of Boyle County, central Kentucky, about 40 miles S.W. of Lexington and 12 miles W. of Danville. It is celebrated as the scene of a hard-fought battle between the Union and Confederate armies of Buell and Bragg, Oct. 8, 1862. General Bragg, with 40,000 troops, was retreating into East Tennessee when, overtaken by Buell with 58,000 men, he was forced to turn and give battle. The fight was a desperate one, lasting all day, and at its close Bragg retired, but was not followed by Buell. The Union loss was placed at 4,300, and the Confederates were thought to have been even heavier. Population 1900, 431.

PERRYVILLE, a village and the capital of Perry County, southeastern Missouri, 76 miles S.E. of St. Louis, 14 miles S. of Chester, Illinois, and about 10 miles from the Mississippi River, on the Chester, Perryville, Ste. Genevieve and Farmington railroad. It is in a region producing large quantities of wheat, besides corn, oats, barley, wool, sorghum, potatoes, tobacco and live-stock. Population 1890, 875; 1900, 848.

PERSEPHONE. See PROSERPINE, Vol. XIX, p. 846.

PERSEUS, the last king of Macedon. See ROME, Vol. XX, pp. 772, 773.

PERSIA. (For general article, see PERSIA, Vol. XVIII, pp. 573–673.) The latest published official estimate (that of 1881) reported the area at 628,000 square miles. Population, based mainly on estimates in 1881, as follows:

Inhabitants of cities	2,000,000
Population belonging to wandering tribes	2,000,000
Inhabitants of villages and country districts	3,750,000
Total population	7,750,000

The estimated population in 1908 was 10,000,000. The number of European and American residents does not exceed 1,000.

The principal cities of Persia are: Teherân, with a population of 250,000; Tabrîz, 180,000; Ispahân, 80,000; Meshed, 60,000; Barfurush, 50,000; Kerman, 45,000; Resht, 41,000; Kazvin, 40,000; Yezd, 40,000; Hamadan, 35,000; Kermansha, 32,000; Shiraz, 32,000; Dizful, 30,000; Kashan, 30,000; and Kom, 25,000. Of the nomads, 260,000 are Arabs; 720,000 Turks; 675,000 Kurds and Leks; 20,700 Baluchis and gipsies; 234,000 Lurs.

REIGNING SHAH AND ROYAL FAMILY. Mohammed Ali Shah, born June 21, 1872; succeeded his father, Muzaffar-ed-dîn, January 8, 1907. Children of the Shah are Stezad es Saltaneh; Sultan Ahmed Mirza, heir apparent, Muhammed Mehdi Mirza, Muhammed Hazzan Mirza and some daughters.

The royal family is very numerous; there are some thousand of princes and princesses, but the official year-book only mentions about a hundred.

The Shah of Persia—by his official title "Shâhinshâh," or "king of kings"—absolute ruler and master of the lives and goods of all his subjects until 1906.

The whole revenue of the country being at their disposal, recent sovereigns of Persia have been able

to amass a large private fortune. The wealth of Muzaffar-ed-dîn was reported to amount to $25,000,000 or $30,000,000, most of it represented by diamonds, the largest, the Deryâ i Nûr, of 186 carats, and the Tâj i Mâh, of 146 carats, and other precious stones, forming the crown jewels.

Up to the year 1906, the form of government was a pure despotism. In that year, on January 11, the clergy and the progressists under the leadership of Said-Mahomet, entered Teherân and asked for the establishment of a House of Justice and the constitution was granted on September 6. On September 25, the Parliament was assembled. An ordinance of September 10, had fixed the number of members at 162, and early in October elections were held. On October 8, the Shah opened the Parliament with great solemnity and the National Council chose a president. A rescript of December 30, 1906, signed by the late Shah and by the heir apparent, and the grand vizier, states the powers and duties of the National Council. The delegates are elected for a term of two years, will meet annually on October 8, and are immune from prosecution, except with the knowledge of the National Council. No laws can be passed and no concessions can be granted, nor treaties concluded; and no loans floated without the consent of the National Council. There is also to be a Senate of 60 members, of whom 30 are to be appointed by the Shah, and 30 to be elected by the National Council. On October 8, 1907, the Shah signed the final Constitution and on November 12, before the House took the prescribed oath. The executive government is to be carried on under a cabinet of eight members.

The country of Persia is divided into 33 provinces which are governed by governor-generals who are directly responsible to the central government and can appoint the lieutenant-governors of the different districts. Every town has a mayor and every village a chief. A law of May, 1907, provides for the election of rural and town councils. In these elections practically all subjects have a right to vote. The annual revenue in 1907-1908, was estimated at $8,000,000 and the expenditure about the same. About half of the revenue consists of payments raised by assessments upon districts, towns and villages, and almost the entire burden of taxation lies upon the laboring class. The other half of the revenue is from customs, posts, telegraphs, fisheries, mines and other concessions. Justice is administered by the governors and their representatives and by the Sheiks-el-Islâm and the priesthood. The former administer justice by the common law, the latter according to divine law. Of the population about 9,000,000 are Shîahs, 800,000 Sunnîs, 9,000 Parsis, 35,000 Jews, 45,000 Armenians and 25,000 Nestorians. Elementary instruction in private schools is very generally diffused among all classes. There is a large number of colleges where students are instructed in religion and in Persian and Arabian literature. A polytechnical school is also open at Teherân with four French professors in 1905. Since 1905 there are military colleges at Teherân and Tabrîz with over 100 pupils.

The regular army amounts to about 65,000, and the irregular troops to about 50,000 men. The army was reorganized in 1905. The navy consists of 8 vessels, all doing service for the customs department. The total value of imports and exports in 1907-1908 was $72,633,170. The chief exports consist of silk stuffs, raw silk, opium, gums, tobacco, wool and carpets. The principal centres of commerce are Tabrîz, Teherân and Ispahân, and the principal ports, Bender Abbas, Lingah and Bushire on the Persian Gulf, and Astara, Enzeli and Bender i Gez on the Caspian.

History. For history of Persia to 1888, see Persia, Vol. XVIII. In 1888, England succeeded in securing the opening of the Karun River to international navigation; in the same year the railroad from Teherân to Shah Abd-ul-Azim was opened. In 1889, Russia was given permission to establish insurance and transportation companies and a street railway in Teherân; and to England a concession for the establishment of a Persian Imperial Bank. In 1890 England was given the tobacco monopoly for 50 years, but in 1891 it had to forego this privilege on account of a great popular revolt. In 1892, Russia secured permission to establish a commercial bank. On May 1st, 1896, Nâsr-ed-dîn was murdered by a fanatic and was succeeded by his son, Muzaffar-ed-dîn. In 1900 Russia made Persia a loan of 22,500,000 rubles to be guaranteed by custom receipts, and obtained railroad and banking concessions. In 1901 the government established a uniform duty of 5 per cent advalorem on imports and exports. In 1902 a commercial treaty between Russia and Persia was ratified. In the same year and in 1903, England obtained a similar treaty and a concession to construct the telegraph connection with India through Persian territory. In 1906 the Shah gave a constitution to his country, and the first Parliment was opened on October 8, 1906. On January 8, 1907, Shah Muzaffar-ed-dîn died and was succeeded by his oldest son Mohammed Ali. In August, 1907, Great Britain and Russia made an agreement between themselves to limit the spheres of their respective interests in Persia to the Persian provinces adjoining the Russian frontier on the one hand, and the British frontier on the other. The two powers respect the integrity and independence of Persia but contemplate the possible necessity of financial control of Persia. The Parliament was in session from October 8, 1907, till June 23, 1908, when the Shah declared it dissolved. As the Nationalists were not so willing to leave the Parliament, the building was surrounded by Cossacs and troops of the line, who demanded the surrender of the liberal members. The latter refused and some fired on the Cossacs wounding and killing a number of them. The building was then bombarded, till it was a mass of ruins, and the city plundered. Many delegates, amongst them the President, sought refuge at the British and French consulates. The Vice-President was captured and 3 prominent agitators were hanged; 154 sol-

diers and 300 nationalists were wounded and killed, and 30 prominent members of the opposition were arrested. A revolution broke out also at Tabrîz, on July 23, 1908. For 35 days there was fighting in the streets and over 800 were killed and wounded. A decisive battle near Tabrîz between the government troops and the revolutionists is expected.

PERSIAN ARCHITECTURE. See Vol. II, pp. 350–351.

PERSIAN BERRIES. See FRENCH BERRIES, in these Supplements.

PERSIAN CERAMICS. See POTTERY, Vol. XIX, pp. 639–642.

PERSIAN GULF. See ARABIA, Vol. II, pp. 207–208, 213.

PERSIAN INSCRIPTIONS. See PERSIA, Vol. XVIII, p. 667.

PERSIAN INSECT POWDER, a powerful insecticide prepared from a dried plant of the genus *Pyrethrum*, one of the *Compositæ*. The plant is largely cultivated in California, where large quantities of the powder are manufactured and exported.

PERSIAN LANGUAGE. See PERSIA, Vol. XVIII, pp. 665–668.

PERSIAN LITERATURE. See PERSIA, Vol. XVIII, pp. 665–673.

PERSONAL EQUATION OR ERROR. See TIME, Vol. XXIII, pp. 677–678.

PERSONALITY OR IDENTITY. See *Self*, under PSYCHOLOGY, Vol. XX, pp. 88–90.

PERSPECTIVE. See PROJECTION, Vol. XIX, pp. 826–829.

PERSPECTIVE PROJECTION. See GEOGRAPHY, Vol. X, pp. 180–183.

PERSPECTOGRAPH, a device for mechanically fixing the principal points of a perspective drawing. It consists of a frame with a hole for an eye-piece, and a pointer which is swung between the eye and the scene viewed. A piece of paper is used to record the points noted, as the pointer is brought opposite to them. In this way the main outlines of a drawing may be arranged in correct perspective.

PERSPIRATION OR SWEAT. See NUTRITION, Vol. XVII, p. 704.

PERTH AMBOY, a township and co-extensive city of Middlesex County, New Jersey, in the northeastern part of the state. It fronts on the Raritan River, Raritan Bay, and Staten Island Sound, and is reached by the Central of New Jersey and Pennsylvania railroads, and by ferry from Tottenville at the southern end of Staten Island. The Raritan River is spanned, at its mouth, by an enormous drawbridge, connecting Perth Amboy with South Amboy. The city is the center of a region rich in clay of superior quality, and is accordingly largely devoted to the manufacture of bricks, tiles, clay piping, etc., and has also cement works, iron foundries, machine shops, oil refineries, cigar factories, and many other establishments. Although distinctively an industrial and commercial city it is a favorite place of residence, a summer resort, and a yachting and fishing center. It has several public and private high schools, a public library, and a soldiers and sailors' monument. Its population in 1900 was 17,699. W. F. J.

PERTURBATIONS. See GRAVITATION, Vol. XI, pp. 65–67.

PERU, REPUBLIC OF. There has been a recent census, which is here given. Of the inhabitants 57 per cent are aborigines and 23 per cent are of mixed races. The republic is divided into 18 departments and 2 provinces (Callao and Moquegua), the area and population of which were reported as follows at the last census taken (in 1896):

DEPARTMENTS.	Area in Square Miles.	Population.
Piura	16,825	213,909
Cajamarca	12,538	442,412
Amazonas	13,943	70,676
Loreto	288,456	100,596
Libertad	10,206	250,931
Ancachs	16,562	428,703
Lima	13,300	298,106
Callao	14	48,118
Huancavelica	9,251	223,796
Huanuco	14,023	145,309
Junin	23,347	394,393
Ica	8,718	90,962
Ayacucho	18,185	302,469
Cuzco	156,270	438,646
Puno	41,198	537,345
Arequipa	21,947	229,007
Moquegua	5,547	42,694
Apurimac	8,187	177,387
Lambayeque	4,613	124,091
Tacna	12,590	50,449
Total	695,720	4,609,999

The carefully estimated total population in 1876 was 2,660,881. Total area, 695,733 square miles. Population of Lima, the capital (1900), 113,000.

There are besides, about 350,000 uncivilized Indians.

As a result of the war with Chile, the latter country has annexed the province of Tarapacá. The Chileans also occupy the department of Tacna for 14 years, after which a popular vote is to decide to which country it is to belong.

CONSTITUTION AND GOVERNMENT. The present constitution, proclaimed Oct. 15, 1856, was revised Nov. 25, 1860. It is modeled on that of the United States, the legislative power being vested in a Senate and a House of Representatives, the former composed of deputies of the provinces, in the proportion of one for every 30,000 inhabitants or fraction exceeding 15,000, and the latter of representatives nominated by the electoral colleges of the provinces of each department, at the rate of two when the department has two provinces, and one or more for every other two provinces. The parochial electoral colleges choose deputies to the provincial colleges, who in turn send representatives to Congress, and elect the municipal councils as well.

The executive power is intrusted to a President. There are two vice-presidents, who take the place of the president only in case of death or incapacity, and they are elected for four years.

The President has to exercise his executive functions through a cabinet of six ministers, holding office at his pleasure. None of the Presi

dent's acts have any value without the signature of a minister.

EDUCATION AND RELIGION. Elementary education is compulsory for both sexes, and is free in the public schools that are maintained by the municipalities. High-schools are maintained by the government in the capitals of the departments, and in some provinces pupils pay a moderate fee. There is in Lima a central university, called "Universidad de San Marcos," the most ancient in America; its charter was granted by the Emperor Carlos V; it has faculties of jurisprudence, medicine, political science, theology and applied science. Lima possesses a school of mines and civil engineering, created in 1874, with good collections and laboratories. There are in the capital and in some of the principal towns private high-schools under the direction of English, German and Italian staffs. Lima has also a public library with a rich collection, besides the one of the university and the school of mines. There are two minor universities at Cuzco and Arequipa.

By the terms of the constitution there exists absolute political but not religious freedom, the charter prohibiting the public exercise of any other religion than the Roman Catholic, which is declared the religion of the state. But practically there is a certain amount of tolerance, there being in Callao and Lima Anglican churches as well as Jewish synagogues. At the census of 1876 there were 5,087 Protestants, 498 Jews; other religions, besides Catholic, 27,073.

FINANCE. The budget for 1900 placed the total revenue at $7,061,639, and the expenditure at $6,959,985.

Peru had a considerable public debt, divided into internal and external. The internal liabilities (1901) were estimated officially at $20,442,330 (including floating and interest-bearing debt). The foreign debt was made up of two loans, contracted in England in 1870 and 1872, aggregating in 1889 $115,000,000.

No interest has been paid on the foreign debt of Peru (which was held chiefly in England) since 1876. An arrangement was made in 1885 with Chile by which a percentage of the guano deposits should be paid as interest to the bondholders, and a small amount was transmitted to England in 1883; but it was not till January, 1890, that the bondholders' claim was settled by an arrangement with the Chilean government securing certain guano deposits, the estimated value of which is $11,250,000. The interest arrears of Peru amounted in 1889 to $114,983,255. In January, 1890, what is known as the Grace-Donoughmore contract was finally ratified. By this the English council of foreign bondholders released Peru of all responsibility for the two loans on condition that the bondholders had ceded to them all the railways, mines, lands, and guano deposits of the state for 66 years. The bondholders undertake to extend the existing railways.

DEFENSES. The army of the republic is composed of six battalions of infantry, numbering 1,920 men; two regiments of cavalry, numbering 800 men; two brigades of artillery, numbering 600 men; total, 3,320 officers and men. There is also a police force of between 2,000 and 3,000 men.

The Peruvian navy now consists of four vessels —one cruiser, one steamer, and two despatch boats.

COMMERCE. The chief crops of the fertile valleys on the coast of Peru are sugar, cotton, wine, and coffee. The exportation of sugar amounted to 102,789 tons in 1899. This industry suffered much in 1889 on account of the disastrous war with Chile. Peruvian cotton is chiefly grown in the valleys of the Piura and Ica, and is a perennial. In 1899, the amount of cotton exported from Piura and Ica was 5,876 tons. The vine has been a profitable industry ever since the Spanish conquest, in several valleys on the coast, and also in the Sierra. Good wine is made at Pisco and Ica, and also a famous spirit from the grape, called *Pisco* and *Italia*. The yearly yield of wine is about 17,600,000 pints, and of spirits 5,280,000 pints. Rice of excellent quality is raised in the coast-valley of Lambayeque, and there are establishments for preparing it at Lambayeque and Ferreñafe. The yearly crop reaches 24,750,000 pounds. Olives are grown in the Tambo Valley near Arequipa; and before the Chilean War, mulberries, silkworms and cochineal were successfully cultivated. The rocky islets and barren deserts of the coast were once a source of enormous wealth to Peru, but are so no more. The exportation of guano from the Chincha Islands began in 1846 and ended in 1872, the supply being exhausted; and the nitrates of Tarapacá were seized and annexed by Chile, as the result of the war.

The staple exports of Peru are sugar, silver and wool. The silver-mines extend along the whole length of the Cordilleras, and are worked here and there, the great center of mining industry being at Cerro de Pasco. In 1898, the Cerro de Pasco mines produced 1,000,000 ounces of silver, and there are others of equal value around Puno, in the south of Peru. In the year 1900, the total value of the mineral produce exported was about $8,475,280. The number of mines in Peru is on the increase. There were 4,714 mining claims of all kinds reported in 1899.

PUBLIC WORKS. The system of railways consists of a dozen short lines in the coast-valleys—varying in length from twenty to eighty miles, constructed to bring the produce down to the seaports—and of two long lines across the Andes. The first of these, from Callao and Lima to Oroya, in the lofty valley of Jauja, is to be 136 miles long, and was commenced in 1870. It threads the intricate gorges of the Andes by a winding path along the edges of precipices, through tunnels, and over bridges that seem suspended in the air. It tunnels the Andes at an altitude of 15,645 feet, and the bridge of Verrugas spans a chasm 580 feet wide, on three piers, the center one being 252 feet high, of hollow wrought-iron. Of this railroad, 86¾ miles had in 1891 been completed, at a cost of $23,129,435. The other great line across the Andes connects

the port of Mollendo with Puno on the shores of Lake Titicaca, passing by Arequipa. The summit is crossed at a height of 14,660 feet, and the line is 346 miles long. Total railways, 1,146 miles.

HISTORY. In August, 1894, a revolutionary movement in opposition to President Caceres broke out, the chief leading spirit being Señor de Pierola, a former president. After a stubborn war, lasting nearly a year, President Caceres fled and took refuge on board a French man-of-war, and on July 10, 1895, General Pierola was elected President. In 1899 he was succeeded by Señor de Romano. Diplomatic relations between Peru and Chile, in consequence of the war, are suspended.

PERU, a city of La Salle County, northern central Illinois, at the head of navigation on the Illinois River, and at the terminus of the Illinois and Michigan Canal, 17 miles S. of Mendota, 100 miles W.S.W. of Chicago, and a mile below La Salle, with which it is connected by a car-line, on the Chicago, Rock Island and Pacific and the Chicago, Burlington and Quincy railroads. It is situated in a region in which coal is extensively mined, and has many important industries; among them, zinc-works employing 500 hands, large agricultural-implement factory, foundry, machine-shops, sawmills, breweries, flour-mills and manufactories of scales, pumps and boilers. The city is lighted by electricity; has two public parks, several churches, schools, a daily and weekly newspaper. Population 1890, 5,550; 1900, 6,863.

PERU, an important city and the county seat of Miami County, Indiana, in the north-central part of the state. It lies on the Wabash River, eighty-two miles north of Indianapolis, and is reached by the Lake Erie and Western and the Wabash railroads. The region about it is rich in agriculture, and the city has become an important center of commerce and manufactures. It has railroad car and engine shops, machine and furniture factories, woolen and glassware factories, vehicle factories, and a variety of other establishments, and is well equipped with schools, banks, churches and the other institutions of a city. Its population in 1900 was 8,463. W.F.J.

PERU BALSAM. See BALSAM, Vol. III, pp. 252, 253.

PERUGIA, LAKE OF. See ITALY, Vol. XIII, p. 449.

PERUVIAN ARCHITECTURE. See ARCHITECTURE, Vol. II, p. 395.

PERUVIAN BARK. See CINCHONA, Vol. V, pp. 682–683.

PERUVIAN INDIANS. See INDIANS, Vol. XII, pp. 868, 869; also PERU, Vol. XVIII, pp. 687, 688.

PESHITO OR PESHITTA. See SYRIAC LITERATURE, Vol. XXII, pp. 863, 864.

PESHTIGO, a village of Marinetta County, northeastern Wisconsin, on the navigable Peshtigo River, near Green Bay, 100 miles N.E. of Oshkosh, and on the Chicago and Northwestern railroad. It contains a large number of saw and planing mills, and has a trade in lumber. Population 1900, 4,228

PESTALOZZI. See EDUCATION, Vol. VII, p. 587.

PESTILENCE. See PLAGUE, Vol. XIX, pp. 169–179.

PETALISM. See OSTRACISM, Vol. XVIII, p. 65.

PETALS OF FLOWERS. See BOTANY, Vol. IV, pp. 119–121.

PETALUMA, a city in Sonoma County, northwestern California, on Petaluma Creek, at the head of navigation, 42 miles N.N.W. of San Francisco, with which it has communication by steamer, and by the San Francisco and Northern Pacific railroad. Its location, surroundings and equable climate have combined to make the city an attractive resort for tourists and strangers. It is also well adapted to the cultivation of grapes and other fruit, and the beautiful and fertile valleys of the vicinity are productive and highly cultivated. The city contains several churches, large graded-school buildings, high-school buildings, flouring-mills, planing-mills, sawmills, foundry, brewery, woolen-mill, two daily and three weekly newspapers, and superior warehouse facilities. Fruit, lumber, dairy products and cereals are the chief articles of export. Population 1890, 3,692; 1900, 3,871.

PETASITES. See HELIOTROPE, Vol. XI, p. 566.

PETCHORA, a river. See RUSSIA, Vol. XXI, p. 80.

PETECHIÆ OR HÆMORRHAGIC SPOTS. See PLAGUE, Vol. XIX, p. 170.

PETER, APOCRYPHAL BOOKS OF. See APOCALYPTIC LITERATURE, Vol. II, pp. 157, 158; and PETER, Vol. XVIII, pp. 709, 710.

PETERBORO, a village of Peterboro township, Hillsboro County, southern New Hampshire, on Contoocook River, 18 miles E. of Keene and 33 miles S.W. of Concord, and on the Fitchburg and the Boston and Maine railroads. It contains manufactories of cotton and woolen goods, shoes, thermometers, piano-stools, trusses, etc. Population of the town in 1890, 2,507; in 1900, 2,52[illegible]

PETERBOROUGH, Canada, the seat of Peterborough County, Ontario, a town and important junction of divisions of the Grand Trunk and the Canadian Pacific railroads, 78 miles northeast of Toronto. The town is well built upon the west bank of the Otonabee River, the route of the Trent Valley canal, and a handsome bridge connects it with Ashburnham. It is the receiving and distributing center of a productive farming region and has manufactures of flour, oatmeal, woolens, leather, bridge and iron work, etc. Population, 1891, 9,717; 1901, 11,239. C.L.S.

PETERLOO, MASSACRE OF. See MANCHESTER, Vol. XV, p. 472.

PETERMANN, AUGUST, a German geographer and cartographer; born at Bleicherode, April 18, 1822. From 1839–45 he assisted Berghaus in the edition of his *Physicalischer Atlas*, and in 1845, Keith Johnson in the English edition of the same work. In 1847 he founded a cartographical institute at London, when he pub-

lished *Physical Statistical Maps of the British Isles*, and contributed articles to the *Athenæum* and the ENCYCLOPÆDIA BRITANNICA. Returning home he, in 1855, founded *Mittheilungen aus Justus Perthes' Geographischer Anstalt.* Among his maps the six of the United States and the nine of Australia are the most famous. He was also a great promoter of African and Arctic explorations. He died from his own hand at Gotha, Sept. 25, 1878. G.A.S.

PETERS, CHRISTIAN FRIEDRICH AUGUST, a German astronomer; born in Hamburg, Germany, September 7, 1806. He was noted for his valuable investigations of the motions of the fixed stars; was long the editor of the *Astronomische Nachrichten* and director of the Altona Observatory. He published important papers on the parallaxes of the stars, the constant of nutation, etc. He died in Kiel, May 8, 1880.

PETERS, CHRISTIAN HENRY FREDERICK, astronomer; born in Coldenbüttel, Schleswig, Germany, Sept. 19, 1813; was graduated at the University of Berlin. In 1853 he removed to the United States. Through the influence of Edwin C. Litchfield, a wealthy alumnus of Hamilton College, he was appointed instructor of astronomy in that institution. In 1867 Mr. Litchfield endowed the chair of astronomy and the observatory with $30,000. Dr. Peters became well known through the expeditions which he conducted in the interest of astronomical science. In 1874 he led a body of experts to New Zealand to observe the transit of Venus. He catalogued 75,000 zodiacal stars, and recorded 12,000 solar spots. He died July 20, 1890. G.J.H.

PETERS, KARL, the founder of German-East Africa; born at Neuhaus, Sept. 27, 1856. In 1884 he founded the Society for German Colonization, and led, in 1884–87, an expedition to East Africa, where he concluded a preliminary treaty with the Sultan of Zanzibar. In 1889–90 he was the leader of the expedition sent to the relief of Emin Pasha; reached the capital of Uganda, Sept. 26, 1890, and concluded a treaty with King Mwanga. In 1891 imperial commissioner; in 1895 captain-general of German-East Africa, and, in 1896, president of the German Society for Colonization, he was dismissed for alleged cruelties perpetrated on natives. He then went to London where he organized the *Peters' Estates and Exploration Company.* He wrote *Die Deutsche Emin-Pasha Expedition* (1891); *Das Deutsch-Ostafrikanische Schutzgebiet* (1895); *Waslehrt uns die Englische Colonial-Politik?* (1897); *The Colonial Power of England* (1904). G.A.S.

PETERS, SAMUEL ANDREW, an American clergyman; born in Hebron, Connecticut, Dec. 12, 1735. He is chiefly remembered for his satirical *History of Connecticut*, which through his proclivity for falsifying gave rise to widespread misconceptions regarding the Connecticut BLUE LAWS (q.v., in these Supplements), and is the "Parson Peter" of Trumbull's Hudibrastic political poem, *McFingal.* He died in New York, April 19, 1826.

PETERS, SAINT, old. See BASILICA, Vol. III, pp. 358–359. New; see ARCHITECTURE, Vol. II, p. 383.

PETERSBURG, a city and the county seat of Menard County Illinois, in the west-central part of the state. It lies on the south fork of the Sangamon River, nineteen miles north by west from Springfield, and is reached by the Chicago and Alton and the Jacksonville Southeastern railroads. It is a center of agriculture, coal-mining, and brick and tile manufacture, and had in 1900 a population of 2,807. W.F.J.

PETERSBURG, a town and the capital of Pike County, southwestern Indiana, near the White River, 20 miles S.E. of Vincennes and 44 miles N.N.E. of Evansville, on the Evansville and Terre Haute railroad. It is the center of a region producing coal, fire-clay, hardwood timber, live-stock, and has brick and tile works, flour and woolen mills and manufactories of lumber. Population 1890, 1,494; 1900, 1,751.

PETERSBURG, a city of Virginia, in 1890 the third city in size in the state. It has communication with other points by the navigable Appomattox River and by the Atlantic Coast Line and the Norfolk and Western railroads. It has numerous churches, high and lower grade public schools, and St. Paul's Female School, the Southern Female College and the Protestant Episcopal school for girls; libraries, state and national banks, water-works, electric lights, street-railways, one weekly, one semiweekly and three daily newspapers and a monthly periodical. The returns for 1900 showed 56 industries reporting in 225 establishments, with a combined capital of $3,960,987, employing 4,981 persons, to whom was paid $1,271,094, and having an annual product valued at $6,464,464. The city is the most important shipping-point for tobacco in the United States, having also a large export trade in cotton, flour and peanuts, and contains extensive tobacco warehouses and factories, cotton, silk, flour and paper mills, and manufactories of heavy machinery and agricultural implements. There are large granite quarries in the vicinity. Population 1900, 21,810. See also PETERSBURG, Vol. XVIII, p. 716; also UNITED STATES, Vol. XXIII, p. 818.

PETERSEN, HALLGRIM, a poet. See ICELAND, Vol. XII, p. 658.

PETERSEN, NIELS MATHIAS. See DENMARK, Vol. VII, p. 81.

PETERS-PENCE OR ROMESCOT, a tax for the benefit of the Pope; thought to have first been levied in England in 721 by Ina, King of Wessex. It was discontinued in 1365, and in 1534 Henry VIII had it prohibited by act of Parliament. Considering the value of money at that period, the levy—which was one penny for each family—was an enormous exaction, as a penny was the price of a day's labor. It has been revived as a voluntary contribution in several countries since the cessation of the temporal power of the popes, and has proven very successful. At the time of

the jubilee of Pius IX in 1877, the sum collected amounted to $3,300,000.

PETIGRU, James Lewis, statesman; born in Abbeville District, S. C., March 10, 1789; was graduated at the University of South Carolina in 1809, and admitted to the bar in 1812. He settled in Charleston, S. C., about 1815, and speedily rose to professional eminence. In 1822 he became attorney-general of the state. Throughout his career he gave his influence to the support of the National Government on the slavery question. Although he had large personal prestige, he made many enemies by his persistent opposition to the doctrine of nullification. In 1860, when war seemed inevitable, he earnestly pleaded in behalf of the Union, though in danger of personal injury. In 1861 he removed to Summerville, S. C., and about the same time was elected to the legislature. He died in Charleston, S. C., March 3, 1863. G.J.H.

PETIOLE. See Botany, Vol. IV, pp. 101, 102.

PETION, Alexandre (1770–1818). See Hayti, Vol. XI, p. 487.

PETIT DE JULLEVILLE, Louis, historian; born in Paris, France, July 18, 1841. After receiving his education he was chosen professor of French literature in the Sorbonne. His chief publication is entitled *History of the Theater in France*. It is composed of five volumes and largely treats of the old French theater. In another work, entitled *The Theater in France*, he traces the evolution of the French drama down to 1889. He died in Paris, Aug. 28, 1900. G.J.H.

PETITE ANSE, an island of Iberia parish, Louisiana, containing a remarkable deposit of rock-salt, which was mined by the Confederates in 1862. The work was carried to a depth of 75 feet, but was broken up by the Union forces in 1863. Work has been resumed in recent years.

PETITION OF RIGHT. See Petition, Vol. XVIII, pp. 717–718.

PETO, Sir Samuel Morton, an English railroad constructor and engineer; born in Woking, England, Aug. 4, 1809. He constructed a large portion of the leading railway works in England, and was engaged in the formation of a large railway in Canada. Among his most important works were the Norwegian Grand Trunk line and the Royal Danish line. Toward the close of 1854 he undertook, without prospect of profit, the construction of a railway from Balaklava, in the Crimea. He was returned as one of the members in the advanced Liberal interest for Norwich in August, 1847, and again at the general election in July, 1852, and retired in December, 1854. He was elected one of the members for Finsbury in April, 1859, and at the general election in July, 1865, exchanged his seat for Bristol, but retired from Parliament in April, 1868, in consequence of the bankruptcy of the firm of Peto, Betts and Crampton, with liabilities of above thirty-five million dollars. He died Nov. 13, 1889.

PETOFI, Alexander, a Hungarian poet and patriot (1822–49). See Hungary, Vol. XII, p. 393.

PETOSKEY, a village of Emmet County, northern part of the southern peninsula of Michigan, on Little Traverse Bay, an arm of Lake Michigan, 60 miles N N.E. of Traverse City, and on the Chicago and West Michigan and the Grand Rapids and Indiana railroads, with steamer communication with lake ports. It has a good water-power from Bear River; manufactures lumber and lime, flour, pulp and handles, and ships lime, maple-sugar and large quantities of fish. Petoskey is a fashionable watering-place and resort for sufferers from asthma and hay-fever. Population 1890, 2,872; 1900, 5,285.

PETRI, Laurentius and Olaus, brothers. See Sweden, Vol. XXII, p. 792.

PETRIE, William Matthew Flinders, archæologist; born in England, June 3, 1853. He began his work as an archæologist by his study and measurements of the prehistoric monuments in Great Britain. Later he carried on exploration in the Delta, and there discovered and exhumed the ancient Græco-Egyptian city of Naukratis. He also investigated the interior of the Illahun and Hawara pyramids. In 1894 he carried on excavations on the ancient site of Koptos, which resulted in the discovery of six successive temples, reaching from the most remote prehistoric time to the age of the Ptolemys. Moreover, these excavations resulted in the recovery of a great number of objects and memorials belonging to the thirty-four different rulers of Egypt. In the lowest temple at Koptos, Petrie found the remains of an ancient settlement which for the first time revealed prehistoric Egypt. In 1903 he began excavations at Abydos, and at a depth of twenty feet discovered ten successive temples, ranging from 500 to about 5000 B.C., which thus made it possible to see the whole of Egyptian history from age to age. There was also found an ivory statuette of Cheops of the finest work, showing for the first time the face and character of the great Egyptian builder. Dr. Petrie's publications include *Stonehenge Plans, etc.; Pyramids and Temples of Gizeh; Tanis; Ten Years' Digging; A History of Egypt during the Seventeenth and Eighteenth Dynasties; Egyptian Decorative Art*, etc. G.J.H.

PETRIFACTIONS. See Mineralogy, Vol. XVI, p. 386.

PETROGRAPHY, etymologically, is a description of rocks, but it is so difficult to describe rocks without reference to their structure and geological relations, that specialists are using the term as a branch of geology which has for its object the study of the texture, mineralogical composition and other physical characters of rocks. It is an indoor rather than an outdoor study. See *Physical Properties of Minerals*, under Mineralogy, Vol. XVI, pp. 387–395.

PETROLEUM V. NASBY, the pseudonym of Locke, David Ross, q. v., in these Supplements.

PETROMYZONTIDÆ. See Lamprey, Vol. XIV, p. 250.

PETROSSA TREASURE. See Plate, Vol. XIX, pp. 193, 198.

PETRUCCI FAMILY. See SIENA, Vol. XXII, pp. 47, 48.

PETSH OR IPEK, a pleasant town of European Turkey, in Albania. It stands on the Bistritza, or White Drin, 73 miles E.N.E. of Scutari. Population about twelve thousand, mostly Turks.

PETTENKOFEN, AUGUST VON, an Austrian military and genre painter; born in Vienna in 1823; in 1866 became a member of the Vienna academy, and in 1867 of the Munich academy. His pictures, which generally relate to episodes in peasant-life and the soldier's career in Hungary, are painted with an exactness and truth which manifest not only large genius but an intimate knowledge—based upon his early soldier-life. He was knighted in 1876. Among his works are *After the Duel*, and *Hungarian Peasants Halt*, in the Fedor Museum, Amsterdam; *A Rendezvous*, in the Vienna Museum. Died March 21, 1889.

PETTENKOFER, MAX VON, a German chemist; born in Lichtenheim, Dec. 3, 1818; became professor of chemistry at Munich in 1847, and professor of hygiene in a Bavarian University in 1865. Among numerous valuable discoveries that he made are a process of obtaining illuminating gas from wood, and the characteristics of oil-colors. His researches into the factors of the dissemination of cholera have been borne out by recent experience. He was one of the editors of *Zeitschrift für Biologie* (1865–82), and among other works are *Ueber die Verlegung der Göttesäcker*, in Basel (1864); *Zum Gegenwärtigen Stand der Cholera-frage* (Leipsic, 1877). Died in 1901.

PETTIE, JOHN, a Scotch painter; born in Edinburgh, March 17, 1839; noted for his lifelike scenes of old English life; became a royal academician in 1873, in place of Landseer. Many of his works have been engraved. Among his noted works are *The Drum-Head Court-Martial; Arrest for Witchcraft; The Disgrace of Cardinal Wolsey;* and *Jacobites, 1745*. Died in Hastings, Feb. 21, 1893.

PETTIGREW, JAMES BELL, a Scotch surgeon and anatomist; born in Roxhill, May 31, 1834. He contributed the article FLIGHT, FLYING-MACHINES, in this ENCYCLOPÆDIA, Vol. IX, pp. 268–284, and of many valuable works on anatomy and other sciences. He is especially famous for his elaborate and intricate investigations in anatomy. He was elected president of the Royal Medical Society in 1860, and was the recipient of many other honors. Among his numerous important works are *The Valves of the Vascular Systems in Vertebrata* (1864); and *The Muscular Arrangements of the Bladder and Prostate* (1867).

PETTIGREW, RICHARD FRANKLIN, an American public man; born in Ludlow, Vermont, July, 1848. He removed with his parents to Evansville, Rock County, Wisconsin, in 1854; was prepared for college at the Evansville Academy, and entered Beloit College in 1866, where he remained two years; was a member of the law class of 1869, University of Wisconsin; went to Dakota in July, 1869, in the employ of a United States deputy as a laborer; located in Sioux Falls, where he engaged in the surveying and real-estate business; opened a law office in 1875; was elected to the Dakota legislature as a member of the council in 1877, and re-elected in 1879; was elected to Congress in 1881 as a delegate from Dakota Territory; to the territorial council in 1884; United States Senator, under the provisions of the act of Congress admitting South Dakota into the Union (1889–95), and again in 1895.

PETUNIA, a South American variety of the nightshade family. See HORTICULTURE, Vol. XII, p. 273.

PEWEE. See PHŒBE-BIRD, in these Supplements.

PEWS. See ARCHITECTURE, Vol. II, p. 413.

PEXOS, a mountain. See CANARY ISLANDS, Vol. IV, p. 706.

PEYER'S GLANDS. See DIGESTIVE ORGANS, Vol. VII, pp. 197–198.

PEYTON, JOHN LEWIS, an American lawyer; born in Montgomery Hall, Augusta County, Virginia, Sept. 15, 1824; received a military and classical education at Virginia Military Academy, and graduated at the law department of the University of Virginia in 1845. In 1851 he was sent by the government on special service to England, France and Austria. Returning in 1853, he resided in Chicago, where he attained great eminence at the Chicago bar. He returned to Virginia in 1856; raised a company for the Confederate cause in 1861; and broke the Charleston blockade in the Confederate man-of-war, *Nashville*. Went to Europe in 1861 as agent of North Carolina to England and France, and conferred with many leading European statesmen. He wrote *A Statistical Review of the State of Illinois* (1854); *The American Crisis* (1866); *Tom Swindel: or, The Adventures of a Boomer* (1893); and a number of other works.

PFLEIDERER, OTTO, a German Protestant theologian; born in Stettin, Sept. 1, 1839. Studied under Baur, at Tübingen, from 1857 till 1861, and next paid a visit of study to England and Scotland; became pastor at Heilbronn in 1868, and superintendent at Jena in 1870, an office which in the same year he exchanged for the chair of theology there. In 1875 he was called to be professor of systematic theology at Berlin. His works are numerous, and may not be ignored by any serious student of philosophy or theology. The latest published are *The Influence of the Apostle Paul on the Development of Christianity* (1885); and *The Development of Theology since Kant* (1890).

PHACOCHŒRUS, OR WART-HOG. See SWINE, Vol. XXII, pp. 812, 813.

PHÆDRA. See THESEUS, Vol. XXIII, 315.

PHAËTONIDÆ. See TROPIC-BIRD, Vol. XXIII, p. 625.

PHAGEDÆNA. See VACCINATION, Vol. XXIV, p. 31.

PHAGOCYTES (Gr., *phagein*, to eat, *kutos*, cavity), the white globules in the blood that possess the property of destroying microbes. These globules or leucocytes attack the noxious proper-

ties of the pathogenic microbes and seek to destroy and eliminate them from the system. It is understood that when any septic element penetrates any part of the body, the battle begins by the leucocytes dissolving the bacteria. W.R.B.

PHALANGIDEA. See ARACHNIDA, Vol. II, pp. 243–245.

PHALANGISTIDÆ. See MAMMALIA, Vol. XV, pp. 384, 385.

PHALANX. See ARMY, Vol. II, pp. 485, 486.

PHALARIS, EPISTLES OF. See PHALARIS, Vol. XVIII, p. 744.

PHALAROPE. See SAND-PIPER, Vol. XXI, p. 272.

PHALLIC WORSHIP, a practice or custom which originated in a reverence for the generative or reproductive powers of nature, and became debased among semicivilized and ancient people into an adoration of a figure of the phallus or male organ of generation. This practice has prevailed in India in recent times; also among some of the Australasian tribes. It prevailed in Phrygia, Chaldæa, Syria, Egypt, Greece and Rome. Priapus, Pan, Hermes and other gods were worshiped in Rome and Greece through a symbolism of the phallus. See PRIAPUS, Vol. XIX, p. 740.

PHANARIOTS. See GREECE, Vol. XI, pp. 111, 112.

PHANEROGAMIA. See VEGETABLE KINGDOM, Vol. XXIV, pp. 142, 143.

PHARANGOBRANCHII, same as LEPTOCARDII. See ICHTHYOLOGY, Vol. XII, p. 733.

PHARAOH'S RAT. See ICHNEUMON, Vol. XII, p. 665.

PHARMACY. (For a general treatment of the subject, see PHARMACOPÆIA, Vol. XVIII, pp. 744–745.) In the United States the *Pharmacopœia* is, in certain states, issued under the requirement of special law, instead of being under the authority of the general government, as in many European states. What is known as the seventh decennial revision of the *Pharmacopœia* was prepared by a convention of pharmacists, which met in Washington in 1890. It is known as the *Pharmacopœia of the United States of America;* was printed at Philadelphia; became official Jan. 1, 1894; and contains modes of preparing and descriptions of drugs, useful information, formulæ, etc. No country has done more to elevate the standard of pharmacy than the United States. There are numerous schools and colleges of pharmacy—some separate and others in connection with prominent universities—where the student is instructed not merely in chemistry, materia medica and botany, but in physics, animal physiology, toxicology and pharmacology. The Philadelphia College of Pharmacy and the School of Pharmacy of the University of Michigan are good examples. In some states it is required of the applicant for a certificate of pharmacy that he be a graduate of an acknowledged school; in others he must pass an examination before a state board of pharmacy.

PHAROS. See ALEXANDRIA, Vol. I, p. 436.

PHARPAR, a river. See ABANA, Vol. I, p. 12.

PHARSALOS, now FERSALA, anciently a town of Thessaly, about 20 miles S. of Larissa, on the River Enipeus, a branch of the Peneus (now the Salambria), and historically notable mainly for the great battle fought here between Cæsar and Pompey, Aug. 9, 48 B.C. It is now the seat of the episcopal palace and the Metropolitan Church.

PHARYNX. See ANATOMY, Vol. I. p. 735.

PHASCOGALE. See MAMMALIA, Vol. XV, pp. 383, 384.

PHASCOLOMYIDÆ. See MAMMALIA, Vol. XV, p. 386.

PHASEOLUS, a genus. See GRAM, Vol. XI, pp. 33, 34; also HORTICULTURE, Vol. XII, p. 295.

PHASIANIDÆ. See POULTRY, Vol. XIX, p. 664.

PHASIS, now called RION, a river. See CAUCASUS, Vol. V, p. 221.

PHEASANT'S-EYE, a plant. See ADONIS, Vol. I, p. 148; also HORTICULTURE, Vol. XII, p. 265.

PHEASANT-SHELL, a name which collectors apply to the bright-colored shells of the gasteropod mollusk, *Phasianella*, which belongs to the family of top-shells (*Trochidæ*). They are found near the shores of tropical seas, especially in Australia.

PHELPS, a village of Ontario County, western central New York, 8 miles N.W. of Geneva, on the New York Central and Hudson River and the Lehigh Valley railroads. It contains important manufactories of machinery, malt, peppermint and other essential oils, and has valuable deposits of gypsum. The village was founded by Oliver Phelps, born in Windsor, Connecticut, in 1749; died in Canandaigua, New York, Feb. 21, 1809. Mr Phelps received large grants of land in western New York; opened at Canandaigua what is said to have been the first land-office in America; invented the system of townships and ranges now in use by government surveyors; was active as a promoter of the Erie and Welland canals; with several other men purchased in northern Ohio a large tract of land known as the "Western Reserve"; and during his career held many positions of trust. Population 1900, 1,306.

PHELPS, AUSTIN, an American clergyman and author; born in West Brookfield, Mass., Jan. 7, 1820. He was graduated from the University of Pennsylvania in 1837. In 1849 became professor of sacred rhetoric in the Andover Seminary, and from 1869 to 1879 he was president of the institution. His writings include: *The Still Hour* (1859); *The New Birth* (1867); *Studies of the Old Testament* (1879); *Theory and Practice of Teaching* (1881); *Men and Books* (1882); *English Style in Public Discourse* (1883); *My Study and Other Essays* (1885); *My Note Book* (1889) Died in Bar Harbor, Me., Oct. 13, 1890. W.M.C

PHELPS, ELIZABETH STUART, author; born at Andover, Mass., Aug. 13, 1815; daughter of Rev. Moses Stuart, an able theological writer, whose intellectual alertness she inherited. In

1842 she married Rev. Austin Phelps, resided four years in Boston, where Mr. Phelps was pastor of a Congregational church, and spent the remainder of her short life in her native town. She was the author of a number of moral tales which were very popular, her *Sunnyside*, a description of life in a country parsonage, selling over 100,000 copies. Her books were vivacious in style, with a delicate humor, their scenes being laid mostly in New England. Others of her works were *Kitty Brown; A Peep at Number Five; The Tell Tale; The Angel over the Right Shoulder; Last Leaf from Sunnyside*, etc. Her daughter inherited her literary facility. She died in Boston, Nov. 30, 1852. G.J.H.

PHELPS, Edward John, an American lawyer and public man; born in Middlebury, Vt., July 11, 1822. He graduated at Middlebury College in 1840; studied law, and was admitted to the Vermont bar in 1843. He removed to Burlington, Vt., in 1845; was second comptroller of the United States Treasury, 1851–53; delegate to the Vermont constitutional convention, 1870; president of the American Bar Association, 1880; professor of law at Yale, 1881–85; minister to Great Britain, 1885–89; one of the United States counsel in the Bering Sea arbitration, 1893; and, later, Kent professor of law at Yale. He died in New Haven, March 9, 1900. E.E.T.

EDW. J. PHELPS.

PHELPS, John Wolcott, an American soldier; born in Guilford, Vt., Nov. 13, 1813. He was graduated from the United States Military Academy in 1836; served in the Creek and Seminole wars and in the Mexican War. In 1859 he resigned from the army but enlisted in 1861 as colonel of the 1st Vermont volunteers. He occupied New Orleans in May, 1862, issuing a proclamation against slavery, which resulted in a quarrel with Gen. Butler. At Camp Parapet, near New Orleans, he organized the first negro troops in 1862. In August, 1862, he was declared an outlaw by the Confederate government for having "organized and armed negro slaves." In 1863 he was elected vice-president of the Vermont Historical Society, and in 1880 was nominated for President by the American, or anti-Masonic, party. He published *History of Madagascar* (1884). He died in Brattleborough, Vt., Feb. 2, 1885. W.M.C.

PHELPS, William Walter, an American public man; born in New York, Aug. 24, 1839. He graduated at Yale in 1860, and at Columbia College Law School in 1863. He retired from the practice of law in 1868; was a Representative in Congress from New Jersey from Dec. 1, 1873, to March 3, 1875, and again from Dec. 3, 1883, to March 3, 1889; delegate to the national Republican conventions of 1880 and 1884; and minister to Austria, 1881–82. He was appointed by President Harrison in 1889 to be one of the commissioners to represent the United States at the International Congress on the Samoan question which met at Berlin; was minister to Germany till 1893; and later a special judge of the court of errors and appeals of New Jersey. He died in Teaneck, New Jersey, June 17, 1894. E.E.T.

PHENACETINE, a derivative of acetanilide or antifebrine, which it resembles in its medical properties, and is accordingly used as an antipyretic and analgesic.

PHENIC ACID AND PHENOL, same as Carbolic Acid, Vol. V, p. 76.

PHENICINE OR PHENICIENNE. See Carbolic Acid, Vol. V, p. 76.

PHENIX, a village of Kent County, central Rhode Island, 14 miles S.W. of Providence, on the Pawtuxet River, and on the New York, New Haven and Hartford railroad. It has manufactories of cotton goods and machinery. Estimated population 1900, 1,500.

PHENOL COLORS. See CARBOLIC ACID, Vol. V, p. 76.

PHENOLS, aromatic hydroxides, though the name is often given to the simplest phenol, carbolic acid in common parlance. This was discovered by Runge in 1834, in coal-tar, from which it is still obtained. It is a white, crystalline solid, turns red on exposure to air, has a characteristic smell and taste, is somewhat soluble in water but more easily in alcohol, is poisonous, is a good antiseptic, and is used as such in medicine. It is also used to preserve timber, to make picric acid, etc. See Chemistry, Vol. V, p. 189.

PHENYLAMINE. See Aniline, Vol. II, p. 43.

PHERÆ. An old name for the town of Kalamata, q. v., Vol. XIII, p. 835.

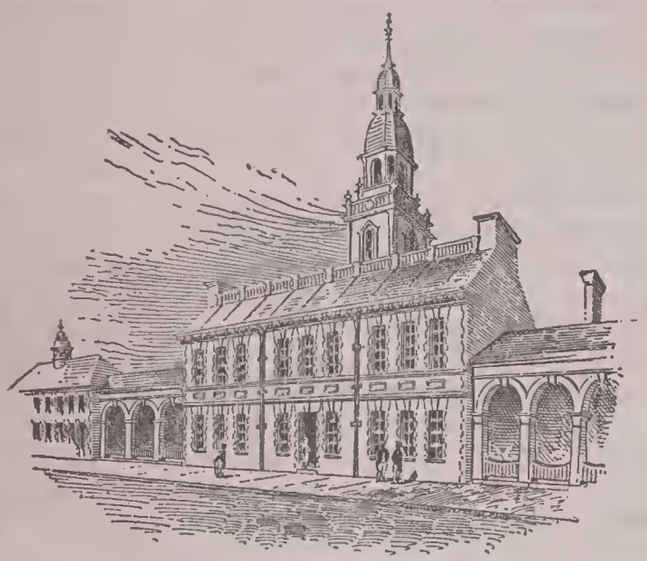
PHIGALIAN MARBLES. See Phygalia, Vol. XVIII, p. 749.

PHILADELPHIA. Since the article on Philadelphia—see Vol. XVIII, pp. 750–755—was published in this Encyclopædia, the city has passed under a new form of municipal government. The present government charter was created by what is known as the "Bullitt Act," 1885, and is a distinct effort to solve the problem of city government by concentrating the power in the hands of an executive who should appoint his chief subordinates and be able to hold them responsible for the manner in which they executed their duties. Prior to this time, the functions of the mayor were chiefly clerical, and those of a director of police. Under the Bullitt Act, the public, municipal business is divided into three departments: one of public safety, which has control of the police, fire and electrical organizations, health, building-inspection and municipal property, and boiler-inspection; the department of public works has supervision of gas, railways, street-cleaning and lighting, surveys and water-supply; the department of charities and correction is under a president and four directors. The mayor appoints the chiefs of all these departments, and they are re-

sponsible to him for the efficiency of their subordinates.

The receiver of taxes and the city solicitor are chosen in the spring, for a term of three years. The city treasurer and city comptroller are county officers, elected in the autumn, for three years—a distinction being made between the county and municipal governments. Under the new system the only conspicuous official malfeasance has been in the office of city treasurer under whom in 1891 an embezzlement of $1,500,000 took place, for which he suffered an imprisonment of five years, being pardoned out in 1896.

Under the new charter there has been a marked improvement in public administration. The mayors have been selected with more care; there has been less room for political "log-rolling," and in the difficult problem of American municipal government



STATE HOUSE, PHILADELPHIA, IN 1775.

Philadelphia has become a type of efficiency and probity. The board of education, which has a sort of supervision over the 37 ward or sectional boards of school directors, is still appointed by the court of common pleas, one member being appointed for each of the different city wards. The sinking-fund and park commissions are controlled by boards, one of whom is the mayor, *ex officio*. The Public-Building Commission is an independent organization, created by the legislature in 1870 for the sole purpose of erecting the expensive and long unfinished city hall. It is free from the control of the councils, and practically without amenability to any authority.

The city and common councils are charged with the legislation of the city. There is one select-councilman for each of the 37 wards, who holds office for three years. There is one common-councilman for every two thousand names on the canvassers' lists at the time the election is held. There are 12 judges of the district-court, as the county court in Philadelphia is termed; four judges of the orphans' court, who perform the functions of surrogate and probate judges; and 28 police magistrates. The city is entitled to 8 members of the state senate, 39 members of the state house of representatives, and five members of the House of Representatives in Congress.

Under the operation of the Brooks Law regulating the sale of intoxicating drinks (see LIQUOR LAWS, in these Supplements), there has been a great diminution in the number of arrests for disorderly conduct and other crimes growing out of intoxication. The sale of liquor after midnight and on Sunday is as thoroughly suppressed as such offenses can be under a democratic form of government. There are no recognized evasions of the law, and during prohibited hours it is almost impossible to obtain liquor.

LIBERTY BELL.

FINANCES. In 1894 the city debt amounted to $54,275,444, which was offset by securities in the sinking-fund of $24,830,363 and by other assets, such as cash on hand and outstanding taxes, amounting to $11,196,198. For the balance, the city has improved and other real estate appraised at about $46,000,000. The assessed valuation of the city for tax purposes is estimated at two-thirds of the actual value, and amounts to $780,000,000, on which the tax-rate for many years has been 1.85 per cent. The receipts of the city from all sources were (1895), in round numbers, $31,000,000, and the expenditures $28,500,000

There are 44 banks in the city, of which three are under state charters, having a capital of $24,000,000 and deposits of $120,000,000. In addition, 42 trust companies, with a capital of $30,000,000 and deposits of nearly $70,000,000, do a large business on collateral stock and bond loans. The $53,000,000 deposited in the four savings banks represent but a small part of the prudential savings of the people. The function performed by savings banks in New England is very largely replaced in Philadelphia by the building and loan associations, which had their origin in the United States in this city. There are 450 of them in Philadelphia, in annual receipt of more than five millions of dollars and holding in unliquidated bonds and mortgages over forty millions of dollars. The usual term for the expiration of a series in one of these building associations is 11 years and 5 months, but as each year they make a new series they are practically perpetual-loan companies. A very large part of the city has been built up within the last fifty years through the operations of these companies, which loan only to their own members and invest chiefly in real-estate securities offered by the borrowers. The operation of these societies will explain the vast proportion of small dwellings and the ownership by their occupiers which characterizes this city.

MANUFACTURES. Until the census of 1890 Philadelphia claimed pre-eminence over all the cities of the Union for the variety and number of its manufacturing establishments, and for the value of their output. That census transferred the pre-eminence to New York, and the condition remains the same. According to the returns for 1900 there were 15,887 manufacturing establishments, having a direct

investment of $476,529,407, and hiring much valuable property. The aggregate number of employees was 264,507, in round numbers, to whom was paid $132,001,912 in wages. The value of the products placed upon the market was $603,466,526.

The chief of these industries, in the order of the products, were: Sugar and molasses, $36,163,817; clothing, $36,214,053; foundries and machine-shops, $38,372,971; printing and publishing, $23,508,875; carpets and rugs, $21,986,062; woolens, $18,340,012; carpentering, $21,751,145; slaughtering and meat-packing, $12,020,462; hosiery and knit-goods, $13,040,905; worsted goods, $16,242,250; leather tanning, etc., $18,187,231; boots and shoes, $7,611,612; cotton fabrics, $15,723,654; malt liquors, $12,606,551; chemicals, $7,810,456; iron and steel, $7,208,948; tobacco goods, $8,990,595; patent medicines, etc., $3,013,034; silk, $4,531,794; painting and paper-hanging, $7,230,597; plumbing and plumbing-supplies, $7,167,158; umbrellas and canes, $3,145,446; paints, $5,923,920; confectionery, $6,000,815; furniture, $6,322,197; lumber-mill products, $3,200,142.

Experts estimate that the increase of manufactures, and of capital and of employees engaged in them, has been thirty per cent in the five years following the census.

A wider renown has undoubtedly come to Philadelphia from the construction of steamships on the Delaware than from any other single industry. This is due not only to the extent of the tonnage built, but to the superb technical achievements of the Cramps. Their yard is located on the Delaware River, in the old Kensington district. The works were founded in 1830, since which time 300 ships have been built. A number of these are the cruisers of the United States navy, as the *Newark*, *New York*, and *Philadelphia*, and the battle-ship *Indiana*, completed in 1896. Here, too, were constructed the *St. Louis* and *St. Paul* for the International Navigation Company, an American line chiefly owned in Philadelphia, but the vessels plying between New York and Southampton. These vessels have a measurement of 11,000 tons and develop 19,000 horse-power.

COMMUNICATIONS. The Delaware and Raritan canal, having fallen under the control of the Pennsylvania Railroad Company, has become simply a financial auxiliary to its interests. By steam navigation Philadelphia has communication with the towns on the Delaware from Trenton to Cape May, and through the Delaware ship-canal to Baltimore and the Chesapeake waters. Surveys have been made at a cost of $100,000 to the city for a ship-canal across New Jersey to Newark Bay, having a capacity to pass through it modern vessels of large tonnage, and if the general government will assist, capacity for its cruisers and battle-ships. Should the Delaware ship-canal be enlarged to similar proportions, it would be possible to concentrate men-of-war at any point from Norfolk to New York harbor without going to sea.

The harbor itself has recently been greatly improved, partly at the expense of the United States government and partly that of the city. The two islands that lay in the river opposite Camden, known as Ridgeway Park and Windmill islands, were entirely dredged away in 1894. The city appropriated $500,000 for improving the channel in the lower reaches of the river, and $150,000 for widening Delaware Avenue, which is the street on the Delaware River front. In addition to this, $1,000,000 from the Girard estate was available for this purpose. It is proposed to extend the wharf-line of the city, and also to improve the Camden front, so as to reduce the width of the river from half a mile to 1,900 feet. The currents of the river thus contracted would maintain a depth of 26 feet at low tide. It is estimated that 25,000,000 cubic yards of

CITY HALL, PHILADELPHIA.

material will need to be dredged away, at a cost of $3,500,000, of which, in 1896, one third had been removed.

Entrance by railroad into the city is now practically confined to the four great systems, the Pennsylvania, the Reading, the Baltimore and Ohio, and the Lehigh Valley, which have absorbed all the other lines. The passage of the Baltimore and Ohio trains is through depressed ways along the banks of the Schuylkill. The Pennsylvania and Reading lines reach the heart of the city in Market Street, near Broad, on elevated causeways of masonry and iron. Their terminal depots are buildings of high architectural beauty and most convenient and sumptuous in their appointments. The station of the Pennsylvania Company confronts the new city hall, has a granite basement story and a superstructure of ten stories in brick, with terra-cotta trimmings, and is a fine adaptation of the Gothic to modern needs. It has a frontage of 306 feet, while the train-shed is 600 feet long and spans a clear distance of 304 feet. The area covered by the shed is about five acres, and 16 tracks enter it side by side. The Reading terminal at Twelfth and Market streets is built of New England granite up to the second floor, above which rise seven stories constructed of pink-tinted brick and white terra-cotta embellishment. In style it is a composite Renaissance. The train-shed is 507 feet in length and 266 feet wide, covered by a roof of a single span.

HOTELS. The somber monotony of Philadelphia buildings began to be changed rapidly at the time of the Centennial Exposition in 1876, and a new appreciation of architectural beauty has controlled recent constructions. In nothing is this more evident than in the new hotels, which show a decided tendency to locate themselves near the center of Broad Street. To the long-renowned Continental Hotel, the Girard House and Bingham's, have been added the Colonnade, of white marble, at the corner of Chestnut and Broad; the Lafayette, in its rear, which was enlarged, renovated and reopened in 1896; the Stratford, still farther south; and the Walton, of brownstone and red brick, opened in February, 1896. These hotels are distinguished for their quiet sumptuousness and elegance and the excellence of their interior decorations.

WATER-SUPPLY. The water-supply of the city is still drawn almost wholly from the Schuylkill River. There are supplementary reservoirs of large dimensions for high service at East Park, Mt. Airy and Roxborough. These, with ten other reservoirs, have a total capacity of 1,017,250,000 gallons.

STREETS. With considerable rapidity the old cobblestone pavements are disappearing from the denser part of the city, and are not extended into the new part. There are 13,000 miles of streets laid out, of which 80 are paved with asphalt, 50 with vitrified brick and 220 with Belgian blocks. Nearly every thoroughfare of importance in the city is traversed by lines of trolley-cars. Since 1890 all the traction cable-roads have been converted into the new electric system, and the old horse-cars have entirely disappeared. The various systems of street passenger traffic were consolidated into one in 1895, the capitalization of which is over $100,000,000. By a system of exchange tickets, for the purchase of which 3 cents is added to the regular fare of 5 cents, one can be transported to any part of the city and may ride a distance of 14 miles. In January of 1896 the drivers and conductors of this great system struck for ten hours' work, a pay of two dollars a day, and to resist the dismissal of union men without cause. The strike was accompanied with some rioting near the car-stables and in the thoroughfares of Chestnut and Market streets, which confined itself to the destruction of cars. For several days street traffic was entirely arrested, but through the intervention of a committe of citizens a compromise was brought about and the old men were taken back, except in so far as their places had already been supplied by new men.

SCHOOLS. In 1895 there were 425 public schools in the city, with 3,161 teachers and an enrollment of 163,707 pupils. The school system was maintained that year at an expense of $3,965,571. There are four high-schools, of which two are for girls and two for boys. One of the girls' high-schools is a normal school. Both are fine and massive structures, capable of accommodating 1,200 pupils. Both are on Spring Garden Street, about four squares apart. The Central High School for lads, at the corner of Broad and Green, long occupied a large brick structure, but in 1896 a substantial and handsome building was in process of erection opposite the old structure. Another graduating-school for boys is known as the Manual Training School, where technical instruction in wood and iron work is given in connection with a curriculum quite as extensive as that of the Central High School, which, with the exception of languages, is intended to be the equivalent of an ordinary collegiate course.

The school administration is a dual system; each ward elects 12 directors or trustees, who have control of the engagement of teachers and questions of discipline. Over them all is a board of education, appointed by the judges of the court already mentioned. This board makes appropriations for the erection of school-buildings and assigns their location, purchases the school-books, and has an advisory relation with the ward or sectional directors. In 1883 this board called to the service of the city James McAllister, of Milwaukee, who succeeded in giving unity to the administration and introducing the system of manual training. Upon his retirement his methods still remained prevalent throughout the system, and the schools of Philadelphia have now become typical for their methods and excellence.

Among the additions of private philanthropy to the educational features of Philadelphia must be noted the Williamson Trade School, resting upon a foundation of $5,000,000 provided by I. V. Williamson. It is located near Media, in Delaware County, but its control is in Philadelphia and its facilities are offered freely to the children of that city. Of more note is the Drexel Institute, in West Philadelphia, near the Schuylkill River, founded by the banker Anthony J. Drexel. The building has a fine architectural effect, is constructed of buff brick, with light terra-cotta trimmings. It is about two hundred feet square. The interior consists of a central court open from the roof to the ceiling, with galleries at each story leading to the various rooms, and a superb staircase by which the galleries are reached. The purpose of the school is to give instruction in various branches of manual industry, and is maintained by the income of an endowment fund of one million dollars.

In 1891 the city councils ordered free libraries to be established throughout the city, under the direction of the board of education. These are for the circulation of books, and are free. There were six branch libraries in 1896, scattered in different parts of the town, having about 64,000 volumes. The beneficence of Henry Charles Lee enabled the old Philadelphia Library to extend its building and double its capacity. It is a substantial but plain brick building, at the corner of Locust and Juniper streets, enriched by collections that have been accumulating for 160 years, and is now in possession of 180.000 volumes.

Among the institutions for special purposes are the Philadelphia Historical Society, the College of Physicians and Surgeons, the Academy of Natural Sciences, at Nineteenth and Race streets, and the Franklin Institute, on South Seventh Street. All of these institutions have extensive libraries concerned with their specialties. The Academy of Natural Sciences, of green sandstone, is a handsome build-

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SCALE, 175 ENGLISH STATUTE MILES TO ONE INCH
0 50 100 150 200 250
KILOMETERS.
0 50 100 200 300 400
Submarine Telegraphs
Steamship Lines
International Boundaries
Province Boundaries
Capitals of Countries
HONGKONG
Mirs Bay
Kie-shi
Takow
Heng-chun
Botel Tabago
BASHEE CHANNEL
Batan
Ibayat I.
Islands
Batan I.
Babuyan I.
Babuyan
Camiguin I.
Islands
Calayan I.
Dalupiri I.
Fuga I.
BALLINTANG CHANNEL
Pratas I.
CHINA SEA
C. Bojeador
C. Engaño
Laoag
Aparri
Cagayan
Tuguegarao
Divilacan Bay
Vigan
Divinisa Pt.
S. Fernando Pt.
Lingayen Gulf
Bolinao
C. Bolinnasay
Lingayen
Dagupan
Camarag
LUZON
ISLAND
Baler
Bongabong
Polillo I.
Bacolor
Bulacan
MANILA
Port Subig
Balanga
Manila Bay
Corregidor
Cavite
Taal
Lubang I.
Bauan
Lipa
Batangas
Tabas
Nueva Caceres
Tibi
Lagonoy Bay
Mt. Mayon (Vol.)
Sorsogon
Albay
Marinduque
Burias I.
Ticao I.
Romblon I.
Tablas I.
Siduyan I.
Masbate I.
Mindoro I.
Mindoro Strait
Busuanga I.
Palapa
SAMAR I.
Catbalogan
Tacloban
Orihos
LEYTE
Pt. Sungi
Calamianes
Nangalao I.
Islands
Culion I.
Lincapan I.
Pt. Poto
Colasi
Capiz
PANAY I.
North Cape
Cuyos Is.
Cuyo I.
Iloilo
Malaspina (Vol.)
Bacolod
Cebu
Magellan murdered 1521
Mt. Sacripante
Dinagat I.
Taltal
Dumaran I.
Pt. Naso
Guimaras I.
Hinigaran
CEBU I.
Calape
BOHOL I.
Siargao I.
Bucas I.
Pt. Cauit
Tagbilaran
Siquijor I.
Butuan Bay
Camiguin I.
Butuan
Ulugan Bay
Green Bay
ISLAS
Puerto-Princesa
PALAWAN
ISLAND
ADJACENTES
NEGROS I.
Kagayanes Islands
Tolon Bay
Pt. Bombonon
Makajalon Bay
Dapidan Bay
Iligan Bay
Cagayan
Lianga Bay
Tagleb
Rocky Bay
Bugsuk I.
Sindangan Bay
Misamis
MINDANAO ISLAND
Pt. Gorda
Balabac I.
Balabac Strait
SULU SEA
Pt. Santa Maria
Siuguicy Bay
Illana Bay
Pollok Harbor
L. Malanao
L. Mindanao
Iligan
Caraga Bay
Davao
Casama Pt.
Banguey I.
St. Michael Is.
Balambangan I.
Mitford
Kudat
Marudu Bay
Kagayan Sulu
Puitan Bay
Marchesa Bay
Zamboanga
Basilan Strait
Basilan I.
Isabela
Olutanga I.
Selangan
Mt. Apo
Mindanao (Vol.)
L. Liguasin
Davao Gulf
Puyaga Bay
C. St. Augustine
Leuo
Port Lebak
L. Buluan
Abai
Bongon
Gaya
Mt. Kinabalu
Labuk Bay
Pangutarang I.
Jolo
Belawan I.
Pt. Bucua
Pt. Coama
Palmas I.
Mata I.
Sarangani Bay
Sarangani Islands
Papar
Sandakan
Maimbum
Lapac I.
Sulu I.
Pata I.
Tataan Islands
Siassi I.
C. Unsang
Menpakol
Labuan
Brunei Bay
BRITISH NORTH BORNEO
Tawi Tawi
Sibutu Pass
SULU ARCHIPELAGO
Brunei
Parvel Bay
Sibutu I.
BORNEO
Mt. Malu
Mt. Baling
Tawao
St. Lucia Bay
Brunei R.
BRUNEI
DUTCH
Mt. Marud
CELEBES SEA
Meares I.
Ariaga I.
Nanusa I.
Anda I.
Karkaralong Is.
Karakelang I.
Kabalusu I.
Talaud Is.
Cabio Is.
Salibabu I.
Taruna
Great Sangir I.
THE M.-N. CO.
MALOLOS
Bulacan
BULACAN
Balintang
Caloocan
San Francisco del Monte
Malabon
Navotas
Masambong
La Loma
MANILA BAY
R. Pasig
MANILA
Tondo
Binondo
Dulompayau
San Miguel
Reservoir
San Juan del Monte
Santa Mesa
Ermita
Pasig
Pateros
Taguig
Pineda
Malate
Santa Ana
San Pedro Macati
Naval Battle May 1, 1898
Malibay
Caridad
Cavite
FORTS
Paranaque
Las Pinas
Bacoor
Cavite Viejo
Noveleta
Rosario
Santa Cruz
San Francisco
CAVITE
LAGUNA DE BAY
Loai-ta Bank
Tizard Bank
Investigator Shoal
Palawan Passage
Barcelona
Sulu
Zel.
Suez

ing devoted to researches in natural history, and is richly equipped with zoölogical and botanical specimens. It is one of the most vigorous of learned societies in the United States. The population of Philadelphia in 1890 was 1,046,964; by the twelfth census (1900) it was 1,293,697.

PHILADELPHIA COMMERCIAL MUSEUM. See COMMERCIAL MUSEUM, in these Supplements.

PHILÆ, an island of the Nile two miles above the first cataract. See EGYPT, Vol. VII, p. 679.

PHILBRICK, JOHN DUDLEY, educator; born in Deerfield, N. H., May 27, 1818; was graduated at Dartmouth College in 1842. He then became a tutor in the Roxbury Latin School, and later in the Boston English High School. In 1847 he organized the Quincy Grammar School, introducing his own plans, which were adopted for the whole school system of Boston. In 1852–56 he was superintendent of public education in Connecticut; in 1857–74 and again in 1876–78 was superintendent of the public schools of Boston. In 1873 he went to the Vienna Exposition as United States commissioner of education. In 1878 he was a member of the international jury at the universal exposition in Paris. In recognition of his services he received the decorations of the gold palm of the University of France, and the cross of the Legion of Honor. He published *Characteristics of the True Teacher; School Government; City School Systems in the United States*, etc. He died in Danvers, Mass., Feb. 2, 1886. G.J.H.

PHILELPHO. See FILELFO, Vol. IX, 141–142.

PHILIDOR, FRANÇOIS. See CHESS, Vol. V, 522.

PHILIP, KING, an Indian chief, son of Massasoit, chief of the Wampanoags of Massachusetts. Massasoit was friendly to the English, but ill treatment drove Philip into hostility, and he formed a confederation of the tribes for the extermination of the white men, attacking them in June, 1675. The war continued for more than a year, with fierce fighting and sanguinary deeds. Twelve towns were destroyed by the Indians and many of the settlers were slain. Philip was killed by Capt. Benjamin Church, Aug. 12, 1676. G.J.H.

PHILIP OF HESSE. See LUTHER, Vol. XV, *et seq.*

PHILIP, JOHN WOODWARD, naval officer; born in Kinderhook, N. Y., Aug. 26, 1840; entered the United States Naval Academy at Annapolis, Md., in 1856; was appointed midshipman on the *Constitution* in January, 1861, and afterward on the *Santee;* and was promoted acting master and attached to the sloop-of-war *Marion* of the West Gulf blockading squadron on June 1. In 1862 he was on the James River on the *Sonoma*, and from July, 1862, to the end of the war served as executive officer on the *Chippewa*, the *Pawnee*, and the monitor *Montauk*. He was promoted lieutenant-commander in 1866 and captain March 31, 1879, serving on various ships of the Asiatic squadron, and being detached in 1874 to command a Pacific mail steamer, and in April, 1877, to command the Woodruff Scientific Expedition around the world. On Aug. 23, 1894, he was made captain of the Boston Navy Yard, remaining there till Oct. 15, 1897, when he was placed in command of the battleship *Texas*, of the North Atlantic squadron. On May 13, 1898, the *Texas* put to sea as part of the squadron under Commodore Schley, arriving off the harbor of Santiago, Cuba, on the 28th, where it was learned that the Spanish squadron under Admiral Cervera was in that harbor. When the Spaniards left the harbor on July 3, in a desperate effort to escape, the *Texas* took an active part in the pursuit, and though the oldest battleship in the fleet, did very efficient service, being ably handled and her gunnery very effective. In the first movement of pursuit there was imminent peril of the *Texas* cutting into the *Brooklyn*, which unexpectedly crossed her bows. Philip's fine seamanship averted this disaster, both engines being reversed and the battleship halted without a shock. On Aug. 10, near the end of the war, he was promoted commodore, and on Sept. 3, was put in command of the North Atlantic squadron, with the *New York* for his flagship. On Jan. 15, 1899, he succeeded Rear-Admiral Bunce as commander of the Brooklyn Navy Yard; on Feb. 4, was presented with a sword by Governor Roosevelt, and on March 3, was promoted rear-admiral. He died in Brooklyn, N. Y., June 30, 1900. Admiral Philip was a deeply religious man. G.J.H.

PHILIPPEVILLE, the ancient Rusicada, a thriving seaport of Algeria, 40 miles N. N. E. of Constantine, on the Gulf of Stora. In the vicinity are quarries of the famous Filfila marble; also iron-mines. The vine is extensively cultivated. In 1882 a magnificent harbor was completed, with two moles, one 4,590 feet long, the other 1,310 feet. Population (1901), 14,483.

PHILIPPICS. See DEMOSTHENES, Vol. VII.

PHILIPPINE ISLANDS. For the early history, traditions and conditions of the Philippine Archipelago, see Vol. XVIII, pp. 762–767.

These islands were ceded by Spain to the United States, by the treaty, signed at Paris, Dec. 10, 1898, the United States paying to Spain $20,000,000 in lieu of the transfer. The Philippines are (with the exception of a part of Mindañao and the Sulu Islands) under civil government. The central government is composed of the Governor-General and 7 commissioners (4 Americans and 3 Filipinos) constituting the upper house, and the Philippine Assembly (opened on Oct. 16, 1907), constituting the lower house of the legislative body. There are four executive departments, Interior, Finance and Justice, Commerce and Police, and Public Instruction, headed by the American Commissioners. The islands are subdivided into 36 provinces, each with a governor, elected by the municipal councils, secretary, treasurer and prosecuting attorney. In 6 provinces with a pagan population the governor is appointed by the Governor-General, with the consent of the Philippine Commission.

From 1902-1903 a complete census of the Philippine Islands was taken, which furnishes the fullest and most authentic statistical information ever before given of the islands.

On August 1, 1904, a new internal revenue system was enacted. The revenue in 1906, was $16,231,497 and the expenditure $15,692,822. The imports (in 1907) amounted to $30,453,810 and the exports to $33,097,867. In addition to the lands originally ceded, the United States subsequently acquired from Spain the little group of islands known as Cegayán Sulu, and nine other small islands, lying off north of Borneo.

The total population of the Philippine Islands on March 2, 1903, was 7,635,426. Of this number, 6,987,686 enjoyed a considerable degree of civilization, while the remainder, 647,740, consisted of wild people. The civilized people, with the exception of those of foreign birth, were practically all adherents of the Catholic Church, while of the peoples here classified as wild, a large proportion, probably more than two-fifths, were Mohammedans in religion and were well known in the islands as Moros. The remaining three-fifths belonged to various tribes differing from one another in degrees of barbarism.

The total area of the islands is 115,026 square miles. It must, however, be understood that this area, while carefully measured on the best charts obtainable, is subject to considerable correction.

The total number of islands and islets comprised in this archipelago, including everything, however small, which at high tide appeared as a separate island, as enumerated by the United States Geodetic Survey, was 3,141, of which 1,668 were listed by name, while 1,473 are, so far as known, without names.

The two largest islands are Luzón, area 40,969 square miles, with a total population of 3,798,507, and Mindanao, area 36,292 square miles and a total population of 499,634. The next largest island, namely, Sámar, has an area of 5,031 square miles and a population of 222,690. The only other islands having an area of more than 1,000 square miles are the following eight: Negros, area 4,881, population 460,776; Panay, area 4,611, population 743,646; Paragua, area 4,027, population 10,918; Mindoro, area 3,851, population 28,361; Leyte, area 2,272, population 357,641; Cebú, area 1,762, population 592,247; Bohol, area 1,441, population 243,148; Masbate, area 1,236, population 29,451. There are 20 islands having an area between 100 and 1,000 square miles, 73 between 10 and 100 square miles, and 262 between 1 and 10 square miles. The remaining number, 2,775, or seven-eighths of all, have areas less than a square mile each.

At the date of the census, March 2, 1903, the islands were divided into 40 civil provinces, the city of Manila, and 9 military districts. Thirty-eight of the civil provinces were divided into municipalities, or municipalities and townships, and two provinces, Benguet and Lepanto-Bontoc, into townships alone, the township being a simple form of municipal government adapted to such of the non-Christian or wild tribes in the several provinces as were not sufficiently advanced for the municipality.

With the exception of the Negritos and the people of foreign birth, all the inhabitants of these islands are believed to be Malays. The civilized population is, therefore, an extremely homogeneous one. Out of the civilized population of 6,987,686, no fewer than 6,931,548, 99.2 per cent, were born in the Philippine Islands. The element of foreign birth in the Philippines, which constituted only eight-tenths of 1 per cent of the inhabitants, was composed mainly of Chinese, who numbered 41,035 and constituted six-tenths of 1 per cent. Besides them there were a few hundred Japanese and East Indians. Next to the Chinese the largest alien element in the Philippines was composed of those from the United States, who numbered 8,135, and formed a little over one-tenth of 1 per cent, while all other nationalities collectively formed another tenth of 1 per cent. Of the foreign born, whose total number was 56,138, no fewer than 29,491, or more than one-half, were in the city of Manila, the remainder being scattered in small numbers over the archipelago. What was true in regard to the distribution of the foreign born as a whole, was true also in regard to the principal nationalities. A little more than one-half of the Chinese, Americans, and Spaniards were found in Manila, the remainder being distributed over the archipelago.

With respect to color, the people of the Philippine Islands showed very nearly as great homogeneity as with respect to birthplace. Ninty-nine per cent of the Christian population belonged to the brown race. Only two-tenths of 1 per cent were reported as being of mixed color. This statement, however, may fairly be questioned, as there is little doubt that the proportion of mixture of races was much greater. The mixture is that of the brown people with the Chinese, Spaniards, and, in recent years, to a trifling extent with Americans. Much of this mixture, however, dates back to past generations, and it is presumable that the present inhabitants have no knowledge of their ancestors. The Yellow race included the Chinese and Japanese, and constituted about six-tenths of 1 per cent; the whites two-tenths of 1 per cent; besides these there were a few negroes, discharged soldiers of negro regiments. Excepting the military comandancies and the wild tribe provinces, where the civilized population was very small, and the city of Manila, which had a large foreign population, the brown people constituted in every case 99 per cent or more of the population, excepting in Sorsogón and Isabella.

The wild peoples of Luzón, the Visayas and Mindoro, were confined almost entirely to the interior of the islands, the exception being that part of the east coast of Luzón not occupied by civilized peoples. The great mountain range of northern Luzón, the Caraballös Occidentales, was occupied almost exclusively by the Igorots, and the Sierra Madre, fronting the Pacific in northern Luzón, by a sparse population of Negritos. Between the two, about the head waters of the Cagayán River, is the territory of the Ilongots. The Zambales mountains were occupied by the Negritos, and they were also found in small bodies scattered

about on several of the islands. The Mangyans were found in the interior of Mindanao, the Bukidnons in Panay, Negros, Mindanao, and in small numbers in other islands. The Moros occupied the Sulu archipelago, the coast of southern Paragua, and much of that of Mindanao, extending into the interior about Lake Lanao and in the Cottabato valley.

The capital and principal city of the Philippine Islands is Manila, the population of which in 1903 was 219,928. It is located on Manila Bay in Luzón Island. The other cities exceeding 10,000 population are, Laoag, 19,699, in Ilocos Norte province; Ilóilo, 19,054, Ilóilo province; Cebú, 18,330, Cebú province; Nueva Cáceres, 10,201, Ambos Camirines province. Thirty-five other towns in the archipelago had a population exceeding 5,000 each.

The range of products in the islands is very wide; about 300 fiber plants of either commercial or local value are found in the different provinces, while food producing plants grow in great variety and profusion, as well as plants yielding valuable gums, dyes, oils and medicines. Tropical fruits, such as the banana, mango, orange, and scores of others are produced with slight or no effort, while corn, small grains, potatoes, tomatoes and many other vegetables respond readily to cultivation. The principal vegetable products of the islands are hemp, sugar, tobacco, copra and rice.

At the close of the year 1902 two steam railroads were in operation in the Philippines, both in the island of Luzón; one extending from Tondo, in the city of Manila, to the town of Tambobong, or Malabón, in the province of Rizal, a distance of 4.35 miles; the other from Manila to Dagupan, in the province of Pangasinán, a distance of 121.79 miles. The construction of two branch lines in connection with these roads was begun in 1903, aggregating 65.87 miles in estimated length and to be completed in December, 1905. To further the construction of transportation facilities and aid the commercial activities of the islands, Congress passed a bill, approved by the President, February 6 1905, authorizing the general government of the Philippine Islands to guarantee an income of not exceeding 4 per cent upon the cash capital invested in the construction and equipment of such roads, or any part thereof, in the Philippines.

On March 2, 1903, Congress passed an act entitled "An act to establish a standard of value and to provide for a coinage system in the Philippine Islands." The Philippine Commission at once took measures to put the act in force and place the currency of the islands on a gold basis. They purchased silver and other metals for the new coinage. The circulation of the new silver certificates commenced in the month of October, 1903. Whenever a silver certificate was put into circulation, an equivalent of silver pesos was deposited in the treasury for the redemption of the certificate when presented for that purpose. The amount in circulation at the end of the month of October, 1903, was 350,200 pesos and at the close of August, 1904, 7,230,000 pesos. A short time after this all business was done upon the new basis.

The Filipinos had engendered a bitter feeling against the Spanish friars and especially objected to their return as parish priests or their collection of rents as landlords. While the government recognized the justice of protecting the friars in the enjoyment of their rights of property, it was felt that it was on every account desirable that some understanding should be reached by which they might be quietly eliminated as a disturbing factor. Arrangements were therefore made, in 1902, for purchasing these lands upon equitable terms and an American archbishop and bishops were appointed by the Holy See to take the places formerly occupied by Spanish churchmen.

EDUCATION.—The Filipinos had few educational facilities. When the Spaniards made the first permanent European settlement at Cebú in 1565, several of the native tribes had written alphabets. They wrote upon bamboo stems and banana leaves with a sharp pointed stick. In remote districts this practice still existed at the close of the Spanish rule. The Spanish schools in the Philippines were in origin and history missionary enterprises, conducted under the direct supervision of the Church. In 1863, a general system of primary schools was established throughout the islands. The insurrection of 1896 and the subsequent revolt of 1899–1901 against the Americans greatly disorganized the work of education. September 1, 1898, immediately after the American occupation, seven schools were organized in Manila. Three years later 765 American teachers had been appointed in the islands, in accordance with the provisions of act 74. The maximum number of American teachers at work in the islands, including superintendents, was 926, in May, 1902. At the beginning of the school year 1903–4 this number had fallen to 723, and by the time the second annual report was written, in October, 1903, only 691 American teachers were available. This was in fulfillment of the plan and promise to replace, slowly, the American teachers with native teachers as the latter became competent. The American teachers acted more and more as local supervisors, organizers and inspectors of barrio schools, so that, although fewer in number they continued to exercise a wide influence over the educational development of the islands. It was found, however, with the return of tranquillity to nearly all the provinces and the abatement of cholera and smallpox, interest in educational matters became so intense and the demands for more schools so insistent that the bureau saw itself obliged to abandon its conservative policy and to increase the number of American teachers to 812, with which number the school year closed in March, 1904. The appropriation bill for the school year 1904–5 provided for 863 American teachers. By September 15, 1904, the corps of student teachers had furnished a force of native municipal teachers consisting of 2,138 men and 1,057 women. It was estimated that the children of school age numbered not less than 1,200,-

000 and school facilities were yet inadequate for thoroughly educating more than one-third that number in the common English branches. Normal schools also were established and well attended by a large number of pupils of both sexes, showing great enthusiasm in their studies. A law was enacted by which Filipino students may be sent to the United States each year to be educated in such trades or professions as they select. As the great mass of people lacked a common language of their own it was decided by the Philippine Commission to give instruction in English. The Spanish language which was the official language under the former régime was practically unknown to 95 per cent of the people. In justice to the lawyers, who understood Spanish, English was not at once made the language of the courts and so it was provided that until January 1, 1906, Spanish should be the official language thereof, and thereafter English.

Recent History.—Events of interest succeeding those noted in Vol. XVIII, center around the occurrences relative to the emancipation of the islands from Spain and their acquisition by the United States. News of the revolution of September, 1868, which cast Queen Isabella II from the throne of Spain, led the educated Filipinos to believe that an era of true progress had arrived for the Philippine Islands. While this hoped-for change on the part of those beginning to take a new interest in the affairs of their country did not arouse anticipations of freedom from Spanish authority, it caused considerable friction between them, on the one hand, and the conservatives, Spanish residents and friars on the other. Spain did not pursue the conciliatory policy which the provisional government inaugurated, and, on the restoration of the dynasty, permitted indiscriminate and unjust punishments and cruelties to be inflicted upon innocent persons on the allegation that they desired independence. The accusations of plotting against the sovereignty of Spain were at first unfounded, but had the effect of sowing the seeds of the discontent surmised, and, on the occasion of General Izquierdo, the governor of the islands, imposing a tribute tax on the workmen in the arsenal at Cavite, an immunity which they had enjoyed from time immemorial, the general dissatisfaction found expression in a revolt among the native troops, and on the night of January 20, 1872, the soldiers in the San Felipe Forte, in Cavite, assassinated the commanding officer and other Spanish officers in charge of the fort. The usual severe penalties were meted out to the offenders, also to many victims of unjust sentences, and the uprising was made an excuse for inflicting greater hardships and deprivations on the Filipinos. Attempts, after this incident, to quell the unrest by terrorizing the natives fell far short of accomplishing the purpose. The number of Filipinos who went abroad to be educated increased year by year and while there could be no free expression of revolutionary ideas in the islands — the press being under a most rigid censorship — a Filipino organ was established in Madrid by sympathizers in which appeared brilliant articles by Dr. José Rizal, Jaena and others from the islands. Rizal was a Tagálog, a native of the town of Calamba, and was the author of a couple of books in which he exposed the defects of the public administration of affairs, the ignorance of the functionaries and their corruption, the vices of the clergy and the inferiority of Spanish culture. He, together with other influential Filipinos, established the Filipino League, to aid in the betterment of the natives. Some secret organizations also sprung up, among which was the El Katipunan, members being bound by solemn oath to die for the liberties of their country if necessary. On August 19, 1896, the priest of the barrio of Tondó, in the city of Manila, learned of the scheme to expel the Spaniards; the governor-general was at once informed of the conspiracy, troops were rushed in, the jails were filled with suspects, and in self-defence the revolutionists struck sooner than they had planned and attacked San Juan del Monte, August 30. They were defeated by the Spanish artillery with great slaughter and many were taken prisoners. The persecution of the suspected parties was at once begun and most of the influential Filipinos were arrested and sent to prison. Many of them were executed by the mandates of a military court-martial in which all principles of equity and justice were ignored. The talented author, Dr. José Rizal, was court-martialed and shot December 30, 1896. The great body of revolutionists had now left the towns and taken up arms against the Spaniards. General Lechambre took the field with 14,000 Spanish soldiers supported by a squadron under Admiral Montojo. The Spanish forces triumphed in the same waters where in a short time afterwards Admiral Montojo's fleet was sunk by Commodore Dewey's ships. Emilio Aguinaldo, with a large band of revolutionists, among whom were natives of great influence, escaped from the Spaniards, crossed the provinces of Cavite and Manila, and fortified himself in the province of Bulacán, at a place called Biacnabató. General Primo de Rivera, who was governor-general of the Philippine Islands, got General Aguinaldo and his chieftains to agree to a treaty of peace, which was reported to have been signed on December 14, 1897. In this was promised expulsion of the friars, freedom of the press and public assemblage, representation in the Spanish Congress and amnesty to all revolutionists. Aguinaldo and his chieftains on their side agreed to remove to Hong Kong on payment of the sum of 600,000 pesos for their arms, ammunition, and other munitions of war which they abandoned at Biacnabató. It afterwards developed that the alleged treaty was a ruse to get rid of Aguinaldo and his chieftains. After their departure, peace reigned for awhile, but minor disturbances reported from all parts of the islands indicated that the revolutionary spirit was still kept alive by the people at large. In 1898, when war between the United States and Spain was declared, General Augustin, then governor of the islands, quickly

organized the various corps of militia and put them under the command of the revolutionary leaders who yet remained in the islands. The Spanish governor endeavored to secure the co-operation of the Filipinos in defending the islands against foreign invasion by various ruses and show of favoritism, but the time-worn duplicity that promised everything in critical moments and gave nothing after the crisis was passed could no longer successfully appeal to the forgiving nature of the natives, as subsequent events proved. On May 1, 1898, Commodore Dewey's ships completely destroyed the Spanish squadron in the Philippine Islands, in the harbor of Manila, in the Bay of Bacoor. Cavite capitulated the same day and Manila was completely blockaded as far as communication by sea was concerned. The Spanish troops to the number of 12,000 were distributed throughout Luzón and the other islands. The Filipino militia was composed of 11,000 men, and the colonial government was confident that the natives would believe in the promises of autonomic government and would take sides with Spain against the American invaders. But in this they were foiled. At the outbreak of the war Commodore Dewey had been stationed at Hong Kong, and before leaving for Luzón, he and the American consul, Mr. Wildman, had an understanding with Aguinaldo that the latter should follow Dewey to Luzón and again raise the standard of insurrection. On May 19, General Aguinaldo landed at Cavite, and within fifteen days thereafter all of the Filipino militia had rebelled against Spain, and the militia forces were so disposed that Manila was completely cut off from all communication by land, and the blockade was complete. On the surrender of Manila, General Aguinaldo soon organized a provisional government at Bacoor; in September he removed his forces to Malolos, where the seat of the revolutionary government was established. When the Paris Treaty of Peace was published in January, 1899, by General Otis, it created great dissatisfaction among the Filipinos, who believed that the intention of the United States in destroying the Spanish sovereignty was to secure the independence of the Philippine Islands. The Philippines were ceded to the United States and instead of the Filipinos being free to establish and maintain a government of their own, they found themselves transferred from the sovereignty of one country to that of another. The Filipino people ignored the treaty and fought against the American domination with great energy. On February 4, 1899, hostilities were inaugurated and the American army began the conquest of the archipelago. See AGUINALDO, in these Supplements.

The insurrection against the United States finally developed into a guerrilla warfare and caused widespread demoralization among the mass of the people. The American conquest of the Philippine Islands may be considered as having been completed by the year 1901, in which year a commission from Washington arrived in Manila for the purpose of organizing a local civil government. After the collapse of the insurrection and after all organized opposition to United States authority had ceased, the great mass of the people resumed their ordinary and peaceful vocations, but they continued to suffer from the depredations of numerous bands of ladrones, who not infrequently were commanded by some veteran outlaw, whose career extended back to Spanish times. These predatory bands as a rule preyed upon their own people, often killing or mutilating those who refused them assistance or were supposed to be unfriendly to them. It was obviously necessary that these bands should be subdued or exterminated before it would be possible for the people to live in safety in their homes or to till their fields; hence, at an early day after the establishment of civil government, the Philippine Constabulary, composed of natives commanded as a rule by American officers, was organized and began operations against them. As a result of the persistent efforts of the constabulary thus aided by the people, the Commission reported in the latter part of 1904 that there was not in the great island of Luzón a single organized band of ladrones to be found. What was said as to Luzón was also applicable to the Visayan Islands, with the single exception of Samar. The low intelligence and semibarbarous condition of many of the inhabitants of the mountains of Samar and of some of the other islands of the archipelago partially explains the irruptions from these sources and the raids made upon the civilized Filipinos living in the lowlands. The Spaniards impressed themselves less, perhaps, upon the people of Samar than upon the inhabitants of the other islands, and except Mindanao, the home of the Moros, there was, therefore, more combustible material there than in the other islands. Doubtless many of the inhabitants of these mountain regions who were completely isolated from the outside world had never seen a white man. The civilized Filipinos were in great terror of them and eagerly co-operated, so far as their fears would permit, with the scouts and constabulary in their elimination.

In commenting upon conditions as to peace and order, separate consideration is required of the Moro Province, which includes all of the great island of Mindanao, except the two Christian Filipino provinces of Misamis and Suriago, on the north coast, and also includes the Sulu Archipelago. With the exception of some 66,000 Filipinos, generally the descendants of convicts deported by the Spaniards from the northern islands, the great area of territory embraced in the Moro Province was inhabited by Moros, who professed the Mohammedan religion, and by a number of other non-Christian tribes. Major-General Otis, commanding the military forces and governor of the islands, sent an expedition commanded by Brig.-Gen. John C. Bates to look after matters in Mindanao and the Sulu group in the summer of 1889. At this time little was known of the Moros save that they professed the Mohammedan religion and were a warlike people

who had always resisted the domination of Spain. General Bates entered into a treaty with the sultan of Sulu by which the latter recognized the paramount sovereignty of the United States, but it was agreed that he was not to be interfered with in the direct government of his people. The authority of the sultan of Sulu embraced only the islands of the Sulu archipelago, being in no way recognized by the inhabitants of the island of Mindanao, in which were found at least two-thirds of the Moro population. The latter, especially the Lake Lanao Moros, were resentful of any intrusion upon their isolation and their chieftain explicitly stated that Americans would not be permitted to enter their territory. When, in the summer of 1902, a small detachment of cavalry was sent from the military post of Parang, on the south coast of Mindanao, with orders to explore the trail leading to the lake, they were promptly attacked by the Moros and several of their number killed. This required action, and a column of several hundred men was promptly pushed forward to Lake Lanao, meeting with fierce resistance. In time they learned that resistance against American troops was futile. With the pacifying of the Moros the last serious outbreaks against United States authority passed away, and, although in 1905 occasional incipient insurrections were manifest in certain localities, the islands as a whole were in encouraging accord with the existing conditions. With the exception of a part of the island of Mindanao, of the island of Joló and other small islands which belong to the Moro province, peace was re-established throughout the archipelago. Although a large majority of the Filipinos still long for independence and self-government, the educated class is convinced that independence may be secured at the proper time by legal means, and that a revolution or any appeal to arms would be harmful to the interests of the people of the Philippines

In July, 1901, military government was superseded by civil government with Judge William H. Taft, of Ohio, civil governor. On his resignation, February 1, 1904, he was succeeded by Luke E. Wright, was followed by J. F. Smith, 1906.

PHILIPPOTEAUX, Félix Emmanuel Henri, a French artist; born in Paris, April 3, 1815. He is famous for his historical and battle paintings, including *Louis XV Visiting the Battlefield of Fontenoy*, now at the Luxembourg; *The Last Banquet of the Girondins*, at the Museum of Marseilles; and *The Siege of Paris*, a cyclorama. He died in Paris, Nov. 8, 1884.—His son Paul Philippoteaux, a French historical painter; born in Paris in 1846. He assisted his father in preparing the *Cyclorama of the Siege of Paris*, and made a similar representation of the *Battle of Gettysburg*, which has been exhibited in New York, Chicago, Philadelphia, and other cities. In 1888 he exhibited a series of thirty large paintings illustrating the career of General Grant.

PHILIPS, Francis Charles, an English novelist and dramatist; born in Brighton, Feb. 3, 1849; educated at Brighton College and the Royal Military College, Sandhurst, and in 1868–71 was in the 2d Queen's Royal Regiment; in Jan., 1884, was called to the bar. His principal novels are *As in a Looking-Glass* (1885), which was published in every capital in Europe; *The Dean and His Daughter* (1887); and *Mrs. Bouverie* (1894).

PHILIPSBURG, a borough of Center Co., Pa., on the Moshannon river, 38 miles N. E. of Altoona; is the centre of the bituminous coal region, there being 22 collieries in the vicinity. Pop. 1890, 3,245.

PHILIP THE BOLD and PHILIP THE GOOD. See Burgundy, Vol. IV, p. 479.

PHILISTOS, a Greek historian. See Sicily, Vol. XXII, p. 24.

PHILLIMORE, John George, lawyer; born in Oxfordshire, England, in 1809; was educated at Westminster and Oxford, admitted to the bar at Lincoln's Inn in 1832, became eminent in his profession, and was returned to Parliament for the borough of Leominster in 1852. He favored electoral and judiciary reform, the abolition of tithes, etc. He was the author of *History of the Law of Evidence; Private Law among the Romans*, etc. He died April 27, 1865. G.J.H.

PHILLIMORE, Sir Robert Joseph, an English jurist, brother of preceding; born in London, Nov. 5, 1810; called to the bar in 1841; judge of the High Court of Admiralty, judge of Arches (1867–75), and justice of the High Court of Justice, probate and admiralty division (1875–83); member of Parliament (1853–57); was made a knight in 1862, and a baronet in 1881. He wrote *Commentaries on International Law; Ecclesiastical Law of the Church of England* (1876); and *Memoirs and Correspondence of George, Lord Lyttleton* (1883). Died Feb. 4, 1885.

PHILLIPPS, Adelaide, an English contralto singer; born in Stratford-on-Avon, Oct. 26, 1833; began as a dancer in public at Boston, Mass., Jan. 12, 1842; was encouraged by Jenny Lind to study singing abroad, and in 1854 made her operatic début in Milan, as Rosina. Her voice was of unusual compass. Her last appearance was in Cincinnati, in 1881. She died in Carlsbad, Germany, Oct. 3, 1882.

PHILLIPS, a post village, the capital of Price Co., Wisconsin, 78 miles S. S. E. of Ashland; has 3 churches, 2 newspaper offices, a bank, a saw-mill, and a tannery. Population 1900, 1,820.

PHILLIPS, Lawrence Barnett, a British inventor and painter; born in London, Jan. 29, 1842. In 1861, having invented a keyless watch, he began business as a wholesale watch and chronometer maker; later he constructed complicated and highly finished specimens of the horological art, and by the invention of various forms of mechanism simplified chronographs and calculating-machines. He wrote *Autographic Album* (1866); *Horological Rating Tables* (1871); and *Dictionary of Biographical Reference* (1873). In Nov., 1865, he became fellow of the Royal Astronomical Society, and in March, 1885, of the Society of Antiquaries. He retired in 1882, occupied himself as a painter and etcher, was a constant exhibitor at the Royal Academy and the leading London and provincial exhibitions, and was elected an associate of the Royal Society of Painter-Etchers.

PHILLIPS, Philip, an American composer and

singer; born in Chautauqua Co., N. Y., Aug. 13, 1834; sang at religious revivals; published *Musical Leaves* (1862); *The American Sacred Songster* (1868); *Song Pilgrimage Around and Throughout the World* (1880). His collections of songs were popular. Died in Delaware, Ohio, June 25, 1895.

PHILLIPS, WENDELL, abolitionist; born in Boston, Mass., Nov. 29, 1811; was educated at the Boston Latin School and at Harvard College, graduating in 1831; afterward took a three years' course in the Harvard Law School; and was admitted to the bar in 1834. Up to this time he had taken no interest in the reform with which his name was afterward associated, but was made an abolitionist in 1835, when he saw a pro-slavery mob drag William Lloyd Garrison through the streets, with threats to hang him. The incident that made him a leader of the abolitionists was the meeting called by William Ellery Channing in Faneuil Hall, Dec. 8, 1837, to denounce the murder of Mr. Lovejoy for his abolition sentiments. Mr. Phillips had never yet delivered a public address, but at the request of the chairman he rose and made a short speech, which carried the audience by storm. In his denunciation of assassination and demand for freedom of speech he had proved himself one of the great orators of the world. From that day forward the life of Wendell Phillips was devoted to reform, which he defended with soul-felt enthusiasm, and unsurpassed eloquence. He accepted Garrison's full creed as to the moral obliquity of slavery and did more than any other man to convert the North to abolition views. He was a strenuous advocate of the equal rights of women with men as members of anti-slavery societies, and in 1840, at the World's Anti-Slavery Convention in London, pleaded earnestly, but vainly, for the admission to the convention of the women delegates from the United States. He continued his work without cessation till the period of the Civil War and the date of Lincoln's emancipation decree. In 1864 he opposed the re-election of Lincoln, which led to a controversy between him and Garrison. This was made more intense in 1865 when Garrison favored the dissolution of the Anti-Slavery Society and Phillips opposed it, declaring that its work would not be completed till the freemen were given the right to vote. As a result Phillips replaced Garrison as president of the society, which continued in existence until 1870, he taking a conspicuous part in the reconstruction controversies. In addition to his services in the cause of freedom for the slave, Mr. Phillips was equally earnest in maintaining the doctrine of the equal rights of women, in defending the cause of temperance, and in sustaining the Irish demand for Home Rule. The workingman found in him an untiring champion, and the Indians an able and eloquent friend. In his later days he became a member of the Greenback political party, holding that "the existing system of finance makes the rich richer and the poor poorer and turns the republic into an aristocracy of capital." His last public appearance was on Dec. 26, 1883, at the unveiling of a bust of Harriet Martineau in the Old South Church of Boston. His wife, Anne Terry Greene, was an invalid throughout her married life. He was a man of fine and commanding presence and of graceful and courtly bearing, and the most polished orator on the American platform. He died in Boston, Mass., Feb. 2, 1884. G.J.H.

PHILLIPS ACADEMY, the name of two nonsectarian institutions, one at Andover, Mass., and the other at Exeter, N. H. The former was founded by Judge Samuel Phillips, Jr., with the aid of his father, and of his uncle, John Phillips (1719–95), the school being opened April 30, 1778, with 30 pupils. It was chartered in 1780, and in 1807 the class in theology became the Andover Theological Seminary It has 8 instructors and an average attendance of about 45; occupies twenty buildings, valued at $100,000, including dwelling-houses, dormitories, an academy hall, a chemical laboratory, a gymnasium, and a library of 52,000 vols. The endowment is $800,000.—PHILLIPS EXETER, an English and classical school for boys, founded in 1781 by John Phillips, opening May 1, 1783. There are 10 instructors and an average attendance of 250 pupils. It occupies buildings valued at $100,000, including a physical laboratory, a chemical laboratory, a large gymnasium, and a library of 1,600 volumes.

PHILLIPSBURG, a city, capital of Phillips Co., Kansas, 200 miles W.N.W. of Topeka, in a prairie region, producing corn, cereals, sorghum, potatoes, hay, wool, and live-stock. Pop. 1890, 992; 1900, 1,008.

PHILLIPSBURG, a mining town, the capital of Granite Co., Mont., 70 miles W.S.W. of Helena; has 2 banks, 2 newspaper offices, 2 quartz-mills, and gold and silver mines. Population 1900, 995.

PHILLIPSBURG, a town of Warren County, New Jersey, in the northwestern part of the state. It lies on the Delaware River, opposite Easton, Pennsylvania, with which it is connected by bridges, and is reached by the Central of New Jersey, the Delaware, Lackawanna and Western, the Pennsylvania and the Lehigh Valley railroads. Its population in 1900 was 10,052. W.F.J.

PHILOCHORUS, Greek historian. See EURIPIDES, Vol. VIII, p. 595.

PHILOCTETES, the most celebrated archer in Greece, possessor of the bow and poisoned arrows of Hercules. He was one of the suitors of Helen which caused him to take part in the Trojan War. He led the Grecians against Troy, but, on the voyage thither, he was left behind by his men on the island of Lemnos because he was ill of a wound caused by the bite of a snake received in the island of Chryse. He was showing the Greeks the altar of Athena Chryse and approached too near to the serpent which was guarding the temple of the goddess. He was brought to Troy from Lemnos by Ulysses, because an oracle had declared that Troy could not be taken without the arrows of Hercules. On his arrival at Troy he killed Paris and ended the war. Returning from Troy he was shipwrecked on the coast of Italy where he built Petelia and Crimissa. W.R.B.

PHILOMATH, village, Benton Co., Ore., 16 miles from Albany; is the seat of Philomath College (United

Brethren and co-educational), founded 1866, which had, in 1899–1900, 9 instructors, 116 students, and a library of 600 volumes. Population, 1900, 343.

PHILOMELA. See NIGHTINGALE, Vol. XVII. p. 512.

PHILOSOPHY OF THE CONDITIONED. See HAMILTON, Vol. XI, pp. 373–376.

PHILTER (Gr., *philtron*, love charm). The ancients had a superstitious belief in the efficacy of certain artificial means of inspiring love, and both Greeks and Romans continually employed love charms and love-potions. It is not known with certainty of what ingredients the love-potions were composed, but, doubtless, they contained certain deleterious and poisonous drugs to which other substances — animal as well as vegetable — were added, the mixing process being accompanied by magical rites. Lucretius is said to have been driven mad with a love-potion, as was also the Emperor Caligula. W.R.B.

PHINTIAS. See ALICATA, Vol. I, p. 506.

PHIPS OR PHIPPS, SIR WILLIAM, colonial governor; born at Woolwich, Me., Feb. 2, 1651. Becoming a ship-carpenter, he engaged in ship-building and in trading in Boston, and in 1684–87 succeeded in recovering treasure to the value of £300,000 from a ship sunk near the Bahamas. For this he was knighted by James II, and appointed sheriff of New England, but on his return failed to obtain this office from the governor. In 1690 he led a military expedition against Port Royal in Acadia, which he captured, and commanded the naval force sent by Massachusetts for the conquest of Quebec. This met with a serious repulse. In 1692 he was appointed governor of Massachusetts, and at once established a court for the trial of the alleged Salem witches, many of whom were executed. He then became involved in numerous quarrels. He died in London, Feb. 18, 1695. G.J.H.

PHLEBITIS. See SURGERY, Vol. XXII, 719.

PHLEGMON. See PATHOLOGY, Vol. XVIII. p. 408, 410.

PHLOGISTON. See CHEMISTRY, Vol. V, pp. 399, 400.

PHOCIDÆ. See MAMMALIA, Vol. XV, p. 450.

PHŒBE-BIRD (*Sayornis fuscus*), a popular name of the fly-catcher of the United States. It is often called pewee or pewit. The names are attempted imitations of the peculiar notes of the bird.

PHŒNICIAN LANGUAGE. See PHŒNICIA, Vol. XVIII, p. 815; and SEMITIC LANGUAGES, Vol. XXI, pp. 678, 679.

PHŒNICOPTERUS. See FLAMINGO, Vol. IX, pp. 249, 250.

PHŒNIX, a city and the county seat of Maricopa County, Arizona, in the southwest-central part of the territory. It lies on Salt River, 20 miles above its junction with the Gila River, and is reached by the Maricopa and Phœnix railroad, a spur from the Southern Pacific. Its dry climate makes it a health resort for many invalids, especially pulmonary patients. Its population in 1900 was 5,544. W.F.J.

PHŒNIX, a village of Oswego County, northern central New York, on Oswego River and canal, and on the Rome, Watertown and Ogdensburg railroad, 15 miles N. of Syracuse. It is in a dairying, farming and fruit-raising district; has an excellent water-power, and contains saw and flour mills, and manufactures of cutlery and tissue-paper. Population 1890, 1,466; 1900, 1,532.

PHŒNIX PARK ASSASSINATIONS. See *Lord Frederick Cavendish*, under DEVONSHIRE, and also HOME RULE, in these Supplements.

PHŒNIXVILLE, a borough of Pennsylvania. It had, in 1890, two railroads, the Philadelphia and Reading and the Pennsylvania. There are in the borough numerous churches, a seminary and good public schools, two national banks with a combined capital of $350,000, a public park, water-works and fire department. The works of the Phœnix Iron Company and the Phœnix Bridge Company are located here, and give employment to about 2,400 men. Other industries include manufactures of shirts, hosiery, pottery, machinery, silk and needles. Population 1900, 9,196. See also PHŒNIXVILLE, Vol. XVIII, p. 824.

PHONAUTOGRAPH. See ACOUSTICS, Vol. I, p. 103.

PHONOGRAPH. Another recent product of electro-mechanical science, and one which bids fair to surpass even the telephone in commercial value, is the marvelous instrument known as the "talking-phonograph." The discovery of the phenomena on which it is based was made by Mr. Edison as far back as 1877, while the great electrician was engaged on some experiments for a totally different end. The underlying principle is the same law of acoustics operating in the telephone, that sound consists in a series of waves spreading from a given source, and that their impact at any distance is in exact ratio to the pitch and volume of the original note. With a knowledge of the action of this law in the vibrations on the telephone diaphragm, it will not be difficult to understand the working of the phonograph, its essential purpose being to obtain a record by which sound-vibrations, whether of the human voice or some other agency, can be mechanically reproduced at any time after their occurrence.

As originally made, the instrument consisted of three parts,—the sender, the receiver or recorder, and the transcriber. The sender comprises a tube having an open mouthpiece at one end, and bearing at the other end a thin diaphragm of metal or other substance, with a sharp point, or stylus, affixed to the center of its outer surface. The second part consists of a cylinder about four inches in diameter, having on its periphery a V-shaped groove, cut spirally from end to end. Over this grooved cylinder a sheet of tinfoil is placed, and the sender is advanced till the point of the stylus lightly touches the tinfoil over the opening of the V-shaped cut. While the words to be recorded are spoken or sung, the cylinder is turned rapidly, the apparatus for moving it giving a lateral as well as a circular motion. The point of the stylus thus traverses the tinfoil spiral from end to end, and the vibrations in the diaphragm caused by the sound result in a series of indentations in the tinfoil. To produce the sound

in the sender or transcriber, the cylinder is again presented to a stylus attached to a diaphragm, the pointer being pressed against the tinfoil by a light spring. The cylinder is now made to revolve, and the motion of the stylus upon the inequalities in the indented tinfoil produce vibrations in the diaphragm corresponding to the sound-caused vibrations originally created in the instrument by the voice. The sounds are thus reproduced with great exactness, but with a softening of the consonants which, to some extent, alters the character of the voice. If the tinfoil record of song or spoken words be sent to a distance, or kept for a length of time, the original sound can be reproduced on applying it to the proper instrument.

Many defects were soon apparent in the working of this instrument, while its wonderful possibilities continued to excite the deepest interest. Ten years after his first revelation, Mr. Edison took up the invention again, and after careful study produced, in 1889, the phonograph as it is known to-day. The tinfoil is now replaced by a wax composition, which not only gives better results, but enables the vibration records to be multiplied in durable form. An electric motor serves to turn the cylinder; the diaphragms are of glass, and the stylus has a sapphire point. The utterance is also made into a trumpet or funnel, while for hearing back the communication rubber tubes are provided with tips to fit in the ears. Dictations are now commonly given in the phonograph for type-writers to transcribe in another place. Songs are sung before it, and speeches and sermons addressed to it, that may be later enjoyed by many who were never within hearing-distance of the vocalist or speaker. Even the tones of the illustrious leaders and teachers of men are thus stored up, that they may be heard by posterity just as they were delivered. Among the latest developments is the sending of the cylinder-strips by mail, so that a correspondent hundreds of miles away may actually speak his message from the duplicate machine in which the recipient places it. What the invention will accomplish for us as it becomes cheaper and more accessible is simply beyond guessing. See also TELEPHONE, Vol. XXIII, p. 146; and GRAPHOPHONE, in these Supplements.

PHONOGRAPHY OR STENOGRAPHY. See SHORT-HAND, Vol. XXI, pp. 875–881.

PHONOLITE. See GEOLOGY, Vol. X, p. 209.

PHONOLOGY. See PHILOLOGY, Vol. XVIII, pp. 800–802.

PHONOMETER, an instrument devised by Thomas A. Edison for measuring the force of sound-waves produced by the human voice. It has a mouthpiece and diaphragm. Behind the latter a piece of rubber communicates with a spring that actuates a pawl, which is set to move a ratchet keyed to the same shaft as a fly-wheel. The instrument shows that the mechanical force of sound is considerably greater than was previously supposed. A loud, continued noise in the mouthpiece will drive the fly-wheel, which is about 15 inches in diameter, with a force sufficient to bore a hole through a pine board.

PHONOPHORE, a telegraphing device invented by Mr. Langdon-Davies of London. Some years ago he first developed the system of transmitting signals through circuits, which in the ordinary sense are not closed. Recent experiments in his laboratory were made through an artificial line of four thousand ohms' resistance, and comprised the sending of phonophore messages alone and of phonophore and telegraph messages simultaneously in the same wire, and in the same or opposite directions. In one experiment the same wire transmitted a telegraph message and two phonophore messages simultaneously, and the working of the phonophores was perfect, even after the resistance of the line had been increased to twenty-three thousand ohms, when the telegraph messages, which were received by needle instruments, could no more be read. A further experiment was made with a line wire open at both ends, and containing a resistance of one hundred thousand ohms. In this case the ordinary telegraph could, of course, not be worked at all, but duplex working of the phonophore was perfectly feasible.

At St. Pancras, messages were being sent by phonophore between London and Leicester, in both directions, on one of the company's wires which all the time transmitted ordinary telegraph messages. The London phonophore was joined to the line between two Morse relays about half a mile apart, one at the passenger and the other at the goods station, while the Leicester phonophore tapped the line thirty miles from the nearest telegraph instrument, which is at Derby. Between Leicester and London there are, on this wire, about six telegraph instruments, and as during operation the continuity of the line is constantly being broken by the working, each instrument is shunted by a phonophore, so that the phonophore messages are translated some six times.

This method of bridging the telegraph instruments does not in any way diminish the clearness of signals as compared with a continuous wire. The messages were printed on a Morse receiver, which was actuated by a phonophore relay. The phonophore transmitter has a vibrating reed, and the distant phonophore receiver is also provided with a reed in the shape of a stretched steel band which can be tuned to the same note.

PHONOSCOPE. G. Demeny's instrument for the use of deaf mutes is a form of phenakistoscope, having a wheel on which are mounted continuous photographs of a person's face taken while uttering certain words. The wheel being mounted in a suitable box, the photographs may be rotated by a hand-crank, and viewed through a slit. A deaf mute, or other person understanding the facial motions incident to speech, may then interpret the words uttered by the person when the series of photographs were taken. Another form of phonoscope is designed to give visual representations of sound-vibrations. The mechanism includes an induction-coil, an interrupter and a rotary vacuum tube. The sounds of the voice may be made to vibrate a diaphragm in the interrupter, and these vibrations cause breaks in the current from the induction-coil. The makes and breaks of the current cause flashes of light in the vaccum-tube, and as the tube is rotated these flashes take symmetrical shapes, forming

streaks radiating from a center, the number of radii varying with the nature of the vibrations. The same sound always produces the same figures.

PHONOTELEMETER, an instrument for estimating the distance of a mark, etc., invented by Captain Thouvenin of Vincennes, France. It is a watch with a curve-measurer on the face, a compass on the stem, and a telemeter counter on the back. The curve-measurer is for determining distances on maps. For judging of distances on the field of battle, the plan is to start the watch on sight of an enemy's fire, and stop it when the detonation is heard, when the telemeter indicates the distance in meters.

PHORMINX OR CITHARA. See LYRE, Vol. XV, p. 115.

PHORMION, an Athenian admiral and general who distinguished himself by so maneuvering the Athenian fleet in the Corinthian Gulf that he gained some remarkable victories over the Peloponnesian fleet in 429 B.C. In the following year he gained victories in the interior of Acarnania.—PHORMION or PHORMIO, an Ephesian philosopher of the Peripatetic school. See PERIPATETICS, Vol. XVIII, p. 557.

PHOSPHATES. See PHOSPHORUS, Vol. XVIII, pp. 830–832; and APATITE, in these Supplements.

PHOSPHINES. See CHEMISTRY, Vol. V, 501.

PHOSPHOR-BRONZE. See PHOSPHORUS, Vol. XVIII, p. 830.

PHOSPHORIC ACID. See PHOSPHORUS, Vol. XVIII, pp. 831, 832.

PHOSPHOROSCOPE. M. Becquerel's device is described under LIGHT, Vol. XIV, p. 607. Another form of phosphoroscope is a toy consisting of pieces of hollow glass made in tubes or to represent figures, and filled with some familiar phosphorescent substance exhibiting color, as the sulphides of lime, barium, etc. When exposed to the light and then brought into a dark room the figures glow with colored light.

PHOTO-BAROMETER. See BAROMETER, Vol. III, p. 331.

PHOTO-CHARTING. See SURVEYING, Vol. XXII, pp. 753, 754.

PHOTOCHRONOGRAPH, a form of chronograph adapted to measuring the time of photographic exposures of short duration. One form consists of a blackened disk which is made to rotate, with a spring pressed against its face. Power is applied to the disk, which is started by releasing a brake, and stopped by putting it on. The instrument is set up facing the camera, in a strong light. A lever is worked to vibrate the spring. The disk being rotated during the exposure, a waved white line is traced on its face by the vibrating spring. The length of the line and the vibrations being noted, the exact length of time is very accurately determined.

PHOTOCHRONOGRAPH, ASTRONOMICAL, an instrument for photographing a star, or the like, and also recording the time of its transit. It is a photographic device, connected with an astronomical chronograph and a transit instrument, and was designed by George A. Fargis and Frank H. Bigelow. The chronograph is used to record the time of transit of stars across the reticle lines or wires of the telescope, and the addition of a photographic device was desired to reduce the errors caused by visual observance of the passage of the stars. It was necessary to do this without injury to the star-trails, and the result was accomplished by means of a small plate attached to the armature of a magnet, by which an up-and-down movement, perpendicular to the star-trail through a small interval, could be communicated to the plate by making and breaking the circuit at fixed intervals, preferably by means of a clock. The intervals shown on the plates taken with this apparatus are definitely marked, and settings of a micrometer-thread may be made on them very accurately, with a probable error of not more than one fiftieth of a second.

PHOTO-ENGRAVING OR PHOTOGRAVURE. See PHOTOGRAPHY, Vol. XVIII, p. 847; SURVEYING, Vol. XXII, p. 754; and ENGRAVING, in these Supplements.

*PHOTOGRAPHY. It is not the purpose of this article to supply a history of photography, but to record the advances made in this art in recent years. Only the most serviceable of these can be noticed. (For a full treatment of the origin and history of photography to 1880, see Vol. XVIII, pp. 834–854.)

From "the beginning," so far as we know, until the present century the lovely images which responded to the action of light upon material objects were fugitive. Ultimately, means were discovered for fixing them, and—but the story is familiar to every one, so it is needless to repeat it.

The production of pictures by the processes of photography is so symbolical of creation, is so fascinating, and so applicable to the world's work in endless directions, that the art has never wanted for enthusiastic votaries willing to face its drawbacks and difficulties, and by patient research and persistent experiment overcome them.

The aims and results of photographic research, then, will be considered here, rather than chronologies. To reduce the time required to secure the latent image has been one of the chief aims of the experimentalist. Effort had to be made in various directions. When lenses were first employed in photography they were very imperfect. Among other things, they distorted the image, and their action was all too slow. The first fault was due to construction, and the latter to material. How to correct the lenses, then, "for figure" and "for color" was an early problem. Step by step this was solved, and years ago objectives were made by which perfect pictures were secured instantly, define that term as you will. Vast progress has been made during the three years last past by the use of a new kind of glass introduced by Abbe and Schott at Jena, Germany. This wonderful product enables the lens-maker to employ a variety of about seventy sorts of optical glass instead of, say, less than a dozen, formerly available. Nearly all of the old faults having been overcome, the opticians now devote

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themselves to the niceties of construction, while the difference in result becomes a matter of choice.

Chemistry has proven such a faithful handmaid to optics that the patient plodders in the laboratory are entitled to share the honor of bringing forth so quickly the most *spirituelle* impression of the faintest ray falling upon the sensitive surface, by the most beautiful operations known in science. In the technique or workmanship of the photographer the greatest changes have taken place, accompanied by important improvements in the results. These improvements, in the posing of the model and in the management of the light, have been made possible by the careful study and application of art principles and by the investigation and better understanding of the theory and management of light.

With the portraitist, these direct not only the choice of position and the control of the light, but also the selection and arrangement of the accessories.

The exposure of the sensitive surface is very often a matter of inspiration, and must be determined by the circumstances of the occasion. Useful exposure-meters are much used out of doors, and their employment, with the selection of the subject, the direction of the light, the management of the shadows, the choice of the day and of the time of day, is involved in the technique. A wider intelligence, greater care, attention to trifles, better "workmanship" in fact, have repaid with "pictures" as well as photographs.

In the earlier days no attempt was made at photography without sunlight, and plenty of it. Now, light from a variety of sources is employed. The once uncertain magnesium light, the incandescent gaslight, the erratic electric spark and the mysterious cathode ray (even "black" light), all render service whenever sunlight is either inaccessible, insufficient, inconvenient or indisposed. Even the glow-worm emits sufficient light to affect the sensitive plate.

After the exercise of the most intelligent technique, followed by careful manipulation, comes the employment of the retouching pencil to "correct" weaknesses and oversights, or, what is all too frequently the case, to annul and despoil the values secured by the previous operations.

In the *manipulatory* department extensive changes have been made. So great are these that the modern or "dry"-plate photographer finds himself wholly unable to cope with the difficulties of the old-time or "wet"-plate processes.

Although films and pellicles were suggested as substitutes for glass as early as 1871, they have not yet proven themselves preferable. By their use a saving is effected in weight and bulk; their liability to break is less than that of glass, and they make the rollholder possible. But their manipulation is often troublesome; their quality is too much controlled by the material upon which they rest (usually celluloid), and they cause much disappointment by deterioration and faults of manufacture.

The orthochromatic or isochromatic plate renders it possible to photograph colors at their true value, or approximately so. Color-sensitiveness is secured by the addition of certain aniline dyes (usually of the eosine group) to the sensitive bromide of silver emulsion. A color-screen is employed with these plates to secure the most delicate color-values.

One of the most annoying drawbacks of the modern dry plate is halation, or the spreading of the light beyond its proper boundaries in the negative image. Reflection of light from the back surface of the plate is the chief cause. The tendency to halation is obviated in several ways: 1. By coating the plate with more than one film of emulsion differing in sensitiveness; 2. By staining the emulsion with a dye which will wash out during the processes of development and fixing, and by "backing" with an opaque mixture in optical contact with the plate.

The development of the image has received the most attention of any of the manipulations. It affords opportunity for an infinite variety of modifications. The improvements sought for by these have been in the direction of speed and quality. As record cannot be made here of a tithe of the suggestions and formula available. A good working-process is presented below, which, with thoughtful use, will answer all ordinary demands. Improved results are secured by the intelligent use of the fixing-solution. The first thing which made this possible was the production of a purer quality of hyposulphite of soda; the next grew from the consent of the manipulator to employ the hydrometer and the thermometer to standardize the fixing-solution. The importance of such tests cannot be over-rated.

Complications constantly arise because of the indisposition to agree upon a standard of weights and measures.

Printing. The art of producing positive photographs upon prepared paper or other surfaces has met with numberless changes, although none of the old processes have become obsolete.

The desire for easier manipulation has caused many to depart from the use of albuminized paper, and resort to ready-sensitized gelatine and collodion papers. Those objecting to the brilliant surface of the above have recourse to mat-surface papers of various kinds, while the carbon and the platinum printing processes, with modifications, hold a share of the preference.

Time has not furnished a method of overcoming deleterious chemicals, careless manufacturing and indifferent manipulation, so that some photographs are yet found to fade.

The introduction of papers coated with silver bromide and gelatine, in emulsion similar to that used in the production of "dry" plates, opened up new industries, practically. By their use, with the assistance of electric light, enlargements and direct prints are made with the greatest facility. When thousands of one subject are

desired they are quickly and uniformly produced by the use of bromide paper and automatic machinery with electric light. In the development of bromide prints on certain papers, a brush is used to apply the developer in lieu of the other methods. In the platinum and other processes, the brush is used likewise.

The intelligent demands of the user of apparatus has been faithfully met by the manufacturer, until now the product, in design and construction, is equal to the best of philosophical and astronomical appliances. In this direction, also, greater speed and improved quality have been obtained.

Rapid reproduction has also been sought for most industriously. While the old-time printer stood dozing over his negatives as they rested in the sun, he dreamed of a quicker method of multiplying his pictures with the promise of longer life for them. By numerous processes this dream has been realized; and now the steam-press is the printer, and the pictures it produces far surpass the earlier product of the veteran dreamer. All methods of hand-engraving have been compelled to share with this young usurper of the reproductive arts. It has also bound the powerful electric light to its service; chained intricate machinery; started new industries for the production of supplies; and is now compelling nature to yield her natural colors to the cajolery of the camera.

So, then, photography has become the chief factor in the illustration of books, magazines and periodicals, using processes detailed in the articles on photo-engraving and in the text-books of the art. (See PHOTOGRAPHY, Vol. XVIII, p. 847; and ENGRAVING, in these Supplements.)

The further applications of photography are without limit. So willing and able a helper has it become that scarcely an advance is made in science, art or industry, until answer is had, through actual test, to the query, "What does photography say?" The stars are not too numerous for it to count; neither sun nor moon can hide their spots from it; the swiftest projectile leaves its track upon the sensitive plate; faithfully it records the tones of the sweetest voice; catches the thoughts nestled in the brain; discovers the "skeleton" in every human house; burrows under the ground; dives into the sea; climbs up into the air; steals into every niche; reveals what the eye cannot see or the senses discover. Among the distinct advances in which modern photography helps, the following are worth noting briefly:

Photo-grammetry, the use of photography in surveying, determining and mapping boundaries, new countries, etc.

Composite photography, following the work of Galton.

Photographs of movement, in which Anschutz, Muybridge and Marey have done wonderful things; kinetoscopy and the cinematograph; long-distance photography, made possible by the tele-photographic lens.

Spectrophotography, and its usefulness in chemistry and astronomy.

The usefulness of photography in meteorology —study of earthquakes, barometric observations, wind, lightning, clouds, etc.—is extensive.

In medicine and surgery photography is useful. The larynx, the interior of the stomach, the eye, and other organs, are exposed by it. The identification of criminals, the detection of forgeries, and other uses in judicial procedure; the registration of ships' courses (and wave-lines used in naval-construction), the determination of latitude by photography, photo-micrography and micro-photography—all find their acceptance to an unlimited extent.

The use of photography in providing subjects for magic-lantern or stereopticon projections, and for the microscope, next to portraiture, gives the most pleasure and instruction.

By white light, by colored light, by black light or by any other light—all these serve. "Let there be *light*," and photography will answer any demand.

Two of the most recent applications of photography are, at this writing, exciting the greatest public interest. The first involves the discovery of Prof. W. C. Roentgen that fluorescent rays are developed in peculiar abundance in the highly exhausted tubes known as Crookes tubes, and that they will penetrate with unexpected facility a great many optically opaque substances. Experimenters do not agree as to the character of these rays. Professor Roentgen says they proceed from the cathode terminal; Professor Rowland and others claim that they come from the anode; while Tesla claims that they are not vibrations of any sort, but are streams of projected material particles. Profs. O. N. Rood and A. M. Mayer have proven that the new rays are incapable of polarization, and therefore radically different from any rays of light or heat heretofore observed. This much is sure,—i.e., that they possess great photographic power, and that the photographic plate has yet another means of *seeing in the dark*, besides that due to its power of perceiving vibrations whose wave-length is too short to affect the nerves of the retina. President Henry Morton of Stevens Institute claims this *accumulative* action, or capacity of *storing up* the effects of any sort of vibrations capable of impressing it (rays too feeble to affect the eye), will, in time, impress the sensitive film. Proof of this is abundantly shown by the photographs of stars too faint to be perceived by the eye, taken at the Harvard Observatory, under the Henry Draper memorial, by Professor Edward C. Pickering. The peculiar properties of fluorescent light were publicly exhibited by President Morton as early as 1872. This was soon after his discovery of *thallene*, a hydrocarbon which possesses the property of fluorescence in a remarkable degree. See *Chemical News* (1872), *L. and E. Phil. Mag.* (1873), and *American Chemist* (1873).

Lastly, but practically most important of all, is *photographs in natural colors*. These, made without applying the colors by hand, or in some other mechanical way, do not yet exist. The efforts to produce them began with Niepce de St. Victor,

and have since led experimentalists in about as many directions as has the production of pictures in black and white. They have been attempted in the chemical way (by silver subchlorides), in the physical way (by the action of interference in the interior of the film), and in the optical way (by the projection of three-glass positives, corresponding to the foundation-colors, with the help of corresponding colored media), and some very beautiful results have been shown, but the great secret is yet withheld. Nevertheless, wonderful progress has been made in the production of pictures in natural colors with photographic effects. Photography has been the principal means employed, letterpress coming in as second helper. More has been done than the simple use of photography as a "key" in letterpress color printing. In what is termed the "three-color process," photography is used throughout for the production of the printing image. This was reached by a long series of experiments, beginning in 1861, but not much headway was made for a few years, because of the absence of photographic plates sensitive to the yellow or red rays. In 1873 Dr. H. W. Vogel of Berlin discovered how to produce such plates. He was soon followed by others; but not until 1892 did the results prove that a practicable method had been attained for three-color reproductive purposes. The collotype printing process was first used, and numerous American establishments are, at the present time, producing unlimited quantities of prints of excellent quality by this method. But the application of the three-color process to letterpress printing, by means of the transfer of the three different photographic images to letterpress or half-tone blocks, now supplies the most economical and expeditious method, with results which have not been excelled. They appear in the market as reproductions usually because of the long time required for the exposure of three negatives, and the obvious difficulty encountered in procuring three negatives (so exactly alike that they register) from any natural or "living" object or scene.

Mr. R. D. Gray of New York, a practical optician, has secured the best results. To combine or superimpose the pictures is not a serious matter if suitable apparatus is provided for it. Mr. Gray makes ordinary positives on glass for lantern projections, and secures one of them in a wooden frame which contains spaces for three other slides. To the next one is attached a mechanical device with very delicate screw-adjustments by which it can be moved in any direction. The operator at the lantern now moves the picture, as directed by an observer near the screen, until its position is identical with the first, when it is said to be "in register," and is sealed in that position. The operation is repeated until all are finished. Each frame is used as an ordinary lantern slide, but in a lantern built with a corresponding number of optical systems with provision for inserting colored glasses in the paths of light, each of which should be of a similar color to that used in taking the negative. If three positives are used, and they are equally transparent in one part of the picture, the red green and blue lights passing through that part will appear white on the screen. If the blue positive is more opaque in that portion of the picture, the red and green lights will predominate, producing yellow; or if the green positive should be opaque, the red and blue lights in excess make purple. Thus the varying degrees of opacity in the positives caused by the selective qualities of the photographic plates and color-screens, however slight, are effective, and the resulting picture shows the delicate tints as well as the brilliant colors of nature.

For reproductions on paper by collotype or half-tone there is no greater difficulty, and the best of presswork and proper colors have combined to flood the world with "photographs in natural colors," as near as possible so far.

Joly and McDonough are experimenting in different directions for the production of photographs in colors from one plate. They rule the plate very finely, with a machine, alternating with lines of red, blue and yellow fluid colors; the printing-paper is lined, also, with similar colors. The results are promising. Kurtz, Bierstadt, Edwards, Ives, Lipmann, Lumiere, and many other industrious experimenters, are making progress in this department of photography.

Instructions now follow for the production of photographic pictures for commonplace purposes. These are gathered from the best sources, and will enable the novice to practice photography with satisfaction and pleasure.

"Dry"-Plate Photography. The introduction (1878–80) of the *gelatino-bromide emulsion process* completely revolutionized the practice of photography. By this process, dry sensitive plates, being much more rapid than those prepared by the older collodion processes, are manufactured in quantities, and stored ready for use when needed. Furthermore, when a "dry" plate has been exposed in the camera, its development and fixing may be deferred for an indefinite period, whereas collodion plates must be separately sensitized before exposure, and developed, etc., immediately afterward, which necessitates the transportation of bulky impedimenta when outdoor photography is attempted. Since its inception, the gelatino-bromide process has been modified in innumerable details, but the general principles remain the same. The commercial preparation of "dry" plates forms one of the most important of the photographic industries. The condensed description of the Paget prize method here given may be taken as representative of the process generally. Prepare two solutions, as follows: 1. Hydrochloric acid (pure), 1 fluid dram; distilled water, 12½ ounces; 2. Nelson's No. 1 gelatine, 80 grains; bromide of ammonium, 210 grains; distilled water, 3 ounces. Twenty minims of No. 1 are added to the whole of No. 2 and the gelatine left to swell. In a glass beaker 330 grains of nitrate of silver are dis-

solved in three ounces of water. Two fluid drams of this latter solution are poured into a test-tube and diluted with an equal volume of distilled water. The solution of the bromized gelatine is then completed by immersing the bottle in hot water, and the diluted nitrate of silver solution is added all at once. The bottle is then shaken, and the remainder of the strong silver solution is added in quantities of half an ounce at a time, shaking as before, after each addition. The emulsion so formed is boiled for 55 minutes, and when cooled to 90° F., one ounce of Nelson's No. 1 gelatine, which has previously been swelled and dissolved in water to make four ounces, is added. When set, the emulsion is squeezed through canvas into a pan containing three ounces of a saturated solution of bichromate of potassium in 48 ounces of water, and allowed to remain in it for an hour. The emulsion is then again squeezed through canvas into clear water, and the operation immediately repeated, it being allowed to remain in the last wash-water for thirty minutes. The addition to the emulsion of two ounces of alcohol, and sufficient water to make up the solution to twenty ounces, completes the process. When filtered, the emulsion is ready for spreading upon its support. Plates of absolutely clear glass are now coated with the sensitive solution, and placed on level shelves in a drying-closet until the films are quite dry, when they are ready for use. These operations are necessarily conducted in non-actinic light. When exposed in the camera, such plates, after development, give a "negative" image; if, however, they are exposed under a "negative" previously obtained, they yield, after development, a "positive" image. As ordinarily prepared, gelatine dry plates are not capable of giving a correct representation of the color-values of the subject photographed, being unequally sensitive to the various colors of the spectrum. The researches of Vogel and others have resulted in modifications, by which plates may be made color-sensitive; that is, capable of giving in the negative the proportionate value of the colors of the subject (see notes above). This and all other improvements are fully described in Wilson's *Cyclopædic Photography* (1895), Eder's *Handbook on Emulsion Photography* (1893), and other works.

Negative-Making. When a gelatino-bromide plate is exposed in the camera to the action of light, the sensitive film is impressioned with what is known as a latent image, i.e., an image which, though present on the surface of the film, is not apparent to the eye. By subjecting the exposed plate to the action of chemical agents known as "developers," the latent image is made to appear, or is "developed." Many substances are available for this purpose. With the first dry plates the ferrous-oxalate developer, consisting of combined solutions of neutral oxalate of potassium and sulphate of iron, was largely used. This was extensively superseded by pyrogallol, which is still, perhaps, the developing agent in general use. A simple formula for the preparation of the pyrogallol developer is as follows:

Stock Solution No. 1.

Pyrogallic acid	¾ ounces.
Sulphite of sodium	3 ounces.
Sulphuric acid (C.P.)	15 drops.
Water	40 fluid ounces.

Stock Solution No. 2.

Carbonate of sodium	3 ounces.
Bromide of potassium	8 grains.
Water	40 fluid ounces.

Filter both solutions and keep in well-corked bottles. Mix equal parts of No. 1 and No. 2 immediately before using. Four ounces of developer is sufficient for a plate 5 by 8 inches. During the past ten years new developing agents have been introduced with such frequency that it is impossible to refer to them in detail. Some of these are peculiarly adapted for special classes of work, and have other advantages. Among those in common use may be mentioned hyroquinone, eikonogen, paramidophenol, rodinal, metol, glycinamidol metacarbol. Eikonogen and metol are largely used by amateur photographers for "snap-shot" or instantaneous work. Formulas and instructions for their use may be found in almost all photographic text-books.

After the development of the image, the film still contains unaltered sensitive silver salts, and if exposed to light would darken, and be rendered useless by the obliteration of the image. To prevent this these salts are dissolved out and removed by the process of fixing. This is effected by immersing the developed plate in a solution of one part of hyposulphite of soda in four parts of water, which clears out the unaltered salts and leaves the image clear and transparent. If the exposure of the plate has been made in a camera, the lights and shadows of the subject are seen to be reversed in the plate, and it is called a "negative"; if exposed under a negative, the lights and shadows, viewed by transmitted light, appear as in the subject, and the plate is called a "positive" or "transparency."

Film-Photography. As early as 1871 the late W. B. Woodbury suggested the use of films coated with a sensitive emulsion instead of glass plates for negative-making. After the gelatino-bromide process came into general use this suggestion was taken up and now gelatine-bromide emulsions are coated upon sheets of insoluble gelatine or transparent celluloid as a support, in lieu of glass plates.

The Positive Printing Processes are generally classified into printing-out methods, which give a fully printed-out image on the sensitive surface exposed to light under a negative, and development methods, which, under similar conditions, give an invisible or faintly visible image requiring to be developed with suitable reagents until it attains its proper vigor or strength. Previous to 1880 the plain salted and albuminized paper processes were in general use, while the carbon process represented the few development methods then available. During the past 15 years com

siderable progress has been made in this branch of photographic practice, until now the number of printing methods available is so large that a brief description of representative processes of the two classes mentioned is all that is here possible. Among the print-out processes the first place, perhaps, may be given to printing on *gelatino-chloride paper*. The first suggestion of gelatine as a vehicle to hold the sensitive silver salts on paper for printing, as a substitute for albumen, was made by Hardwich in 1856. In 1881, Wilkinson published a method for preparing gelatino-chloride paper, based on the suggestion referred to, and a year later, Abney published the earliest practical method of producing such a paper. It was not until 1885, however, that gelatino-chloride ready-sensitized paper was commercially introduced by the late J. B. Obernetter of Munich. He was followed, in 1886, by Liesegang, with a paper called "aristotype." This name is now generally used for printing-out papers of this kind. The use of aristotype papers in America began about 1889. They have, in a large measure, superseded the older kinds of print-out papers. The preparation of gelatino-chloride paper is thus described: Paper is coated with a fine layer of chalk or baryta and finished (according to the surface desired in the resulting emulsion paper) with either a mat or glossy surface. It is then uniformly coated with a film of sensitive emulsion made as follows:

A. Nelson's No. 2 gelatine ------- 240 gr. Water ---------- 4½ oz.	C. Nitrate of potassium ---------- 63 gr. Chloride of sodium ---------- 63 gr. Water ---------- 1½ oz.
B. Nitrate of silver -- 225 gr. Water ---------- 1½ oz.	

Add B to A and emulsify into C. When emulsified, add 6 drams of alcohol and 1 dram of water containing 9 grains of salicylic acid and 1 grain of chrome alum. This emulsion should be prepared and the paper coated with it and dried in non-actinic light. When dry the sensitive-coated paper is stored under light pressure, away from light, until required for use. To obtain a print, the paper is placed under a negative in a printing-frame and exposed to light until the full details of the picture are printed out. It is then washed in several changes of water until the free silver present in the film is all dissolved out. The print at this stage presents a disagreeable brick-red tone which may be changed to brown, purple or black by immersing in a toning-solution. This may be composed of water 32 ounces, chloride of gold 2 grains, made slightly alkaline by the addition of carbonate of soda. As soon as the desired tone is obtained the print is placed in a solution of diluted acetic acid (½ ounce acetic acid to a gallon of water) for a few minutes, rinsed in clear water and fixed by immersion for 15 minutes in a fixing-bath composed of hyposulphite of soda 1 ounce, water 20 ounces. This renders the print insensitive to the influence of light. After fixation it is well washed in running water for an hour, when it may be mounted and finished. A print-out paper widely used is *collodio-chloride paper*. This is very similar to gelatino-chloride paper, except that the sensitive salts are held in a collodion instead of in a gelatine film. This process was invented by G. Wharton Simpson in 1864, but, like the gelatino-chloride process, has been commercially adopted only of late years. The manipulations for its use closely resemble those already given for gelatino-chloride paper. A great variety of effects in color and finish may be obtained with either of these papers by modifications of the formula.

In 1883, Pizzighelli announced a process by which prints in platinum instead of in silver were made by a print-out method. These prints have a cold black tone, and resemble engravings. In this process a hard-surface paper is coated with arrowroot, ferric oxalate, oxalic acid, ammonium oxalate and chloro-platinite of potassium, in solution. When dry, the paper is exposed to light in the usual manner, and the image fixed by immersion in a solution of hydrochloric acid and water. Then the prints are well washed. They are then, it is claimed, "absolutely permanent."

The Gelatino-Bromide Paper Process is the best known of the development-printing methods. The sensitive surface used in this process is gelatino-bromide emulsion (see *Gelatino-Bromide Emulsion Process*, above) coated upon stout paper. It is known as bromide paper. By exposure to light under a negative, and subsequent development, it gives a black and white picture similar to an engraving, but the image is made up of a fine grain instead of the lines observable in an engraving. Being sensitive to light, bromide paper must be handled with the same precaution required in the use of dry plates. The filling of the printing-frames and all after manipulations, except the exposure, must be done in non-actinic light. The usual method followed is to expose the paper under a negative in a printing-frame at a distance of about a foot from a gas-burner of average intensity for a few seconds. It is then removed from the printing-frame (in the dark room) and immersed in clean water until it becomes limp. The invisible image obtained by exposure is now developed with almost any of the developers recommended for dry-plate work. Metol is advised, as peculiarly advantageous for bromide paper. Prepare:

1. Metol ---------- 35 gr. Water ---------- 8 oz. Add 6 drams of sulphite of sodium to above when the metol is dissolved.	2. Carbonate of potassium ---------- 6 dr. Water ---------- 8 oz.

To develop, mix equal parts of No. 1 and No. 2 and dilute with an equal volume of water. According to the duration of the exposure and the sensitiveness of the paper, varying quantities of No 1 are used, as indicated. Ferrous oxalate, amidol, hydroquinone or pyrogallol may be used instead of metol. When developed the prints are immersed in a bath composed of alum 6 ounces, citric acid 1 ounce, water 8 ounces. They are then rinsed in three or four changes of water, and fixed by immersion for five minutes in a solution

of hyposulphite of soda 4 ounces, water 20 ounces. Finally, they are washed, mounted and finished, as usual. Various processes have been suggested for changing the color of bromide prints by intensifying the image. Details of these modifications may be found in the text-books devoted to the subject. Bromide paper may also be used for obtaining large direct positives, called enlargements, from small negatives. This is done by blocking the whole of a window except a small space just large enough to take the negative to be enlarged. Place the negative in the rebate slide of the camera, usually occupied by the focusing screen, and fix the camera close up to the open space in the blocked window, so that all light entering the room comes through the negative (the lens being turned into the room). In the darkened room, at some distance from the lens, a sheet of bromide paper is tacked to a vertical stand and the image of the negative is focused upon it. The exposure is then made, after which the enlarged image obtained is developed and fixed in the usual manner.

The Platinotype Process, invented by Willis in 1878, and considerably modified in 1890, may be considered as a typical method of printing by development. The preparation of the paper used in this process has not been published, but the process is based on the reduction of ferric oxalate (by the action of light) to ferrous oxalate and the further reduction of a platinum salt by ferrous oxalate to a metallic state when wetted with a suitable developing agent. Paper is coated with a solution of ferric oxalate, oxalic acid and mercuric chloride in water. When it is dried it is exposed under a negative in the usual way and the faint image so obtained is developed by immersion in a bath of oxalate of potash and chloro-platinite of potassium in water. When developed the prints are fixed by immersion in three changes of a weak solution of hydrochloric acid and well washed.

The Kallitype Process, introduced by Nicol in 1890, is a development method based upon the action of light on the iron and silver salts in combination. In this process Rives paper is slightly sized with gelatine and sensitized by brushing the surface with a solution of ferric oxalate and nitrate of silver. The paper is exposed to light under a negative, and the faint image thus obtained is developed with a solution of borax, Rochelle salts and bichromate of potassium. It is fixed by immersion in a weak solution of ammonia, and thoroughly washed. According to the composition of the sensitizing and toning solutions the resulting prints vary in color, as red, brown or black.

Thus, briefly, a running account of photographic progress since, say, 1880 is made. This progress in the direction first named has been wonderful. When daguerreotypes were made the exposure required was half an hour. It is now difficult sometimes to divide a second into sufficiently small parts to record with one part the time taken to make the impression upon the sensitive plate.

EDWARD L. WILSON.

PHOTOGRAPHY, ASTRONOMICAL. The idea of applying the photographic method to form pictures of the heavenly bodies seems to have originated with Dr. John W. Draper, of New York. About 1843 he succeeded in taking a daguerreotype of the moon. This process was, however, too slow to be applied on a large scale to other heavenly bodies than the sun. The method, therefore, was little developed until the process now known as photography was discovered.

This process was soon applied with great success by the late Dr. L. M. Rutherford, of New York, who, in 1864, had mounted in his garden in New York City a telescope, which was especially constructed to take photographs of the heavenly bodies. His photographs of the moon soon acquired celebrity on account of their sharpness and minuteness of detail. He also showed that the same method could be applied to the exact measurement of small distances in the heavens. This was done by taking photographs of clusters of stars on glass negatives. He applied the method with the greatest success to the Pleiades. It consisted in forming a photograph of the cluster in the principal focus of his telescope. Thus on the glass plate he had an image of the Pleiades as they appeared in the heavens. He then devised an instrument for measuring the distances and relative positions of the stars found on the plate. With the aid of these measures, their positions in the heavens relative to the central star of the group, Alcyone, were determined with an accuracy rivaling the best measures hitherto made.

A farther step in the same direction was taken by the Rev. Charles Pritchard, director of the observatory at Oxford, England. By photographing a bright star surrounded by a number of faint and therefore more distant ones, at different times of the year, he was enabled, by the slight displacement of the bright star on the plate, to determine the parallax of the latter. Whether this method is as accurate as others is still an unsettled question, but there can be no doubt of its value.

When, in 1888, Professor Holden took charge of the Lick Observatory, he saw that with the unrivaled means at his command excellent work could be done in photography. He therefore invited Prof. E. E. Barnard, of Nashville, who combined most happily the two professions of photographer and astronomer, to become a member of his staff and apply his art to the heavens. The result has been an unequaled collection of photographs of celestial objects, which, at the time of writing, is in course of publication by Mr. Barnard. It was found by Gill, at the Cape of Good Hope, as far back as 1882, that with a common camera it was possible to photograph stars down to the ninth magnitude—a limit far beyond that which the naked eye could distinguish. By applying this method Barnard was en-

abled, without expensive apparatus, to make his most interesting pictures.

At the present time the most important work going on in celestial photography is the great International Photographic Chart of the Heavens. In 1886 it was found by the brothers Henry, at the Paris Observatory, that with a certain special construction of telescope it was possible to photograph all the stars in a pretty wide field of view, down to the lowest limit visible with any ordinary telescope. The plan was, therefore, devised of an international enterprise, having for its object to take photographs of the entire heavens as they appear in our time, for the use of posterity in detecting changes that may take place. Invitations were sent to astronomers interested in the subject in all parts of the world to assemble at a general convention in Paris in April, 1887. There the details of the plan were worked out by committees, and the instruments and methods to be used were decided upon. A number of observatories engaged to procure the instruments and take part in the work. The latter has been successfully prosecuted up to the present time. Several observatories have nearly completed their share; though, as might have been expected, others are far in arrears. But there is no doubt that, at no distant day, the work will be finished.

In the various fields of physical astronomy, the photographic method has proved of the greatest value. As far back as 1869 it was applied by Winlock, and others in the United States, to take photographs of the total eclipse of the sun which occurred in that year. The solar corona, with all its irregularities, was thus placed permanently on record for study. As more sensitive chemicals and more refined methods were applied in successive solar eclipses, it became possible to fix more and more details in this way. The filamentous structure of the sun's corona has thus been brought out with greater certainty than it could be by mere eye observation during the rare moments of an eclipse.

It has even been supposed possible, by some of the highest authorities, to photograph the solar corona when there was no eclipse. But it seems very doubtful whether this has actually been done or can be done. The glare of the sun's light in its immediate neighborhood is so intense as completely to obliterate the faint light of the corona; and it seems likely that the supposed corona photographs have been only those of the light diffused in the earth's atmosphere.

Another important application of photography has been the photographing of spectra of the stars and planets. As in other cases, the method has the advantage over eye observations that the observer can measure the lines on his plate at leisure with much more care and attention than he can devote to the measurements in a moving telescope. The chemicals now used are so sensitive that it seems possible to photograph at least everything that can be seen, and quite likely much that would be invisible to the naked eye. Indeed, large nebulous regions have been photographed by Barnard and Pickering in Orion and around the Pleiades, where nothing of the kind has ever been seen by the eye.

The observatory which, in recent times, has applied the photographic method to the spectroscopic study of the stars on the largest scale is that of Harvard College, under the direction of Professor E. C. Pickering. An important part of his work is a general study of the photographic spectra of the various stars. Instead of attaching a spectroscope to the eye-piece of the telescope, which is the usual method of forming the spectrum of a star, a large prism of small dispersion is placed over the object-glass. The advantage of placing the prism here is that the effect of atmospheric undulation is many times less than it would be were the prism applied to the eye-piece. Then, when the telescope is pointed at the heavens and set in motion, all the stars in the field of view are shown as so many spectra. These spectra are all photographed on the plate in the focus of the telescope. The negatives thus formed can be studied at leisure. A corps of examiners, mostly expert young women, is employed to study the innumerable images on every plate, and detect those showing any special peculiarity.

Among the noted instruments being here brought into use is the great Bruce photographic telescope, the gift of Miss C. W. Bruce, of New York. This instrument is remarkable for the shortness of its focal length as compared with its aperture. The latter is 24 inches, while the former is 11 feet. An extraordinary concentration of starlight on the plate, with a corresponding diminution of the bad effect of atmospheric undulation, is thus attained. This short focal length with such an aperture would not be successful in a telescope of ordinary construction, with only a single objective. The construction is, therefore, that of the "doublet," with two objectives, thus forming a gigantic camera. With such an instrument it is possible to photograph a region of the sky about five or six degrees in diameter without any serious loss of definition, unless at the extreme edge of the field.

Yet another application of photography at the same observatory is that of a constant watch of the sky to detect any new star which may show itself in the heavens. The apparatus for doing this consists of a small telescope, having a field of several degrees, which moves automatically by successive jumps, from horizon to horizon, and at each point photographs the principal stars on the plate in its focus. The various fields photographed are thus combined on the same plate so that it is impossible to distinguish them. But no distinction is necessary, because all that is required is to detect any new star that may appear. How often soever the telescope may pass over the same region, the same stars will be photographed upon it, and therefore the appearance presented by the plate will be the same. If, however, a new star puts in its appearance, it will be de-

tected by a comparison with the other plates just as certainly as a criminal is detected by the Bertillon measures of his head and limbs.

Notwithstanding all these advantages, the photographic method has its drawbacks. As a general rule, delicate details cannot be impressed on a photographic plate so well as they can be seen. The great foe of astronomical observation, atmospheric undulation, can be better evaded by the eye than by the unthinking plate. The astronomer who looks at the planet Mars through a telescope in order to outline the features on the surface of the planet finds that, during the greater part of the time he is looking, these features are obliterated by the undulations of our own atmosphere. He therefore waits for the moments of good definition, and takes advantage of them to make his measures and note his observations. But the photographic plate can exercise no such discrimination. It records everything as it appears, undulations and all, and thus the most delicate details fail to be developed because they are confused by the motions of the atmosphere.

There is no branch of astronomy in which the amateur can work so easily and successfully as this. As already remarked, the ordinary camera can be used to take photographs of clusters and the regions in the Milky Way, where the separate stars are wholly invisible to the naked eye. More exact work can be done with a photographic telescope of the smallest size, but this requires accurate clockwork to move it. There is, however, no difficulty in taking photographs of any star visible to the naked eye without any motion of the telescope. It must be remembered that the ordinary visual telescope is not that best adapted for photographic work. The latter requires either to have a special object-glass suitable for bringing the photographic rays to a focus, or to be supplied with a corrector, which consists of a separate lens which placed over the object-glass will enable it to produce the necessary effect of bringing the photographic rays alone to a focus.

SIMON NEWCOMB.

PHOTO-LITHOGRAPHY. See PHOTOGRAPHY, Vol. XVIII, pp. 846, 847.

PHOTOMETER. See GAS, Vol. X, p. 90.

PHOTOPHONE, same as RADIOPHONE. See TELEPHONE, Vol. XXIII, pp. 140, 145.

PHOTOSPHERE. See SUN, Vol. XXII, p. 679.

PHOTOSYNTAX OR PHOTOSYNTHESIS, a term used in plant physiology to indicate the process often called carbon-assimilation. It is the first step in the assimilation of food by green plants, and consists in the construction of a carbon-molecule, which contains hydrogen and oxygen out of carbon dioxide and water through the agency of chlorophyll and light. It is the well-nigh universal method by which organic material is constructed from inorganic material, and hence holds a very important relation to the existence of plants and animals.

PHOTOTAXIS, a term used in plant physiology to indicate a certain result of irritability to the direction of incidence of the rays of light, being a phase of heliotropism. When light falls obliquely upon the motile spores (zoöspores) of certain algæ, they arrange themselves in the water so that their long axes are parallel to the direction of incidence, this phenomenon being called phototaxis. When they move, they move in the line of incidence; if away from the source of light, they are said to be negatively phototactic; if toward the source of light, they are positively phototactic.

PHRAATES, the name of five Parthian Kings. See PERSIA, Vol. XVIII, pp. 601, 603–606, 609, 611.

PHRAGMITES. See REED, Vol. XX, p. 332.

PHRANTZES GEORGIUS. See BYZANTINE HISTORIANS, Vol. IV, p. 545.

PHRAORTES, a Median king. See PERSIA, Vol. XVIII, pp. 573, 574.

PHRAORTES, an usurper. See PERSIA, Vol. XVIII, pp. 580, 581.

PHRATRIES. See TOTEMISM, Vol. XXIII, pp. 502–504.

PHRYGIAN RELIGION AND LANGUAGE. See PHRYGIA, Vol. XVIII, p. 867.

PHRYNIDES. See ARACHNIDA, Vol. II, pp. 253–255.

PHTHA OR PTAH. See EGYPT, Vol. VII, p. 622.

PHYCOMYCETES. See FUNGUS, Vol. IX, pp. 729, 730.

PHYLLOCACTUS. See HORTICULTURE, Vol. XII, p. 275.

PHYLLOME. See BOTANY, Vol. IV, p. 96.

PHYLLOPODA. See CRUSTACEA, Vol. VI, pp. 586, 587.

PHYLLOPTERYX. See HIPPOCAMPUS, Vol. XI, p. 761.

PHYLLORHININÆ. See MAMMALIA, Vol. XV, pp. 416, 417.

PHYLLOSTOMIDÆ. See MAMMALIA, Vol. XV, pp. 418, 419.

PHYLLOTAXIS. See BOTANY, Vol. IV, pp. 103–106.

PHYLLOXERA. See VINE, Vol. XXIV, pp. 256–258.

PHYLOGENY, in natural history the study of the descent of an individual tribe. See ANCESTRY OF PLANTS and HEREDITY, both in these Supplements.

PHYSALIS, a genus of plants belonging to the family *Solanaceæ*, and closely related to the genus *Solanum*, to which the potato and tomato belong. The species of *Physalis* are commonly called ground cherries, on account of their berry-like fruit, which often resembles a cherry in color and size, and is inclosed in the persistent inflated calyx.

PHYSETERIDÆ. See MAMMALIA, Vol. XV, p. 399.

PHYSICAL EDUCATION. See GYMNASIUM, Vol. XI, pp. 310, 311; GYMNASTICS, Vol. XI, pp. 311–313.

PHYSICAL GEOGRAPHY. See GEOGRAPHY, Vol. X, pp. 188, 189.

PHYSICK, PHILIP SYNG, an American sur-

geon; born in Philadelphia, Pa., July 7, 1768. He graduated at the University of Pennsylvania in 1785, afterward studied medicine, and in 1788 went to London, where he became the private pupil of the celebrated surgeon, John Hunter, then at the zenith of his fame as an anatomist and physiologist, as well as being the leading zoologist of his day. In 1790 he was admitted as house surgeon to St. George's Hospital, London; and after residing for a year at Edinburgh he returned in 1792 to Philadelphia, and there began the practice of medicine. In 1805 he was appointed professor of surgery in the University of Pennsylvania, in 1819 was transferred to the chair of anatomy, and in 1824 was elected president of the Philadelphia Medical Society. He wrote for medical journals accounts of cases he had treated, or of processes or instruments he had invented. He has been called the father of American surgery. He died in Philadelphia, Dec. 15, 1837. E.E.T.

PHYSIOCRATS. See POLITICAL ECONOMY, Vol. XIX, pp. 372–374.

PHYSIOLOGICAL CHEMISTRY. Physiological chemistry deals with the chemical changes which go on in the structures of living organisms. It includes both plant and animal chemistry. Of course the chief interest centers in the processes going on in the human body. Yet the opportunities for studying the cause, course and result of these changes and for modifying them by experiment are so very limited in the human subject that a large part of our knowledge of human physiology has been obtained by means of observations on animals

In recent years very extensive studies in the relative values of various foods for the support of life have been made, one of the objects in view having been the regulation of diet, so that by proper selection of foods the maintenance of life in full activity may be secured at the smallest possible expense. It is a common phenomenon to find families earning large wages purchasing their supplies so injudiciously that they are actually suffering from slow starvation in respect of certain essential elements of nourishment, such as fats, proteids or lime. The food most perfectly adapted to the early period of life is the mother's milk. The adjustment of its constituents to the work it has to do is very remarkable. The inorganic substances, such as salts of potassium, sodium, magnesium calcium, phosphorus and chlorine (excepting only iron), which dog's milk, for example, contains, are present in exactly the same proportions as in the body of the pup which it is supporting. If a similar adjustment could be maintained throughout life, much expense and much wear and tear of the digestive organs might be spared.

Among the elements present in the body, in very small amount, iodine has acquired a new significance. It has been recognized that cretinism, a condition of mental weakness and physical degeneracy common among the inhabitants of Alpine districts, is closely connected with very small development of the thyroid gland. Feeding cretins with sheep's thyroids (sweetbreads) was found to produce a wonderful amelioration of the symptoms. It now appears that iodine in some form of organic combination is an essential constituent of the healthy thyroid, and that it is the absence of this constituent which causes the disease referred to.

The organic compounds found in the body yield very slowly to chemical investigation, on account of their complex character or their instability. Some light has been thrown on the proteids. These are amorphous bodies such as blood, fibrin and casein, containing nitrogen and sulphur. Substances having very similar properties have recently been made artificially, but they do not seem to contain sulphur. If this should lead to the synthesis of a real proteid, a region of physiological chemistry at present very obscure would be brought much more completely within the range of chemical investigation. One of the most important products excreted by the animal body is uric acid, $C^5H^4N^4O^3$. In a healthy man the proportion of the nitrogen which he takes up in his food and eliminates in this way is comparatively small. Its overproduction leads to painful diseases, like gout. In animals like the cat and dog it is almost absent from the excreta, while in birds and reptiles it often forms the chief means of exit for the nitrogen. Its constitution is known, and its recent preparation artificially from aceto-acetic ether and urea must be regarded as a discovery of the first importance.

Adenine is a new base found in the substance of the cell nuclei. Its formula, $C^5H^5N^5$, indicates that it is a polymer of prussic acid. This and the three other bases found in the nuclei are interesting, as they are probably intermediate steps in the formation of urea or uric acid.

The study of the poisonous substances produced by animals and plants is of great interest from the medical point of view. Thus it is estimated that thousands of human beings perish yearly from snake-bites. A study of the effects of snake-poison has shown that careful injection of gradually increasing quantities enables the animal so treated finally to withstand doses five or six times that ordinarily sufficient to produce death. Not only so, but the blood serum of animals thus immunized acquires the properties of an antidote to the poison, and when injected into a rabbit (e.g.) with, or even after the snake-poison, entirely prevents death or even serious symptoms of any kind. The prepared serum, which has been called antivenene, seems to act chemically, destroying the harmful substances. The exact nature of the latter has not been determined, but they seem to resemble the albumens, and are called tox-albumens.

The production of poisonous secretions is not confined to animals like snakes, scorpions and spiders. In fact, death from the effects of the toxic substances produced by bacteria is far more common. Thus the bacilli of diphtheria and tetanus, and those found in putrifying organic matter, form poisons of extreme virulence. The latter are often called ptomaines. The efforts to separate pure chemical substances from liquids in which bacilli are growing, or from decaying flesh or vegetable products, have

frequently been successful. Thus, methylguanidine $NH=C<^{NH^2}_{NHCH^3}$ was isolated from horseflesh four months old, and tetramethylenediamine (putrescine) and pentamethylenediamine (cadaverine) from other decaying substances. But they were found to be either non-poisonous, as in the last two cases, or greatly inferior in this respect to the crude material from which they were extracted, as in the first. Tetanine, a base extracted from cultures of tetanus bacilli, was poisonous to the extent that 0.5 grams was fatal to a guinea-pig; but the crude organic matter contained in the filtered culture-medium was so much more virulent a poison that, in spite of its undoubtedly containing much non-poisonous matter, one twentieth of the above amount would have been sufficient to poison a thousand guinea-pigs. The most actively poisonous substances seem to have been decomposed in the process of extraction. They are regarded as being similar to the corresponding bodies in snake-poison, and are classed as tox-albumens.

ALEXANDER SMITH.

PHYSIOLOGY, ANIMAL. See EMBRYOLOGY, in these Supplements.

PHYSIOLOGY, VEGETABLE. See PHYSIOLOGY, Vol. XIX, pp. 50–72.

PHYSOSTOMI. See ICHTHYOLOGY, Vol. XII, pp. 730–733.

PHYTOPHTHIRES. See HEMIPTERA, Vol. XI, p. 576.

PHYTOZOA. See BOTANY, Vol. IV, p. 126.

PIA MATER. See ANATOMY, Vol. I, p. 760.

PIANO, ELECTRIC. The instrument known by this name is rather a piano with an automatic electric attachment. It is applicable to any ordinary form of upright piano, and is operated by a little motor, set in the base of the instrument and supplied with a current of about ten amperes and five volts. It makes use of standard perforated music, such as is manufactured for several other instruments. A music-holder containing the perforated rolls is placed directly below the keyboard, and the music-rolls are unrolled by means of belts connecting with the motor. Electric contacts are provided to connect with each note, and when the perforation for a certain note passes under its contact a circuit is closed and an electric magnet put into operation. The magnet, through the medium of several minor connecting devices ending in a striker-arm, raises the inner end of the key, and of course depresses the outer end just as a player would do. A drum, extending the whole length of the piano at the base, operates friction-shoes whenever a contact is made, and the shoe turns a bell-crank that pushes a lever against the striker-arm. The operation of the piano by hand is not interfered with in the least, and the perforated music thus mechanically rendered may be written with more notes in the chords than it would be possible for a performer to sound with ten fingers. The music is re-rolled automatically, and the speed or tempo is regulated by moving a little switch, which shifts a belt working on two cone-pulleys, so that a change in time is necessarily gradual.

C. H. COCHRANE.

PIANOGRAPH. An instrument designed to be attached to a pianoforte, and to record graphically the music played. Carpentier's prints lines of varying length, showing where holes should be cut in the sheet for its subsequent use in an electric piano or other automatic instrument. Parise's instrument is a sort of typewriter attachment, designed to print the notes as ordinarily written, except the stems, quavers, etc., which have to be added by hand. By its use a composer may read his improvisation as soon as it has been played. The arrangement consists of a series of levers extending from the keys and connecting with small rods which reach the cylinder of the pianograph proper. This cylinder bears a roll of paper, and as the player strikes the keys the rods strike the paper through an inked ribbon, making the record.

PIASSABA or PIACABA, a remarkable vegetable fiber which has become an article of much importance. It is procured from Brazil, chiefly from the ports of Para and Maranha, and is produced by one or more species of palm. That which furnishes the greater part is the coquilla-nut palm (*Attalea funifera*); but Mr. Wallace states that much of it is procured from a species of *Leopoldinia*, which he has named *L. piassaba*. This material has been found of great utility in making brushes of a coarse kind, particularly those required for sweeping streets.

PIATT, JOHN JAMES, an American poet; born in James Mill, Dearborn County, Ind., March 1, 1835. He worked as a youth in a printing office, and studied at the Capitol University, Columbus, Ohio, and at Kenyon College. From 1861 to 1867 he was a clerk in the United States Treasury Department, Washington, D. C., and was librarian of the House of Representatives from 1871 to 1875. In 1882 he was appointed United States Consul at Cork, Ireland, where he remained until 1893, when for a short period he was consul at Dublin. Meanwhile he had written much for the newspapers, being a staff contributor to the Louisville *Courier Journal* and the Cincinnati *Commercial*. He has attained considerable recognition as a minor poet. His first volume of verse, written in collaboration with W. D. Howells, and entitled *Poems of Two Friends*, was published in 1860. His other works are: *The Nests at Washington* (1863); *Poems in Sunshine and Firelight* (1866); *Western Windows* (1868); *Idyls and Lyrics of the Ohio Valley* (1884); *At the Holy Well* (1887); *Lost Hunting Ground* (1893); *The Ghost's Entry, and Other Poems* (1895); *Odes in Ohio, and Other Poems* (1897); *The Hesperian Tree* (1900).

W.M.C.

PIATT, SARAH MORGAN BRYAN, an American poet, wife of J. J. Piatt; born in Lexington, Ky., Aug. 11, 1836. She was educated at the Henry Female College, Kentucky, and early adopted literature as a profession. She has written: *A Woman's Poems* (1871); *A Voyage to the Fortunate Isles* (1874); *Poems in Company with Children* (1877); *Dramatic Persons and Moods* (1880); *The Witch in the Glass* (1888); *An*

Enchanted Castle (1893). A complete edition of her poems appeared in 1894. W.M.C.

PIATTI, ALFREDO, an Italian violoncellist; born in Bergamo, Jan. 8, 1822; had in his youth the advantage of instruction from his grand-uncle, Zanetti, and was able to begin playing in the orchestra at the age of 7. He entered the Milan Conservatoire in 1832, studied under Merighi, and made his public appearance as a solo performer in 1837. He went to England in 1844, making his first appearance at a concert of the Philharmonic Society in June of that year in a concertino by Kummer, his performance at once establishing his position in the front rank. He obtained this success notwithstanding the fact that at this concert Mendelssohn had preceded him, playing Beethoven's *PF. Concerto in G.* He and Mendelssohn played several times together in private, and Piatti is thought to have completed for Mendelssohn the first movement of a concerto for violoncello and orchestra, but the manuscript has never been found. Signor Piatti composed a concertino and two concertos for violoncello obligato of great merit.

PIAZZI, GUISEPPI, an Italian astronomer. See ASTRONOMY, Vol. II, pp. 662, 705.

PIBROCH, a form of music performed on the bagpipe of the Highlanders, including marches and dirges. Its martial character has been found to have a wonderful power in arousing their military instincts. Its rhythm is so irregular, and its notes in the quicker parts so much jumbled together, that a stranger has difficulty in following the modulations or reconciling his ear to them. The earliest mention of the military music of the bagpipe is in 1594, at the battle of Balrinnes. According to Sir Walter Scott, the connoisseurs in pipe-music affect to discover in a well-composed pibroch the imitative sounds of march, conflict, flight, pursuit, and all the current of a heavy fight. Many remarkable instances have been recorded of the effect of the pibroch on the Highlanders.

PICARD, ALFRED, civil engineer; born in Strassburg, France, Dec. 21, 1844. He was educated at the Ecole Polytechnique, became a skillful engineer of bridges and roads, and, in 1870, before the outbreak of war with Germany, distinguished himself by his great works of defence at Nancy. In 1880 he became connected with the ministry of public works, was director of railways in 1882, counselor of state the same year, and inspector-general in 1887. He presided over the committees and juries of the Exposition of 1889, and organized the Exposition of 1900. G.J.H.

PICARD, JEAN, an astronomer (1620–82). See ASTRONOMY, Vol. II, p. 659.

PICARDS. See ADAMITES, Vol. I, p. 129.

PICCOLOMINI, a famous Italian family, which was first settled in Rome, then at Sienna, and finally obtained the duchy of Amalfi. Of its members ÆNEAS SYLVIUS became Pope Pius II; ALESSANDRO (1508–78) became Bishop of Patras, and wrote various philosophical and scientific works and dramas; FRANCESCO was a Platonist philosopher, who taught for many years at Padua, Sienna and Perugia; and OTTAVIO, most noted of all, became a commander of the Austrian army in the Thirty Years' War. He was born in 1599, served under the King of Spain and the Duke of Florence, and then entered the army of Ferdinand II. At Lutzen he led the cavalry regiment in the fight which proved fatal to Gustavus Adolphus. He was a favorite of Wallenstein, but betrayed the latter's treason to the emperor, and was then commissioned to capture Wallenstein, dead or alive. Before he could do this Wallenstein was murdered by others, but Piccolomini was rewarded with a share of his estate. In 1635 he was sent to drive the French from the Netherlands, but was not so successful against the Dutch. Philip IV of Spain employed him a second time in the Netherlands, with more success than before. In 1648 he was recalled to Austria and was made a field-marshal. After the peace of Westphalia he was sent to the Convention of Nuremberg as a plenipotentiary, and for his services there and elsewhere was raised to the dignity of a prince of the Holy Roman Empire (he had hitherto been Duke of Amalfi). He died in Vienna in 1656. His name is borne by the second play in Schiller's Wallenstein trilogy, which deals with the treason of Wallenstein and Piccolomini's efforts to thwart it; but the Max Piccolomini who figures in the play is a poetic fiction, for Ottavio had no son. W.F.J.

PICEA. See FIR, Vol. IX, pp. 195, 196.

PICHICIAGO. See CHLAMYDOPHORE, Vol. V, p. 587.

PICHINCHA, a mountain. See ECUADOR, Vol. VII, p. 559.

PICHURIM BEANS, a name given to the large cotyledons of *Nectandra pichury*, a South American plant belonging to the family *Lauraceæ*. These "beans" have a sassafras-like flavor, and are used in confections.

PICIDÆ. See WOODPECKER, Vol. XXIV, p. 686.

PICKARD-CAMBRIDGE, OCTAVIUS, an English clergyman and scientist; born in Bloxworth Rectory, Dorsetshire, Nov. 3, 1828; was a student at the Middle Temple, London (1849–52), and at University College, Durham (1855–58); M.A. (1859); ordained deacon (1858), and priest (1859); became rector of Bloxworth and Winterbourne Tomson in 1868; and was elected a F.R.S. in 1887. He wrote *Spiders of Dorset* (1879–81); *Araneidea*, in *Scientific Results of the Second Yarkand Mission* (1885); *Arachnida of Kerguelen Island* (1877); and the article ARACHNIDA, in this ENCYCLOPÆDIA.

PICKENS, ANDREW, an American soldier and statesman; born in Bucks County, Pa., Sept. 13, 1739. In 1761 he was a volunteer in Grant's expedition against the Cherokees. During the Revolution he rose from captain of militia to the rank of brigadier-general, and with Marion and Sumter kept the field with a partisan corps against the British. In 1781 he subdued the Cherokees and added a large section of territory to what is now Georgia. He won a victory at Kettle Creek, and for his gallantry at the Cowpens he received a sword from Congress. He

rendered important service at Augusta, Ninety-Six, and Eutaw Springs, and negotiated a treaty with the Cherokees at Hopewell, where he soon afterward settled. He served several years in the State legislature, and was a Representative in Congress from South Carolina in 1793–95, in which latter year he was elected major-general of militia. He died in Pendleton District, S. C., Aug. 17, 1817. E.E.T.

PICKENS, Francis Wilkinson, an American statesman; born in Tagaloo, S. C., April 7, 1807. He graduated at the College of South Carolina, and in 1829 began the practice of law. He served for several years in the South Carolina legislature, and was Representative in Congress 1834–43. He was minister to Russia, 1858–60; was Confederate governor of South Carolina, and took an active part in the Civil war. He died in Edgefield, S. C., Jan. 25, 1869. E.E.T.

PICKEREL. See Pike, Vol. XIX, p. 97.

PICKERING, Charles, an American naturalist and explorer, grandson of Timothy Pickering; born in Starucca Creek, Pa., Nov. 10, 1805. He was graduated from Harvard in 1823 and from the Boston Medical College in 1825. He then removed to Philadelphia, where he became an active member of the Academy of Natural Sciences. From 1838 to 1842 he was naturalist with the Wilkes Exploring Expedition sent by the United States to South America and the South Seas, and from 1843 to 1845 he traveled in Africa and India engaged in scientific research. He was a prominent member of leading American scientific societies. His works include *The Races of Man and Their Geographical Distribution* (1848); *The Geographical Distribution of Animals and Man* (1854); *The Geographical Distribution of Plants* (1869); *Chronological History of Plants: Man's Record of His Own Existence, Illustrated through Their Names, Uses and Companionship* (1877). He died in Boston, Mass., March 17, 1878. W.M.C.

PICKERING, Edward Charles, an American astronomer; born in Boston, Mass., July 19, 1846. He was graduated from Harvard in 1865 and was instructor in mathematics at the Lawrence Scientific School from 1865 to 1867. He became professor of physics at the Massachusetts School of Technology in 1867. He observed the total eclipse of the sun on Aug. 7, 1869, when he was sent by the government to Mount Pleasant, Iowa. He was a member of the United States Coast Survey Expedition to Xeres, Spain, to observe the eclipse of December 22, 1870. In 1876 he was appointed professor of astronomy and geodesy and director of the observatory at Harvard, and under his management this observatory became one of the foremost in the United States. As an associate member of the Royal Astronomical Society of London, he was awarded, in 1886, its gold medal for his photometric researches. In 1876 he was vice-president of the American Association for the Advancement of Science. He established the first physical laboratory in the United States and was the founder of an auxiliary station in Arequipa, Peru. He has made a specialty of the study of the light and spectra of the stars, and has made a catalogue of over 4,000 stars. He has made important photometric measurements of Jupiter's satellites while they are undergoing eclipse, and of the satellites of Mars and other faint objects. He has published *Elements of Physical Manipulation* (1873). W.M.C.

PICKERING, John, an American scholar; born in Salem, Mass., Feb. 7, 1777. He graduated at Harvard in 1796. He was secretary of legation in Lisbon from 1797 to 1799, when he went to London as private secretary to Rufus King, minister to the court of St. James. In 1801 he returned to Salem and was admitted to the bar in 1804. In 1827 he removed to Boston, and in 1829 was appointed city solicitor, which office he held till shortly before his death. He took an active part in State politics, being at times a Representative from Salem in the legislature, a senator from the counties of Essex and Suffolk, and a member of the Executive Council. He was a member of the board of overseers of Harvard College from 1818 to 1824; president of the American Academy of Arts and Sciences; originator and first president of the American Oriental Society; and a member of many literary and scientific societies in Europe. He was the author of *A Vocabulary of Americanisms* (1816); *An Essay on a Uniform Orthography for the Indian Languages of North America* (1820); a *Greek and English Lexicon* (with Dr. Oliver) (1826); etc. He died in Boston, Mass., May 5, 1846. E.E.T.

PICKERING, Percival Spencer Umfreville, an English scientist; born in London, March 6, 1858; educated at Eton, from which he obtained in 1875 an exhibition in science at Balliol College, and in 1880 took first-class honors in natural science at Oxford, and was lecturer in chemistry at Bedford College in 1881–89. He was elected a fellow of the Royal Society in 1890. Wrote voluminously on subjects connected with chemistry. His writings include *The Constitution of Molecular Compounds* (1883); *The Nature of Solution* (1886); *The Thermal Phenomena of Neutralization* (1887); *The Principles of Thermochemistry* (1888); *Determinations of the Heat Capacity and Heat of Fusion of Some Substances* (1890); *The Heat of Dissolution of Gases in Liquids* (1892); *Examination of the Properties of Calcium Chloride Solutions* (1894).

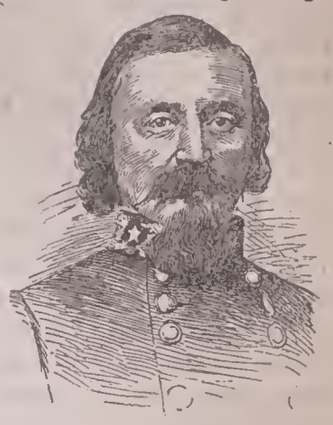
PICKERING, Timothy, an American patriot and statesman; born in Salem, Mass., July 17, 1746. He was a descendant of John Pickering, who settled in New England in 1630. He was graduated from Harvard College in 1763 and was admitted to the bar in the following year. He became register of deeds for Salem County in 1764. Taking an active part in the patriot cause, he helped organize the provisional government of Massachusetts, and was appointed judge of the Court of Common Pleas for Essex and judge of the Maritime Court for the Middle District of New England. In 1766 he was commissioned

lieutenant of militia and was promoted until in 1775 he was made a colonel. In 1773 he wrote a pamphlet called the *State of the Rights of the Colonists*, and also drafted the Salem protest against the Boston Port Bill. In 1775 he wrote *An Easy Plan of Discipline for the Militia*, a popular manual which was officially used in the Continental Army. In December, 1776, Pickering joined Washington's forces and fought in the battles of Brandywine and Germantown. In 1777 he was made adjutant-general and then quartermaster-general. Later he was a member of the Board of War and was present at Yorktown. After peace was declared he settled in the Wyoming Valley and laid out Luzerne County, Pa. He was employed in various negotiations with the Indians and concluded a treaty with the Six Nations in 1791. In 1792 he was appointed postmaster-general and in 1795 was made Secretary of War. In December of the same year he was appointed Secretary of State, retaining the portfolio until May, 1800. He was one of the founders of the United States Military Academy at West Point. In 1801 he became involved in financial troubles and returned to his old home in Massachusetts, where in 1802 he was appointed judge of the Common Pleas Court. In 1803 he was elected to the United States Senate. From 1812 to 1814 he was out of public life, but was elected to Congress in the latter year and in 1817 was a member of the Massachusetts Executive Council. He was a leader of the New England Opposition and favored the Hartford Convention. In public life he was distinguished for firmness, energy, activity and disinterestedness. He died in Salem, Mass., Jan. 29, 1829. W.M.C.

PICKERING, William Henry, an American astronomer; born in Boston, Mass., Feb. 15, 1858. He graduated at the Massachusetts Institute of Technology in 1879, and became instructor there and assistant professor at Harvard University. He led expeditions to observe total solar eclipses in Colorado, 1878; Grenada, W. I., 1886; California, 1889; Chile, 1893; and in Georgia in 1900. He established the Arequipa Station of Harvard Observatory in 1891; erected an observatory and telescope for Mr. Lowell at Flagstaff, Ariz., in 1894; and established an astronomical station for Harvard Observatory in Mandeville, Jamaica, W. I., in 1900. He is much interested in mountain climbing, and has a record of 19,400 feet and over 100 peaks. He is the author of *The Moon; Visual Observation of the Moon and Planets;* and of many astronomical reports and contributions to scientific journals. E.E.T.

PICKERSGILL, Frederick Richard, painter; born in London, England, in 1820. He became eminent as an artist, obtaining in 1842 a second prize for his *Death of King Lear*, while his *Burial of Harold at Waltham Abbey* brought him the first of three Royal Commission prizes, and was purchased for the House of Lords. A member of the Royal Academy in 1857, he was its keeper from 1873 to 1887. He died in Yarmouth, Dec. 27, 1900. G.J.H.

PICKETT, George Edward, an American soldier; born in Richmond, Va., Jan. 25, 1825. He was graduated from the United States Military Academy in 1846, and entered the Mexican War as 2nd lieutenant. He was present at the capture of the City of Mexico, distinguishing himself at Contreras, Churubusco, and Chapultepec, and was promoted to the rank of brevet captain in 1847. In 1849 he was transferred to Texas, where in 1855 he was made captain of the Ninth Infantry. He served on the frontier in Washington Territory and in 1856 occupied San Juan Island, where he prevented the landing of British troops, and received the thanks of Congress for his services. In 1861 he resigned from the Federal Army and joined the Confederate forces, being commissioned colonel and assigned to duty on the Rappahannock River. In 1862 he was promoted to brigadier-general. In the same year he was severely wounded in an engagement at Gaine's Mill. After his recovery he was promoted to major-general. In the battle of Fredericksburg his division held the center of Lee's line, and at Gettysburg in 1863 he made the gallant assault of Cemetery Ridge, famous as "Pickett's Charge." He later commanded the department of North Carolina, successfully defended Petersburg in 1864, and performed excellent service at Dinwiddie Court House and Five Forks. At the close of the war he engaged in business in Richmond, Va. He died in Norfolk, Va., July 30, 1875. W.M.C.



GEN. G. E. PICKETT.

PICKNELL, William Lamb, an American artist; born in Hinesburg, Vt., Oct. 23, 1854. He studied art in Rome from 1873 to 1875 and for two years at the École des Beaux Arts under Gérôme. He settled at Pont Aven, Brittany, where he worked five years under Robert Wylie and painted *Route de Concarneau*, a picture that established his position as an artist, and won honorable mention in the Salon of 1880. The work now hangs in the Corcoran Art Gallery. As a member of the Society of American Artists he received medals in 1881 and 1884. In the latter year he was elected a member of the Society of British Artists. His best works include *On the Border of the Marsh*, *The Fields of Kerran*, and *The Breton Peasant Girl*. His works are to be found in Paris, London, New York, Boston and other cities. He died in Marblehead, Mass., Aug. 6, 1897. W.M.C.

PICO, island. See Azores, Vol. III, p. 149.

PICOTEES. See Pink, Vol. XIX, p. 115.

PICRIC or CARBAZOTIC. See Carbolic Acid, Vol. V, p. 76.

PICRITE. See Peridote, Vol. XVIII, p. 544.

PICROTOXINE, a very poisonous bitter substance found in *Cocculus indicus* (fishberries) and

other varieties of *Anamirta*. It forms colorless needles, soluble in alcohol and hot water, but slightly soluble in cold water, ether of chloroform. It is doubtful whether it is a simple substance or a mixture. It is used externally to cure porrigo, and has been given internally or by subcutaneous injection, in epilepsy.

PICTON, Canada, a town, railway terminus and port of entry on the Bay of Quinté, Lake Ontario, in Prince Edward County, Ont., 34 miles S. W. of Kingston. It is the seat of Ontario College. Population, 1901, 3,698. C.L.S.

PICTOU, a town and the capital of Pictou County, Nova Scotia, and a port of entry on Northumberland Strait, at the head of Pictou Harbor, on the Intercolonial railroad, 113 miles N.N.E. of Halifax. It has a good harbor, coal is mined in the vicinity, and the town possesses shipyards and several manufacturing industries. Population 1901, 3,235.

PICTS. See BRITANNIA, Vol. IV, p. 319; also SCOTLAND, Vol. XXI, p. 495.

PIDGIN OR PIGEON-ENGLISH. See CANTON, Vol. V, p. 35.

PIEDMONT, a village of Mineral County, central northeastern West Virginia, 170 miles E. of Wheeling, on the north branch of the Potomac, and on the Baltimore and Ohio and the Cumberland and Pennsylvania railroads. It has repair-shops of the Baltimore and Ohio railroad, employing several hundred men; coal is mined in the vicinity. Population 1900, 2,115.

PIEDMONT PLAIN, same as ATLANTIC PLAIN. See NORTH CAROLINA, Vol. XVII, p. 572; also UNITED STATES, Vol. XXIII, pp. 842, 843.

PIERCE, GEORGE FOSTER, an American clergyman; born in Greene County, Ga., Feb. 3, 1811. He graduated at Franklin College in 1829, and studied law, but, determining to enter the ministry, was admitted to the Georgia Methodist Episcopal Conference in 1830. Thenceforward, except in the year 1834, he labored in Georgia until 1839, when he became first president of the Georgia Female College, Macon, and in 1848 was chosen president of Emory College. In 1854 he was elected bishop. He died Sept. 3, 1884. E.E.T.

PIERCE CITY, a village of Lawrence County, southwestern Missouri, 50 miles S.W. of Springfield, on the St. Louis and San Francisco railroad; has two large flour-mills, wagon-shops, limekilns, and a pottery. Population 1890, 2,511; 1900, 2,151.

PIERMONT, a village of Rockland County, southeastern New York, four miles S. of Nyack, just N. of the Palisades, on the west bank of the Hudson, and on the New York Central and Hudson River railroad; contains handsome residences, and has four churches, a pier one mile long, railroad repair-shops and an iron-foundry. Population 1900, 1,153.

PIEROLA, NICOLAS DE, Peruvian president; born at Camana, Peru, January 5, 1839. Educated at the College of Santo Torobio, Lima, he was admitted to the bar in 1860, founded a review, *El Progreso Catolico*, and in 1864 became editor of *El Tiempo*. He was made minister of finance in 1869, was accused of tampering with the funds at the end of his term, and, though acquitted, left the country. Sustained by the clerical party, he organized insurrections against the government in 1874 and 1877, being banished after the failure of the second. Permitted to return in 1879 he offered his services in the Chilean War, and after the defeat of General Prado proclaimed himself dictator, and continued the war. After a period of resistance to Chile he was overthrown by a military revolt, and took refuge in the United States. Returning in 1882 he was a candidate for the presidency in 1890, but was defeated, and was arrested and imprisoned for attempting to excite a riot in Lima in connection with the election. A new revolution in 1896 carried him to the presidency, which office he held until 1899. G.J.H.

PIERPONT, JOHN, clergyman; born in Litchfield, Conn., April 6, 1785; was graduated at Yale College in 1804, and became tutor in the family of Col. William Allston of South Carolina. Returning to Litchfield in 1809, he studied law, and was admitted to the bar in 1812. After practicing for a time, ill health obliged him to give up the profession, and he became a merchant in Boston and afterward in Baltimore. Unsuccessful in this, he engaged in the study of theology in 1816, and in 1819 was ordained pastor of the Hillis Street Church in Boston, where he remained till 1845. He was an ardent advocate of the abolition of slavery, and of legislation for prohibition and against imprisonment for debt. His views on these subjects caused a controversy in his parish, which continued for some years. After exonerating himself, he withdrew, and was afterward pastor of the Unitarian Church at Troy, N. Y., and of the Congregational Church at Medford, Mass. During the Civil War he was chaplain of a Massachusetts regiment and afterward a clerk in the treasury department. He published *Airs from Palestine*, etc. He died at Medford, Mass., Aug. 26, 1866. G.J.H.

PIERRE, a city and the capital of South Dakota and of Hughes County, in the central part of the state, on the Missouri, at the mouth of the Bad River, and on the Chicago and North-Western railroad. Originally there was an Indian post here, but the town was settled several years ago, and after a stubborn contest Pierre was designated as the permanent capital of the new state of South Dakota. Buildings for the accommodation of the legislature and the state officers have been erected; a United States Indian Industrial School and Pierre University (Presbyterian) are located here. In 1895 the latter institution had 11 instructors and 98 students. Population 1890, 3,235; 1900, 2,306.

PIERREPONT, EDWARD, an American geographer and diplomat; son of Edwards Pierrepont; born in New York City, June 30, 1860. He was educated in England, graduating from Oxford in 1882. In 1883 he studied at the Columbia Law School and was admitted to the New York bar. In 1884 he published *From Fifth Avenue to Alaska*, the result of an exploration trip to the Northwest. He was elected a member of the Royal Geographical Society of London in 1884,

SUPPLEMENT CONTINUED IN REAR OF VOLUME XII.

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